Autonomous Weapon Systems

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Preface

This background report aims to introduce the readers to the topic of autonomous weapon systems. This report is considered to be a summary of the most essential information and should not be used as the only source of information. In order to write a well-constructed position paper, readers are highly encouraged to conduct further research. A list of sources for this additional analysis is included in the last chapter of this document. Furthermore, to grasp the fundamentals, a set of questions has been designed for the reader to get a general idea of what they should be focusing on when writing the position paper for their respective states and further negotiations. These questions can be found in the eighth chapter of this report. Readers should also take into consideration that the sources for this topic are limited, owing to broad information about it not being publicised. This agenda point has not been addressed by the North Atlantic Council or any other NATO body yet.[1] The simulated North Atlantic Council should aim to create a guideline on how to implement those systems in the NATO States' armed forces and set proposals of both legal and ethical boundaries for the usage of autonomous weapon systems.

1   Introduction

Technology is rapidly advancing each day. With these continuous developments, we have witnessed many examples of modern military systems with autonomous capabilities, some of which are mentioned in the third chapter of this report. Many arguments for and against these types of weapons have been made and society is undoubtedly very divided on this issue.[2]

Artificial intelligence could play a key role in improving military operations. For instance, creating intelligent autonomous robotic machines would allow militaries to overwhelm enemy defences through fast exchanges of data. Autonomous weapons could collect and process information faster, increase precision,[3] and strengthen the capabilities of armed forces.[4] Despite that, many people claim that it would be unethical to pass the responsibility to kill onto a mere machine. They are afraid of a dystopian outcome, where technology would be in control of humans, rather than vice versa.[5] Nevertheless, the advances in technological development present an opportunity for NATO to reform the defence industry. NATO Deputy Secretary General Mircea Geoană has stated that "*once NATO sets a standard, it becomes in terms of defensive security the gold standard in that respective field.*"[6]

"If NATO establishes a common standard among the Alliance for the use and development of autonomous weapons, it may be able to greatly contribute to its capabilities"

2 Autonomous Weapon Systems

There is no clear definition of autonomous weapon systems (AWS) that would be used in an international perspective, as the meaning of this basic terminology is not unanimous.[7] In general, it may refer to the machine being able to operate without human intervention (to function and act independently on a human operator).[8] Other opinions state that it might refer to the weapon being morally independent (being able to make subjective considerations about situations that require judgments of good or bad behaviour).[9] [10]

For example, the United States Department of Defense defines AWS as "*a weapon system that once activated, can select and engage targets without further intervention by a human operator. This includes human-supervised autonomous weapon systems that are designed to allow human operators to override operation of the weapon system, but can select and engage targets without further human input after activation.*"[11] However, Heather Roff, a research scientist at The Global Security Initiative at Arizona State University has pointed out that even this definition is unclear and problematic. According to her, it is uncertain what 'select' means. In addition to that, more complications arise because the difference between an *autonomous* weapon (having the freedom to act independently) and an *automated* weapon (being pre-programmed to act automatically) is often unclear.[12]
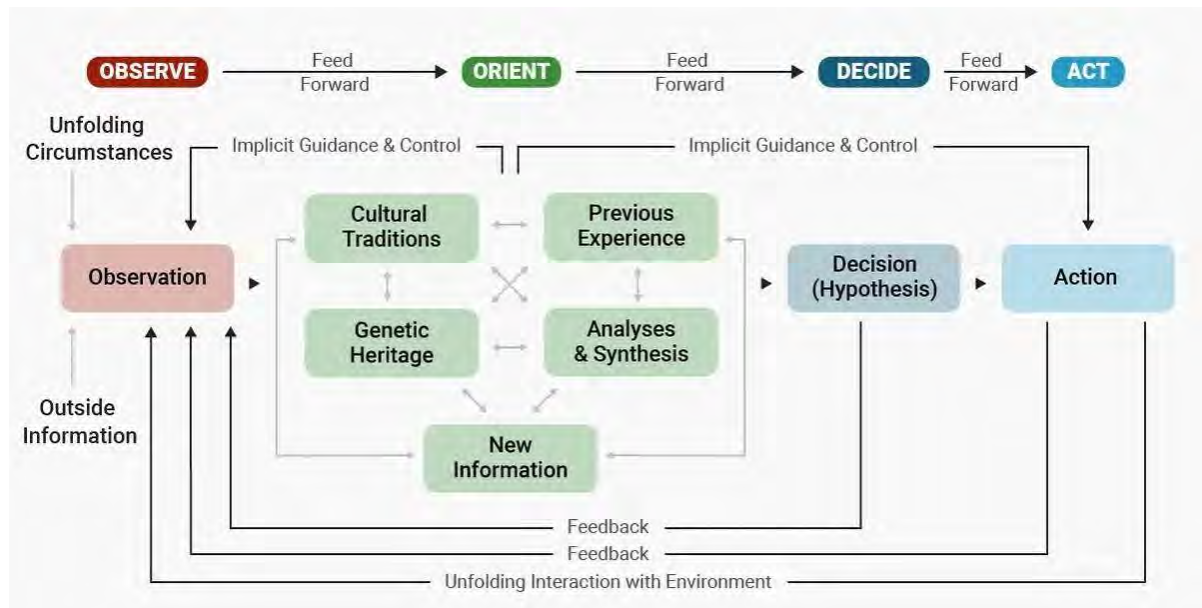
2.1 OODA Loop

In order for the autonomous weapon to be able to function and make decisions on its own, the OODA loop is used as a tool to understand the complex process the weapon has to go through. The United States Air Force colonel and military strategist John Boyd divided the human (and thus military) decision-making procedure into four steps.

Observe. In the OODA loop, the first step of the human decision-making process is to observe the environment surrounding the person. With their observations, they would then gather all the information and data about this environment and further identify a problem or a threat to gain an overall understanding of the situation (*everything from identifying the size of the opposing force, how they are armed, to the meteorological conditions in the operational area*).

Orient. Afterwards, the person would try to navigate and reflect on all the gathered data from the first step. This is the most crucial step of the OODA loop, as the person will try to analyse the data in order to put it into perspective (*e.g. air strike / naval bombardment / infantry drop and exfiltration*).

Decide. While considering all potential outcomes (based on the information gathered and analysed), the person then decides how to act (*e.g. naval bombardment because it is most risk-averse*).

Act. The final step of the OODA loop allows the person to carry out the decisions made in the third step (*e.g. sending the actual ship and carrying out a bombardment mission*).

John Boyd OODA Loop

2.2 Autonomy

2.2.1 The Command-Control relationship between a human and a machine

It is possible to categorise weapons as fully autonomous once no human control over target selection and force is detected in the system (human-out-of-the-loop). However, we can also define the weapon as human-supervised autonomous if the human operator has limited authority over the tasks and interventions (human-on-the-loop). Another way of categorising these weapons is as semi-autonomous, where the weapon would stop and wait for the human command before acting (human-in-the-loop).[13]US Navy Office of Naval Research Levels of Autonomy

2.2.2 US Navy Office of Naval Research Levels of Autonomy

The US Navy Office of Naval Research and the UK's Systems Engineering for Autonomous Systems Defense Technology Centre uses a more detailed model that describes six levels of autonomy.

Level	Name	Description
1	Human-operated	All the activity in the systems is a direct result of the human-initiated environment, although it may have information-only responses to sensed data.
2	Human-assisted	The system can perform an activity in parallel with human input, acting to augment the human's ability to perform the desired activity, but cannot act without accompanying human input.
3	Human-delegated	The system can perform limited control activity on a delegated basis. The level encompasses automatic flight and engine controls, and other low-level automation that must be activated or dedicated by human input and act in mutual exclusion with the human operation.
4	Human-supervised	The system can perform a wide variety of activities given top-level permissions or direction by a human. The system provides sufficient insight into its internal operations and behaviours so that it can be easily understood by its human supervisors and appropriately redirected. The system does not have the capability to self-initiate behaviours that are not within the scope of its current directed tasks.
5	Mixed initiative	Both the human and the system can initiate behaviours based on sensed data. The human can understand the behaviour of the system in the same way that they understand their own.
6	Fully autonomous	The system requires no human intervention to perform any of its designed activities across all planned ranges of environmental conditions.

US Navy Office of Naval Research Levels of Autonomy

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3   AWS in practice

Although there are certain legal and ethical issues elaborated in chapters 5 and 6 that are mostly against the usage of AWS with higher levels of autonomy, the benefits of such weapons and their effectiveness represent a very useful tool for the armed forces in the 21st century. For example, intervening in critical situations that require fast reaction, time could possibly be a disadvantage for the human-in-the-loop categorisation because a machine's ability to react could be faster than a human's reaction. Moreover, what is also vital to emphasise, is that missions may not be successfully carried out if the human and (human-in-the-loop) weapon connection is cut off due to the machine occurring in a place with low connectivity. One of the key topics of the simulated negotiations should therefore be finding a balance between those advantages and ethical limits.

From the available but limited sources, NATO States already have some weapon systems with various levels of autonomy. One of the examples is Phalanx

Phalanx CIWS

CIWS, which is a close-in autonomous weapon competent in selecting and evaluating the situation followed by the capability of using kill-assessment functions. It can defend against various missiles deployed by an enemy.[14] This weapon could be classified as a 'Mixed initiative' according to the US Navy Office of Naval Research Levels of Autonomy mentioned in the previous chapter.

Another weapon system, which was even proposed by the U.S. Air Force, is called the MQ-9 Reaper. It is a system capable of striking with a high level of precision, and efficient in proceeding with a wide range of missions in support of the combatant commander.[15] According to the US Navy Office of Naval Research Levels of Autonomy, we could classify this weapon as "Human-delegated"or "Human supervised".

Regarding influential countries, the information sources are even less specific. According to the statements of the Ministry of Foreign Affairs, China supported the banning of the usage of AWS but not the development of such technologies. Therefore, Chinese weapon companies develop and export such weapon systems internationally and even promote these technologies as 'lethal autonomous weapons'.[16] Meanwhile, India is strengthening its armed forces with new types of drones with the ability to act autonomously on the battlefield.[17]

MQ-9 Reaper

4 AWS in recent conflicts

In many recent conflicts, weapons that have autonomous capabilities and are fully automatic have been used by many armed forces, even though it is often difficult to know whether or not a weapon's autonomous functions are being used. The United Nations suggested that for example, Turkey-made Kargu-2 loitering missiles (specialized autonomous weapons capable of identifying and attacking while staying airborne for a limited amount of time)[18] were used to autonomously attack retreating rebel soldiers in Libya. However, the Turkish manufacturer denies that the drone has such capability.[19] These missiles could function without any data connectivity between the human operator and the machine.[20]

In the ongoing war between Ukraine and Russia, various types of loitering missiles, such as the US' Switchblade, are used on the side of Ukraine,[21] while the Shahed-136 missiles are reportedly deployed by the Russian army.[22] However, there is no evidence that those weapons have been operated autonomously without the previous command from the human operator.

5 International Humanitarian Law

International Humanitarian Law (IHL), also known as the 'law of armed conflicts', is a collection of rules that tries to limit the effects and outcomes of an armed conflict. To be more precise, it applies when a violent conflict begins and sets some basic rules of war, bans certain types of weapons (biological, chemical), and protects people who do not directly participate in the conflict, such as civilians, medical professionals, religious military personnel, wounded and ill combatants or prisoners of war.[23] It also contains four important aspects, which apply not only to people but also to AWS to abide by the law and not invoke any ethical and legal questions. As IHL is the most foundational topic centred around AWS, readers will realise that it is not as simple as it sounds.

5.1 Legal framework

The legal framework of the AWS could be divided into two important topics: the responsibility of the state using such weapons; and the responsibility of an individual, for example a military commander or a developer of autonomous weapons. The question of individual responsibility is yet undetermined by the courts of NATO Member States, it is therefore required to wait for the direct answer to the question of the 'conflict of responsibilities' between the producers and commanders.

ARSIWA, also known as Articles on the Responsibility of States for Internationally Wrongful Acts, states the situations in which states are responsible for their own wrongful acts. ARSIWA was adopted as a resolution of the General Assembly of the United Nations. It is considered to be a so-called 'soft law' (not legally binding), however, all NATO States voted in favour of the resolution.[24]

From the important principles, Article 4 states that *"the conduct of any State organ shall be considered an act of that State under international law, whether the organ exercises legislative, executive, judicial or any other functions, whatever position it holds in the organisation of the State, and whatever its character as an organ of the central Government or of a territorial unit of the State."*[25] Article 5 declares that *"the conduct of a person or entity which is not an organ of the State under article 4 but which is empowered by the law of that State to exercise elements of the governmental authority shall be considered an act of the State under international law, provided the person or entity is acting in that capacity in the particular instance."*[26]

5.2 Distinction

One of the fundamental principles of the IHL is distinction. The IHL only allows attacks on objects or groups of people that are a part of armed forces and belong to one of the parties that participate in a conflict. A member of armed forces and a civilian taking part in

the conflict may be lawfully attacked, while civilians who do not participate in hostility are protected.[27] Essentially, armed forces are required to distinguish between combatants and non-combatants.

Combatants are people authorised to use force in armed conflicts. In those situations, they are allowed to participate in hostilities and are not subjected to criminal prosecutions for it (unlike regular civilians). According to the Third Geneva Conventions, combatants are "*members of the armed forces of a party to the conflict, as well as members of militias or volunteer corps forming part of such armed force*"; "*members of other militias and members of volunteer corps, including those of organized resistance movements belonging to a party to the conflict and operating in or outside their own territory, that are being commanded by a person responsible for his subordinates, have a fixed distinctive sign recognizable at a distance and are carrying arms openly*".[28]

On the contrary, non-combatants are people who do not or no longer participate in hostilities. The Geneva Conventions categorise them into several groups, such as people who are sick and wounded, prisoners of war or detained civilians.[29]

5.3   Proportionality

One of the most complex principles of IHL is proportionality. It prohibits "*attacks which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated*".[30] IHL forbids any attacks directed at civilians or indiscriminate attacks that strike military objectives or civilian objects without the above-

mentioned distinction between a combatant and a person protected under the IHL.

One of the concerns is that although AWS can be programmed to comply with the principle of proportionality and to minimise damage by choosing suitable weapons, the machine may not be able to make appropriate decisions.[31] For example, a fully autonomous weapon could mistake two children holding toy guns as two armed individuals. Therefore, it may be uncertain how the system could properly distinguish between a civilian and military personnel, which brings the question back to the principle of distinction.[32]

5.4   Precaution

Precaution measures must be taken and "*in the conduct of military operations, constant care shall be taken to spare the civilian population, civilians and civilian objects*".[33] The principle of precaution requires a detailed and properly planned phase for everyone involved in preparations. It includes not only military commanders but also the manufacturers and programmers of AWS.

The duty of not violating the principle of precaution is an unstoppable verification of the target, a suitable choice of weapon, as well as the method and timing of the attack. It requires rapid reaction to surroundings. Some argue that due to multiple unforeseen circumstances, it is essential to have a human soldier 'on the loop' to intervene in the attack on time before the machine violates the rule of IHL. As previously mentioned, others say that AWS are capable of reacting faster and therefore humans would not even be fast enough to grasp the situation.[34]

6   Ethical and political aspects

Ethical issues with AWS have been addressed by many people and organisations over the past few years. They have raised arguments against these types of weapons due to many problems associated with morals. One of the most noticeable organisations fighting against their use is Stop Killer Robots. The members of this organisation fight to ensure human control over all weapon forces and call for the enforcement of a new international law banning autonomy in weapon systems.[35]

It is believed that these machines are incapable of complying with the crucial principle of IHL – distinction. According to Noel E. Sharkey, a Professor of Artificial Intelligence and Robotics at the University of Sheffield, one of the major issues of AWS is that they are unable to properly recognise a combatant and a non-combatant, or even those who have surrendered and no longer participate in the conflict.[36]

Many people have emphasised that it should solely be a human decision to take another human's life,

and a machine should not be allowed to make such an important and crucial decision, as well as afterwards perform the act on its own. One of the reasons is the fear of the machine losing control and targeting anyone it wants. Therefore, opponents oftentimes argue that these weapons should not be deployed at all due to the possibility of losing control and committing war crimes, as well as causing massive damage to military forces and innocent civilians. Even if the system is reviewed prior and everything adheres to the guidelines and requirements, people are still worried that these systems will not be able to determine whether or not it is worth it to attack a target when it could also bring danger to civilians.[37]

7 Conclusion

Autonomous weapon systems could contribute to NATO's capabilities and greatly influence the organisation's security if Member States settle on a common ground and further negotiate how to regulate the development and usage of these weapons. Additionally, it could contribute to each state's technological advancements and capabilities in AI. NATO States should also discuss legal and ethical aspects and adopt an ethical code for AWS, which is important in order not to violate the IHL and instead adhere to its four most fundamental principles.

8 Questions for negotiation

I.   What is your state's definition of AWS? Does your state support the development of AWS (or even actually employ some form of AWS)?

II.   Should NATO adopt a common definition and standardisation for AWS (note that AWS may be used in both offensive and defensive roles)?

III.   Should NATO encourage the development of AWS, e.g. through a joint research centre with a focus on developing autonomous weapons or even a technology-sharing agreement?

IV.   If NATO members were to employ a more-or-less fully autonomous weapon system to engage human targets, what would the protocol look like? E.g. Who should authorise the strike? Should there be an obligation to notify NATO and other Allies about the use of such weapon system? Who should be held responsible for the failure of such strikes and/or civilian casualties caused by them?

V.   How effective could AWS be in the future? Is it even possible to work without AWS?

9 Recommended further reading

1. Articles about AWS and NATO:
https://cepa.org/article/nato-must-embrace-ai-and-autonomous-weapons/

    https://cepa.org/article/why-nato-needs-lethal-autonomous-weapon-standards/

2. Country positions on AWS:
https://www.hrw.org/report/2020/08/10/stopping-killer-robots/country-positions-banning-fully-autonomous-weapons-and

3. Article about the legal and ethical dimensions of the first alleged fully autonomous strike:
https://lieber.westpoint.edu/kargu-2-autonomous-attack-drone-legal-ethical/

4. International Red Cross report on Autonomous Weapons:
https://www.icrc.org/en/download/file/1707/4221-002-autonomous-weapons-systems-full-report.pdf

5. A video of a (semi) autonomous system – the Centurion C-RAM Air Defense System engaging drones in Afghanistan:
https://www.youtube.com/watch?v=phpabF_5ulU (note the rapid acquisition and precision tracking C-RAM is capable of, which would be impossible for human operators

6. One of the other main developers of unmanned and AWS in NATO is the Netherlands – here is a look at some of their arsenal as well as a concept video for pairing them with flesh-and-blood troops:
https://www.janes.com/defence-news/news-detail/royal-netherlands-army-commences-armed-robot-trials-in-first-among-western-militaries

https://twitter.com/FeWoessner/status/1581177330642264064

7. Institute of International Relations (ÚMV):
https://www.iir.cz/

8. RAND Corporation:
https://www.rand.org/

9. International Red Cross:
https://www.icrc.org/

10. Report about the development and use of autonomy (the document is rather technical – readers should preferably focus on the data the report visualises in graphs):
https://www.sipri.org/sites/default/files/2017-11/siprireport_mapping_the_development_of_autonomy_in_weapon_systems_1117_1.pdf

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Pražský studentský summit

Pražský studentský summit je unikátní vzdělávací projekt existující od roku 1995. Každoročně vzdělává přes 300 studentů středních i vysokých škol o současných globálních tématech, a to především prostřednictvím simulace jednáníčtyř klíčových mezinárodních organizací – OSN, NATO, EU a G20.

Asociace pro mezinárodní otázky

AMO je nevládní nezisková organizace založená v roce 1997 za účelem výzkumu a vzdělávání v oblasti mezinárodních vztahů. Tento přední český zahraničně politický think-tank není spjat s žádnou politickou stranou ani ideologií. Svou činností podporuje aktivní přístup k zahraniční politice, poskytuje nestrannou analýzu mezinárodního dění a otevírá prostor k fundované diskusi.

Ngoc Nguyen

Autorka je spolupracovníkem Asociace pro mezinárodní otázky a členem přípravného týmu Pražského studentského summitu.