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LICENCE TO KILL

Artificial intelligence in weapon systems and new challenges for arms control

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ANALYSIS

Editorial information

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Contents

1. Artificial intelligence in weapons systems

Summary

Lethal autonomous weapons systems (LAWS) are the third revolution of warfare. Like gunpowder and the atomic bomb before them, LAWS will radically change the way that war is waged and will therefore determine the balance of power in the world of tomorrow. Many states are already working on developing fully autonomous weapons, the most prominent being the USA, China, Israel, and South Korea. The EU member states have adopted very different positions on LAWS. The national conditions and skills needed to develop military AI also vary strongly. In Germany, beyond the specific topic of drones, military AI has not yet been given much attention by expert circles, and even less so by the general public.

The use of LAWS raises fundamental ethical and legal questions to which the international community has not yet found consistent answers. It is also associated with major security risks. But the global community has not yet succeeded in adopting an international legally binding treaty to regulate or prohibit LAWS. This is first and foremost due to a lack of political will.

Nevertheless, 125 nations participating in the UN Convention on Certain Conventional Weapons (CCW) agreed on common guiding principles to govern the handling of LAWS (Guiding Principles on Lethal Autonomous Weapons Systems) in autumn 2019. However, if the CCW states cannot agree on recommendations for a comprehensive common "framework" by the Sixth Review Conference of the CCW in December 2021 as the basis for an international ban treaty, the negotiations threaten to be permanently dissolved.

The key political demands are as follows:

- → Lethal Autonomous Weapons Systems (LAWS) must be globally banned.
- → The principle of "meaningful human control" must be retained or introduced as a universal standard for weapons systems.
- → Adequate technological approaches must be developed for arms control and verification of AI-based weapons systems.
- → Europe needs a common military AI strategy.
- → European/international standards need to be introduced to regulate the development/use of armed and arms-capable drones.
- → Fully autonomous drone swarms must be classified as weapons of mass destruction.
- → The European AI system must be made more competitive.
- → A global dialogue on ethical standards for the development and use of artificial intelligence is necessary.

Definition of LAWS

LAWS stands for "Lethal Autonomous Weapons System". There is currently no unanimously accepted definition. International experts typically use a functional definition of "autonomy in weapons systems" adopted by the USA and the International Committee of the Red Cross (ICRC), which states that a weapons system is "fully autonomous" if it completes an entire targeting cycle without significant human control after being activated. A targeting cycle consists of five steps: find, fix, track, select, engage. In short, LAWS are able to independently select a target, attack, and kill.

Degrees of autonomy

Weapons systems such as missile defence systems that can operate autonomously in the first three phases of the targeting cycle (find, fix, track) have been used for years. But expanding this autonomy to the "select" and "engage" phases and other types of arms beyond defensive applications is new.

Many systems are operated with partial autonomy at first, i.e. with a human actor as the final decision-maker. The process of increasing the autonomy unfolds step by step[1]: as the functionality of specific weapons systems gradually becomes more autonomous, the decision-making role played by humans when they are used decreases. There are three levels:

- → A person is '**in the loop**' if they retain a high degree of oversight and control over the system (automatic systems).
- → A person is '**on the loop**' if the system operates autonomously, but the person continues to monitor and control the process (semi-autonomous systems).
- → Finally, a person is '**off the loop**' if the system operates completely autonomously without any human intervention (fully autonomous systems).

Current status of the development of LAWS

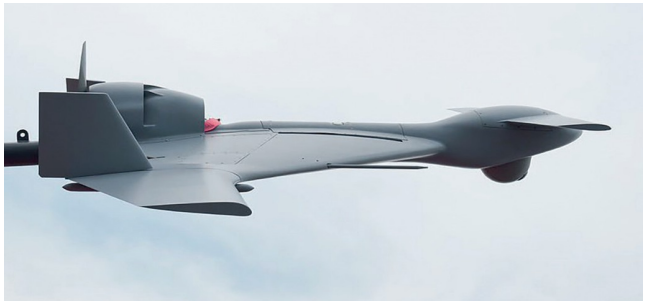
Experts estimate that more than 30 nations around the world are already actively working on developing fully autonomous weapons[2], the most prominent being the USA, China, Israel, South Korea, France, Great Britain, and Russia. Around 380 partially or fully autonomous systems already exist or are currently being developed.[3] The vast majority of weapons systems are currently partially autonomous, i.e. the autonomy of their actions remains limited, and their operation is still subject to human control. But the number of functions that weapons systems can perform automatically or autonomously is constantly growing.

Potential applications of AI in the military sector

There is great potential for applications of artificial intelligence in the military sector – both defensively and offensively. In **defensive applications**, AI-based systems are primarily used for *reconnaissance and assessment of situations* (assessment of enemy forces and rapid execution of retaliatory strikes), *logistics* (autonomous vehicles, delivery drones), *defence systems* (especially against missiles, cruise missiles, and artillery shells), and *ordnance disposal*. In **offensive applications**, AI-based systems can be used in LAWS, for instance in combat drones, tanks, combat robots, ships, and submarines.

Examples of weapons systems that are already well on their way to autonomy include the ***HARPY*** *drone* (Israel), the ***KUB-BLA*** *kamikaze drone* (Russia), the ***T-14 Armata*** *battle tank* (Russia), the ***Blowfish A3*** *helicopter drone* (China), the ***JARI*** *drone combat ship* (China), the ***SGR-A1*** *combat robot* (South Korea), the ***Sea Hunter*** (USA), the ***Taranis*** *stealth combat drones* (GB), and ***nEUROn*** (France).

Fig. 1 | HARPY drone – considered to be fully autonomous by experts.



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The future of military AI

For now, most AI-based weapons system are only ready for deployment to a very limited extent. They can only perform precisely defined tasks and cannot yet adapt to changing situations. But these adaptive qualities are precisely what is required in real combat. They require so-called "**learning systems**", i.e. systems with the ability to learn from previous applications and dynamically adapt to local conditions and circumstances to which they have previously never been exposed. There is also great military interest in so-called **swarm technology**, which is considered a "game changer". A swarm is a group of individual systems that interact and work as a collective entity with a common goal. The units coordinate themselves without a central control unit. Individual deficiencies or casualties therefore only have a minor effect on the performance of the whole swarm. A swarm can consist of drones, robots, or submarines. However, it is difficult for humans to exert control over them.[4] Several countries are already working on preliminary experiments with **stealth combat drones**. These drones achieve long flight times and high speeds, while remaining undetectable by radar. The best-known example is the British *"Taranis"* drone. Stealth combat drones will be ready for deployment in around ten years.

Pros and cons of military AI

The proponents of military AI argue that increased autonomy in weapons systems could significantly increase the speed, range, precision, and effectiveness of operations. AI-based systems allow the threat situation and events unfolding on the battlefield to be apprehended much more broadly and quickly. They can also make more qualified decisions more quickly than humans. According to its proponents, artificial intelligence will be quicker and better at processing the enormous amounts of data that modern armies must manage in armed conflicts. Furthermore, it is not susceptible to fatigue or stress. Finally, it may be able to protect the lives of soldiers and reduce the number of civilian casualties.

The opponents of military AI cite the many dangers associated with its use[5]:

→ **Risk of deliberate/unwitting manipulation and hacking**
AI systems are highly dependent on the accuracy of the input data, making them prone to conscious and unconscious bias. Algorithms reflect the moral preconceptions and stereotypes of their programmers and frequently produce bizarre misjudgements. There is also a risk of hacking or manipulation through malware.

→ **New dimension of global destabilization**
Autonomous systems might significantly lower the inhibition threshold for war, since the use of LAWS can greatly reduce the loss of human life and equipment. At the same time, autonomous systems could accelerate the pace of acts of war beyond human reaction speeds. This creates the risk of automatic conflict escalation ("flash wars") with greater numbers of victims and a new dimension of global destabilization. Incorporating artificial intelligence into nuclear systems is especially risky. If artificial intelligence is allowed to control the use of nuclear defence systems, the risk of nuclear weapons being used may increase.[6]

→ **Risk of proliferation**
There is also a high risk of proliferation. Currently, only a few rich countries have the capacity to research and develop LAWS. But production is becoming cheaper due to

3D printing and other technologies; unlike nuclear weapons, LAWS do not require special raw materials to manufacture. Furthermore, exporting (partially) autonomous weapons has been a flourishing market for years. Authoritarian leaders and non-state actors such as terror groups, warlords, and criminals can also acquire LAWS. Houthi rebels, ISIS, and Boko Haram are already deploying combat drones. Experts estimate that at least 102 countries have military drone programmes.[7] The more actors have access to LAWS, the more difficult it becomes to implement international control.

→ **Premature deployment of insecure systems**
The real danger of the "AI arms race" is not that any given country will fall behind its competitors in AI development, but that the perception of a race will incite each country to prematurely deploy insecure AI systems, endangering themselves and everyone else.[8]

Ethical and legal principles

The use of LAWS raises fundamental ethical and legal questions to which the international community has not yet established consistent answers.

Ethical question: can the decision about a person's life or death be left to a machine?

→ **Arguments against**: It is a violation of human dignity to delegate life and death decisions to an algorithm on the battlefield. Outsourcing killing to machines in times of war as an automatic "process" transforms people into objects. For the victims, it may not matter whether it was a human or an algorithm that caused their death. But a society that permits such a practice and avoids the burden on its collective human conscience associated with killing in times of war risks nothing less than abandoning the most basic civilized values and humanitarian principles.[9] It is a red line that humanity should never cross.

→ **Arguments for**: Even humans are not infallible in war, especially when they are driven by strong emotions such as anger or fear. LAWS allow warfare to be conducted more precisely, which ultimately results in better protection for the civilian population.[10]

Legal question: are LAWS compatible with international humanitarian law?

In armed conflicts, international humanitarian law is always applicable, regardless of the weapons systems being used. However, it was developed with conventional weapons systems in mind, which do not act autonomously. Consequently, it addresses people rather than machines.

→ **Against**:[11] LAWS are incompatible with international humanitarian law because autonomous systems are not capable of differentiating between combatants and civilians or between military and civilian objects in dynamic combat situations. Furthermore, it is impossible for a machine to evaluate the proportionality of an attack. Finally, with LAWS that can autonomously issue the order to shoot, the central role played by humans in being responsible for the operation of weapons systems is lost. This creates a "responsibility gap", meaning that it is no longer clear who can be held accountable if the machine decides incorrectly. Should the nation, the commander, the operator, the manufacturer, the programmer – or perhaps the weapons system itself – be held accountable?

→ **For**: In the future, it will be possible to program LAWS in such a way that they comply with the basic principles of international humanitarian law. LAWS can make warfare more humane, as people will no longer be needed at the frontlines. Furthermore, human-waged wars in the past have repeatedly and massively violated international humanitarian law.[12]

→ **Alternative approach**: LAWS can be treated neither as weapons nor as conventional combatants. Consequently, current international humanitarian law does not apply, and new legislation must be introduced. A new convention that regulates "irregular combatants" such as autonomous weapons systems is needed.[13]

Artificial intelligence in arms control[14]

Artificial intelligence has become a key issue for arms control in two respects. When considered as an object of arms control, AI eludes the traditional approaches of the past, since it has neither the physical characteristics and abilities nor the transparent modes of functioning relied upon by current methods and procedures of quantitative and qualitative arms restriction. On the other hand, AI offers new tools that could in turn benefit arms control. It is conceivable that the verification (compliance monitoring) of existing and future arms control treaties could greatly benefit from AI as a technical resource, for example thanks to greater accuracy and speed in collecting, processing, and analysing data.

2. Development of LAWS in selected nations

2.1 European Union

The EU certainly has the potential to become a global leader in artificial intelligence and its applications in the defence sector; the European AI ecosystem is well-developed overall. The ex-EU member Great Britain clearly in the lead, followed by Germany, France, and Spain. The EU has the largest supply of software developers, including top AI experts.[15] With 425,000 publications on AI, the EU ranks first place worldwide in terms of publications; with 233,000 patent applications, it ranks second place in terms of patents.[16] The EU's defence budget of $281 billion is the second largest in the world. With *Airbus Defence & Space GmbH* (Eurodrone), *Future Combat Air Systems* (FCAS), *BAE Systems, ATOS, THALES*, etc., some of the world's largest arms companies are based in the EU.

However, this potential risks being wasted. The European AI ecosystem remains very fragmented; the state of AI development varies considerably across EU member states, and the national AI strategies of these states have not yet been harmonized. European investment in artificial intelligence is far behind the USA and China, and the European data protection regime is extremely restrictive compared to these countries. With its **White Paper on Artificial Intelligence** published in February 2020, the European Commission presented a proposal to regulate AI within the region for the first time. Economic experts are already warning against overregulating this new technology.[17] Other experts describe the white paper as "too vague, too premature, too non-binding, too unrealistic."[18]

The topic of **AI in the military sector** was only recently added to the agenda of EU institutions. In September 2018, the European Parliament (EP) passed a resolution calling for a legally binding prohibition of LAWS.[19] The European Commission only began to examine this issue in any depth during the Finnish council presidency (July – December 2019). A coalition of several EU countries has attempted to launch a discussion with a joint reflection paper on *Digitalization and AI in Defence*.[20]

The topic of military AI has not been addressed by official EU documents on artificial intelligence such as the *EU white paper* of February 2020, the *Ethics Guidelines for Trustworthy AI* (April 2019), and the *AI Strategy* (December 2018).[21] Synergies between civilian and military technologies were only considered for the first time in the new *EU industrial strategy*, which was published in March 2020.

Meanwhile, the **European Defence Agency** (EDA), a European hub for defence innovations, has significantly expanded its activities in the field of AI. In 2017-2019, the EDA began developing autonomous systems as part of the *PADR project* (Preparatory Action on Defence Research). Other projects are currently being prepared.[22] In the future, the EDA will also consolidate cooperation between EU member states in the area of military AI.[23] An *AI Action Plan* developed for this purpose will be presented towards the end of 2020.

Military AI is also featured in the new **European Defence Fund** (EDF). This fund has been endowed with a budget of around €7 billion to finance transnational arms projects and military research. Around 4-8 percent of this budget is earmarked for *"disruptive technologies and high-risk innovations"*. This includes technologies like AI that are expected to radically transform theoretical and practical warfare. Among other projects, the development of the **Eurodrone** and the **Future Combat Air System** (FCAS), Europe's largest arms project, is being financed by the EDF. The fund's goal is to promote collaborative arms research and development in order to strengthen the efficiency, competitiveness, and innovativeness of the European defence sector. Such collaboration is urgently needed, as the EU is currently operating an expensive system of national solo programmes with more than 170 different weapons systems, more than six times as many as in the USA.

The original draft of the EDF included a *ban on the funding of LAWS* in Article 11, Paragraph 6. This passage was introduced by the European Parliament but subsequently deleted after pressure from the European Council. The final version only contains a reference stating *"that funded projects should in no way lead to weapons systems that violate international law."*[24] This includes land mines, as well as nuclear, chemical, and biological weapons.

2.2 EU member states

The EU member states have taken very different positions on the research, development, and use of LAWS. Whereas France, Great Britain, Germany, Sweden, and Italy are already working on (partially) autonomous systems, some member states remain undecided. Ireland and Austria have joined a coalition of 30 states calling for a preventive ban on LAWS. The new Finnish government has also followed suit. Belgium is the only EU country to have already banned LAWS.[25] These very different positions and starting points for military AI development present a great challenge for the interoperability of the armed forces of EU member states, as well as with NATO partners.

France is the first and only EU country to have published a military AI strategy, presented in September 2019 *(L'intelligence artificielle au service de la défense)*. It was written by a team of experts led by AI celebrity Cédric Villani in the French ministry of defence and is regarded as an example of best practice. France views artificial intelligence as an important instrument for its geopolitical strategy and has invested extensive resources in integrating AI into its weapons systems. Large defence contractors such as *Thales, Safran, Nexter*, and *DCNS* play a leading role in this. The French **nEUROn system**, a stealth combat drone, has one of the highest degrees of autonomy out of all weapons systems currently being developed.[26]

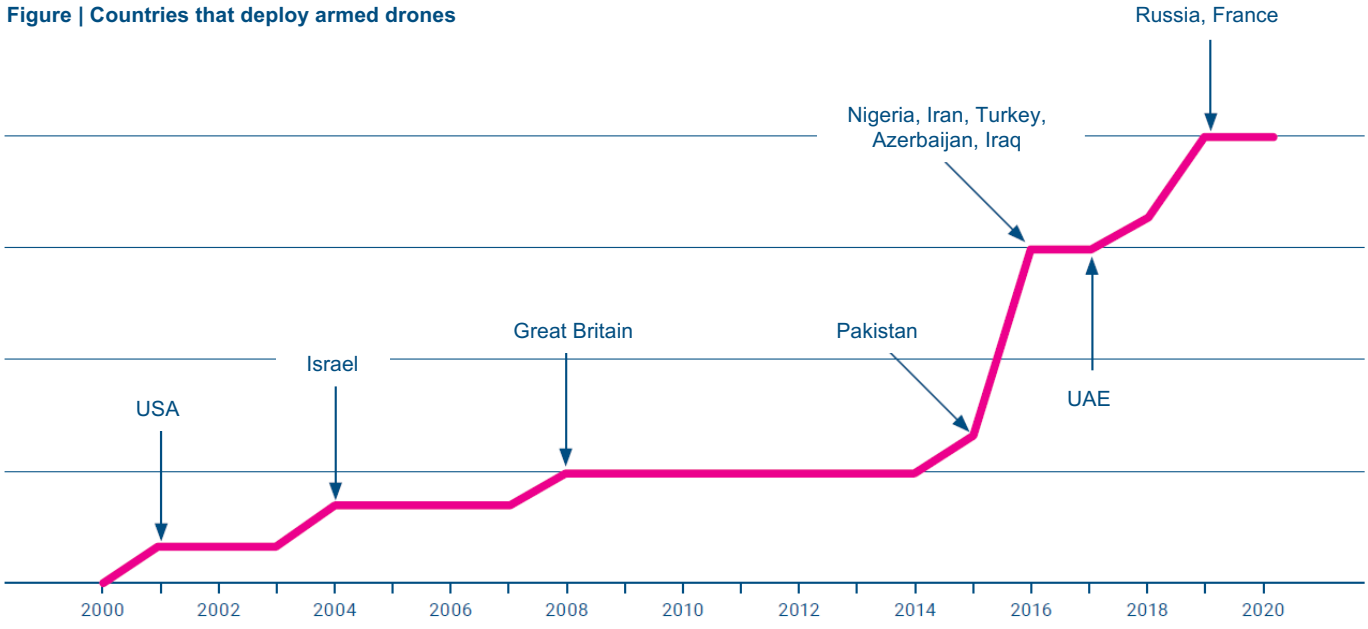
The ex-EU member **Great Britain** has also been intensively working on developing LAWS for several years. Its best-known product is the supersonic stealth combat drone **Taranis**, which is expected to be operational from 2030. As a result, Great Britain is strongly opposed to a preventive ban on autonomous weapons. At the same time, the British government asserts that it does not wish to develop fully autonomous weapons, and British legislation requires that a person must be in control of any attack. The country has not published a comprehensive national strategy nor a military AI strategy.

In **Germany**, LAWS are a difficult topic. Various parties with partially conflicting interests are involved in the debate. Many German decision-makers still view the country as a "civil power", i.e. a country that rejects any military projects and aims to resolve international conflict primarily by diplomatic and non-military means. Consequently, the federal government took on a commitment to condemn autonomous weapons systems in the *coalition agreements of 2013 and 2018*. However, this commitment has never been realized to date; the federal government has never spoken in favour of banning LAWS at an international level within the framework of CCW negotiations.

In the *AI strategy of the federal government* published in November 2018,[27] the military use of AI is only marginally addressed. The strategy focuses primarily on research, business, and society. The foreign policy and defence policy aspects of AI are not discussed. Unlike France, the German government clearly does not view AI as a geopolitical instrument that might play a key role in Germany's influence around the world.

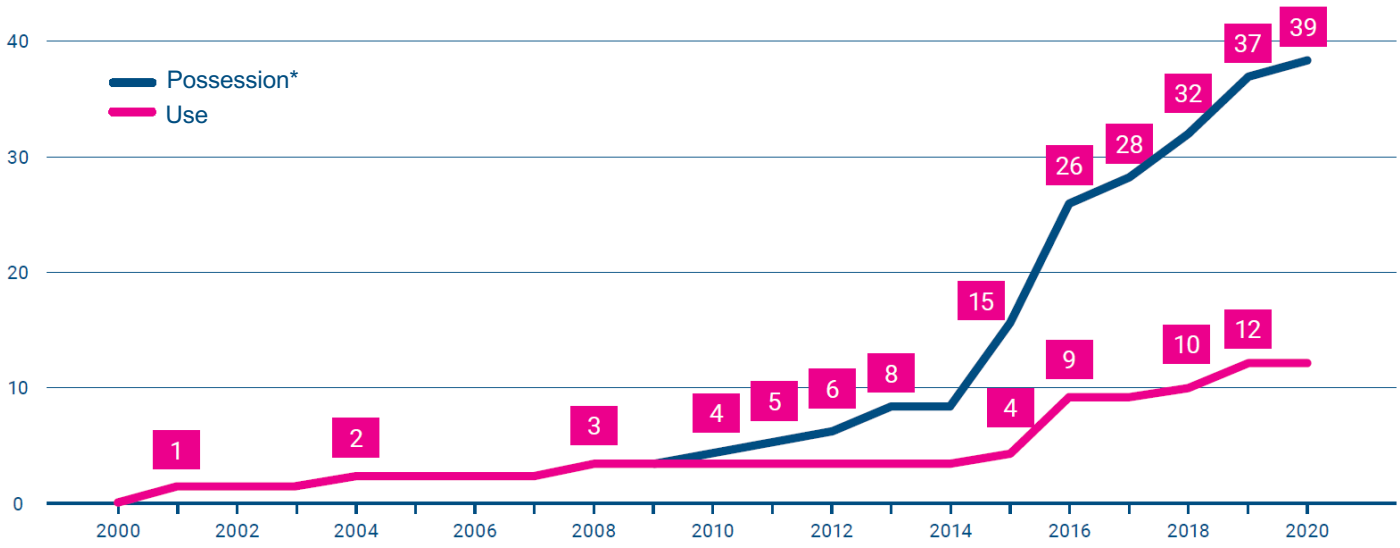
The **Federal Ministry of Defence** (BMV) has not yet – at least not officially – presented a military AI strategy and has not positioned itself clearly on the matter. For years, it has focused on the Bundeswehr's demand to *arm drones for missions abroad*. The new arms-capable **"Heron TP" drone** will be stationed in Afghanistan in 2021 and in Mali in 2024. This drone is (currently) remotely controlled by humans, but it could be developed into an autonomous system in the medium or long term. Whether the new drone will indeed be armed with weapons must be decided by the Bundestag for each mandate. According to the coalition agreement, this can only occur after a *"detailed appraisal of the international and constitutional legal status and the ethical status"*. The BMV led this debate with a series of events lasting several weeks – the so-called *#DrohnenDebatte2020*[28] – in May 2020. In its final report to the Bundestag[29], the BMV concludes by emphatically recommending that the Bundeswehr drones should be armed. In parallel, with the final report, the BMV presented for the first time **Principles for the use of German armed unmanned aircraft systems** (UAS) to serve as a basis for parliamentary discussion.

Figure | Countries that deploy armed drones



Source: https://www.newamerica.org/international-security/reports/world-drones/

Figure | Countries with armed UAVs: trend over time



*Possession or decision to procure

Source: https://www.newamerica.org/international-security/reports/world-drones/

The **German Bundestag** itself has not yet positioned itself clearly on the question of military AI. Attempts by Bündnis90/Die Grünen and DIE LINKE to condemn LAWS were rejected by the governing parties CDU/CSU and SPD and the opposition parties FDP and AfD. This was backed by a recommendation for a resolution of the Foreign Affairs Committee of November 29, 2019. This recommendation contrasted starkly with another recommendation by the "AI and State" project group within the Bundestag Study Commission on AI, which called for LAWS to be outlawed internationally.

Even within the **Germany economy**, there has been considerable criticism of LAWS. The Federation of German Industries (BDI), which unites the German arms industry under a single roof, called for a binding treaty to ban autonomous weapons.[30] Meanwhile, however, some arms companies have been setting precedents: **Rheinmetall** is building an armed drone tank[31] – *Mission Master* – that will soon be ready to enter series production.

2.3 USA

In the field of artificial intelligence, the USA is the world leader (for now). Besides its gigantic investments and vast oceans of top talent, this is largely thanks to the presence of the world's largest and most advanced technology sector, led by corporations such as Google, Amazon, Apple, Facebook, Microsoft. The **"Global AI Index 2019"**[32] confirms the dominant position of the US, with a clear lead over China. However, the index also predicts that China will overtake the US in artificial intelligence within just five to ten years. This is primarily due to lower public investment compared to China and unfavourable structural factors such as data protection rules and other regulations.

It remains to be seen whether the **"American AI Initiative"**[33] launched in February 2019 by President Trump will make any difference. Trump's initiative calls on the federal authorities to prioritize research and development into artificial intelligence. Critics have described it as purely symbolic politics. According to them, not only does the initiative come much too late – two years after China – it also remains very vague, failing to offer a vision for the future, without any concrete goals or funding commitments.[34] Consequently, it cannot claim to be a national strategy that will secure leadership in AI technology.

The 15-member **National Security Commission on Artificial Intelligence** (NSCAI) founded by Congress in 2018 is considered to be more promising. This commission advises Congress and the government on matters relating to AI and regularly publishes interim reports with extensive recommendations, most recently the *Second Quarter Recommendations*.[35] The commission's final report will be presented to Congress in March 2021.

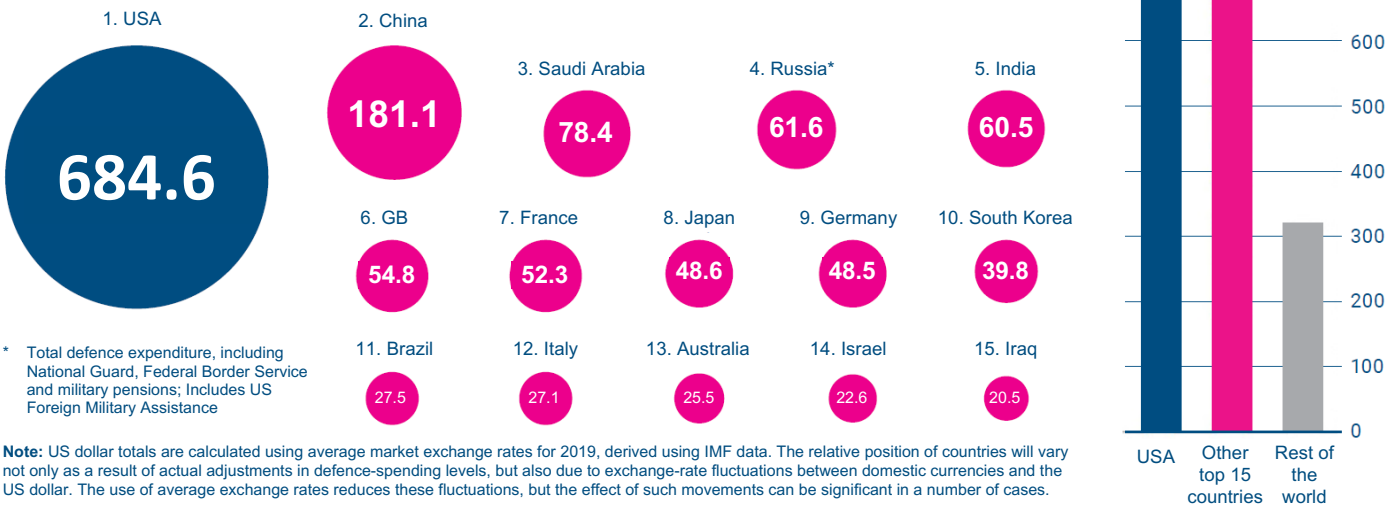
To specifically distance itself from authoritarian governments, the White House released **ten principles for regulating AI** in January 2020. These principles aim to protect "economic and national security, privacy, civil liberties, and other American values, including the principles of freedom, human rights, the rule of law, and respect for intellectual property". In essence, they revolve around the development of "trustworthy AI". The *"Ethics Guidelines for Trustworthy AI"* published by the European Union in April 2019 may have served as a model.

AI in the US military sector

Technological leadership is one of the factors that allowed the United States to become a military superpower. The country has long been the undisputed global leader in the research and development of weapons systems. A gigantic national defence budget of 732 billion USD provides a solid financial basis.[38]

Figure | Defence spending: Top 15 in 2019†

Figures in billions of US$



* Total defence expenditure, including National Guard, Federal Border Service and military pensions; Includes US Foreign Military Assistance

Note: US dollar totals are calculated using average market exchange rates for 2019, derived using IMF data. The relative position of countries will vary not only as a result of actual adjustments in defence-spending levels, but also due to exchange-rate fluctuations between domestic currencies and the US dollar. The use of average exchange rates reduces these fluctuations, but the effect of such movements can be significant in a number of cases.

† At current prices and exchange rates

Source: https://www.iiss.org/blogs/military-balance/2020/02/global-defence-spending

AI military strategies

In November 2012, the Pentagon published **"Directive 3000.09"**,[39] its first official directive on autonomy in weapons systems. This was also the world's first public policy brief on LAWS. In its directive, the Pentagon clearly spoke out against the use of fully autonomous weapons systems in the military and demanded that there always be a person "in the loop".

The Obama administration also defined AI as a key technology for securing military superiority. However, in 2018, its **National Artificial Intelligence Research and Development Strategic Plan** was immediately abolished by the Trump administration and replaced with a new AI military strategy: **"Harnessing AI to Advance Our Security and Prosperity"**.[40] The primary goal of this new strategy is to secure the military and technological supremacy of the USA over its strategic competitors. As part of this strategy, the Pentagon announced that it intends to employ artificial intelligence in all areas of the military in the future, for example in intelligence services and surveillance operations, as well as to predict maintenance problems in aircraft and ships. To achieve this, massive investments in AI were announced.

The Pentagon's strategy also calls for **ethical AI principles for military use** at national and international levels. These principles were drafted over the following months by the so-called *"Defense Innovation Board"*, an illustrious group of well-known figures from business (*Google, Microsoft, Facebook*) and research (*California & Massachusetts Institute of Technology, Carnegie Mellon*, and other universities) chaired by Eric Schmidt, the ex-CEO of Google. In February 2020, five principles of AI were presented to the public: *"being responsible, equitable, traceable, reliable, and governable"*, proposing that humans should remain responsible for the development, distribution, deployment, and results of AI. The principles also argue that all AI systems should remain controllable.[41] The Pentagon's goal is therefore – at least officially – not complete autonomy in weapons systems. The Pentagon has taken this approach in response to protests from the private sector and pressure from the public. The real challenge, however, lies in implementing these principles. It is questionable whether they will continue to be observed if other states begin to use fully autonomous weapons themselves.

2.4 People's Republic of CHINA

When the computer program *AlphaGo* developed by *DeepMind* successfully defeated the Chinese world champion Ke Jie at the Asian strategy game of Go for the third time in May 2017, it was somewhat of a Sputnik crisis for the Chinese government. Leading AI experts were immediately assembled, and a national AI development plan (**New Generation Artificial Intelligence Development Plan**)[42] was drafted. This plan was ratified by the State Council of China in July 2017. The Chinese government set two objectives: a) build an AI industry with an annual turnover of 150 billion USD; and b) establish China as the world's leading AI power. The development plan also calls for the use of artificial intelligence to be intensified in the military sector. AI is presented as a panacea that can both make the economy more sustainable and authoritarian rule more efficient.

The existing AI ecosystem in China offers favourable conditions for achieving these goals by 2030: the Chinese state is making huge investments in AI companies, both domestically and abroad. The development of AI is heavily reliant on the (private) economy, and especially on the so-called BAT companies, which have been assigned to specific sectors: **Baidu** (autonomous driving), **Alibaba** (smart cities), **Tencent** (health sector), and **iFlytek** (voice recognition). The world's most valuable AI start-up is currently Chinese: *Sensetime*, a manufacturer of facial recognition technology. China also has the world's largest data pool – generated from state surveillance system and around 870 million internet users. At the same time, data protection legislation within the country is relatively lax, which has facilitated China's successes in AI and data mining. The number of Chinese publications and patent applications relating to AI has increased at a remarkable

rate in recent years.

But China's AI ecosystem also has weaknesses: most basic AI research still comes from the USA. China has a lack of domestic AI experts; although there are around 18,000 AI developers working in China, there are over five times more than this in the USA and the EU.[43] There are also weaknesses in semiconductor manufacturing, especially in the development of AI chips. China remains strongly dependent on other countries; many of the Chinese successes in AI have been facilitated by foreign capital and cooperation within multinational research teams and companies. Even in China, the two dominant deep learning frameworks are *Tensorflow* (Google) and *Pytorch* (Facebook). China has taken to forcing foreign companies to participate in the transfer of technology and is known to engage in industrial espionage on massive scales.

Beijing AI principles

Given its economic strength and technological progress, China wishes to take on a larger role in shaping the global governance of artificial intelligence – for both legal and ethical norms and technical standards. Earlier technologies and the internet were largely determined by the USA.

Thus, the Beijing Academy for Artificial Intelligence published the **"Beijing AI principles"**[44] at the end of May 2019. The most important AI organizations and companies in China were involved in drafting these principles, including the three large tech companies *Baidu, Alibaba,* and *Tencent*, as well as the Chinese Academy of Sciences. At first glance, the Beijing AI principles seem strikingly similar to the AI principles of Western governments and companies.[45] However, closer inspection reveals that emphasis is placed on the state and the community at the expense of individuals.

From the perspective of political practice, the Beijing AI principles seem cynical. The state government is already implementing AI-supported surveillance systems with facial recognition software in more than 70 cities as an instrument of systematic surveillance of citizens (social credit system), to suppress protest movements, and to perpetrate crimes against humanity targeting the Muslim minority in Xinjiang, among other acts.

AI military strategies

In July 2019, China adopted its tenth **Defense White Paper**.[46] This policy paper presents the principles of China's new foreign and defence policy and the comprehensive modernization of the People's Liberation Army in detail. It also describes how the Chinese army, air force, and navy intend to integrate artificial intelligence into their weapons systems, command networks, and communications.[47] The objective is to transform the Chinese armed forces into a "world class" army by 2050. Unlike the USA, China has not yet published any ethical guidelines regarding the use of AI in weapons systems.

Within the *Academy of Military Sciences* (AMS) of the People's Liberation Army, a new *Research Centre for Artificial Intelligence* was established with several hundred military scientists and strategists. This centre can perform research and development without any major restrictions.[48] Unlike in Western states, the authoritarian regime can also pursue ambitious arms programmes. There is no parliament to exert critical oversight, and citizens' concerns are irrelevant. As the Commander in Chief and Chief of the Military Commission, President Xi always has the final word.

A key pillar is so-called **"military-civilian integration"** (MCI), which was declared a national strategy in 2015. The goal is to intensify networking between the military and civil sectors to collaborate in the development of so-called dual-use technologies. Close cooperation between the People's Liberation Army (PLA) on the one hand and private businesses and academic research institutes on the other allows China to simultaneously promote economic growth and modernize its military, while quickly repairing deficits in its defence sector. The strategy also includes intensified recruiting of civilian scientists for military research.[49] Unlike in Western countries, the authoritarian Chinese regime is able to exert enormous pressure on private companies to force them to cooperate. Little opposition is expected from the workforce. Employee protests such as those organized in US technology companies would be unthinkable in China.

2.5 Russian Federation

"Artificial intelligence is the future, not just for Russia, but for all of humanity. It offers colossal opportunities, but also threats that are difficult to predict. Whoever leads in AI will rule the world."[50]

With this quote, now become famous, Russian President Vladimir Putin declared his country's position in the technological race for artificial intelligence in 2017. At the time, however, Russia was in an extremely poor condition, with a weak private tech sector with only a few AI start-ups[51], a lack of innovation culture, a relatively low budget for AI research and development[52], a meagre defence budget, an exodus of educated experts, and Western sanctions on many key areas in the defence sector. Accordingly, Russia was far behind in the global AI race, and it seemed unlikely that the country would ever be able to compete with China and the USA.

Although Russia remains unlikely to lead the world in AI in the near future[53], its potential capabilities should not be underestimated, as the country is making great efforts to catch up.[54] Especially in STEM subjects, the well-educated workforce may help the country to re-join the ranks of high-tech trendsetters in the AI sector.

The state as an enabler

Unlike in the USA and Europe, private tech corporations do not lead AI development in Russia; instead, companies owned by or closely associated with the state play the most prominent role. The Russian government is setting the course even more heavily than in China. The majority of military AI research is performed within the Russian Ministry of Defence, which has extensive technical, academic, and industrial infrastructure, as

well as enormous financial, human, and material resources. Thus, the Russian approach to AI largely follows a top-down model. Nevertheless, the Russian government is increasing its efforts to facilitate networking between the growing private high-tech sector and the expanding military-academic infrastructure.

Russian AI strategy

For the first time in his speech on the state of the nation in February 2019, President Vladimir Putin announced a large-scale artificial intelligence programme with the goal of making Russia a world leader on the market by the mid-2020s. In October 2019, he adopted the long-awaited **National Strategy for the Development of Artificial Intelligence for the Period until 2030** by decree.[55] The key goals cited by this strategy are increased prosperity, higher quality of life, national security, competitive strength of the Russian economy, and an internationally leading role in artificial intelligence. The role of the private sector in the national development of AI is not addressed.

Calls for a code of ethics to manage artificial intelligence

In a sensational speech at the *"Artificial Intelligence Journey Conference"* in Moscow in early November 2019, Russian President Vladimir Putin called for new rules to regulate the development of artificial intelligence. Experts and businesses were urged to define moral rules to govern the interactions between humans and artificial intelligence. *"Technology should not be invented for technology's sake."*[56]

AI in the military sector of the Russian Federation

The Russian defence sector has been preparing for a protracted high-tech race with its primary adversaries, the United States and NATO, for many years. The Russian Ministry of Defence already began researching and developing unmanned and robot-based air, ground, and maritime systems in 2012. Since then, it has redoubled its efforts to integrate elements of artificial intelligence into its weapons systems. AI plays a central role in Russia's hybrid approach to warfare. Most military AI projects are conducted under the auspices of the Russian Ministry of Defence (MOD) and affiliated institutes, research centres, and industrial conglomerates.

3. The ethical responsibility of companies – the example of US technology corporations

As artificial intelligence continues to spread, AI researchers, developers, and IT companies have a growing ethical responsibility for the potential use and social effects of the technology they develop. This is especially true for applications of artificial intelligence in the security and defence sector, which is arguably the most sensitive area of AI.[57]

The *employees* of major US technology companies have expressed growing concern that new technology could be used to violate basic human rights, invade the privacy of individuals, or even kill people, rather than for the benefit of mankind. Their internal protests have been becoming louder and more insistent, and many employees have refused to cooperate with technologies used for military purposes.

Google

At **Google**, massive protests were repeatedly held by thousands of employees, and even some resignations. The first was in April 2018 in connection with the controversial *MAVEN project* of the Ministry of Defense, which employees feared would mark the company's entry into the development of autonomous weapons systems. Since 2017, Google had been supplying AI that allowed the video material recorded by US surveillance drones to be efficiently searched for objects of military relevance. Massive employee action was once again held in October 2018 to protest the equally controversial *JEDI project*, a multibillion-dollar contract from the Pentagon to build a US military cloud.

In open letters to the company's management[58], employees demanded a clear commitment from the corporation to never develop technology that might be used for purposes of war.

This pressure from employees, supported by politicians and human rights organizations, found its mark. Google withdrew from the projects, foregoing several multibillion-dollar contracts from the Pentagon.

After the first MAVEN protests, Google published **"Seven ethical AI principles"**[59] in June 2018. These principles include the statement that *technology must always be socially beneficial, for example in healthcare, security, energy, transportation, etc.* Furthermore, AI should *not reflect or reinforce bias regarding gender, race, or age.* The principles also name four areas in which Google will refrain from using artificial intelligence, including technologies whose purpose violates generally accepted principles of international law and human rights. Google also committed to *not provide any artificial intelligence for use in weapons*. Within the national security community, this decision by the company's management triggered a shockwave. Google was accused of treason for refusing to defend its homeland against China.

Microsoft

Employee protests were also held at **Microsoft**. The group successfully won the bidding war for the *JEDI project* in October 2018. Like their counterparts at Google, Microsoft employees called upon their company in an "open letter"[60] to refrain from participating in the Pentagon's *JEDI project* and commit to a set of ethical principles. However, the protests were ineffective. The president of Microsoft, Brad Smith, did not discontinue cooperation with the Pentagon. Just one year later, the employees repeated their demands. This time, they were prompted by a contract between Microsoft and the Pentagon worth 480 million USD for the delivery of 100,000 *HoloLens2 glasses* to the US military. In a letter to CEO Satya Nadella and President Brad Smith, employees demanded the end of cooperation with the military and development of weapons technologies of all kinds, as well as the adoption of corporate AI ethics guidelines. Microsoft's top managers advised against withdrawing from new technologies such as augmented reality or artificial intelligence in military contexts. However, Microsoft did develop its own guidelines: **six principles for AI and ethics**, presented by President Brad Smith.[62]

TESLA

TESLA is pursuing a completely different corporate policy. The company's founder Elon Musk has become one of the most prominent opponents of LAWS. He strictly rejects the military use of AI and refuses any type of cooperation with the Pentagon. In 2015, together with leading AI and robotics researchers (including *Stephen Hawking,* Apple co-founder *Steve Wozniak*, and DeepMind CEO *Demis Hassabis*), Musk called for a preventive prohibition of LAWS in an open letter.[63]

The open letter was presented at the start of the *"Int. Joint Conference on AI"* (IJCAI), one of the world's leading AI conferences. It has now been signed by over 4,500 researchers worldwide and more than 26,000 other individuals. Two years later, during the IJCAI in August 2017, Elon Musk and Mustafa Suleyman (DeepMind) presented an open *Letter to the United Nations*[64] demanding an immediate ban on LAWS and their inclusion on the CCW's list of prohibited weapons. The letter was signed by 116 experts from 26 countries.

The ambivalent relationship between Silicon Valley and the Pentagon

As the above examples show, the relationship between the US technology sector and the US Department of Defense has been extremely ambivalent for years.[65] Some companies such as Amazon, Intel, IBM, Microsoft, and Oracle do not hesitate to supply their technology to the military and security forces and specifically compete to win contracts from the Pentagon.[66] But other companies such as Google and Apple maintain a cautious distance from the Pentagon, fearing damage to their reputation among customers and employees, who are increasingly demanding political credibility. In Silicon Valley, which is politically mostly left-wing, companies have to pay close attention to how cooperation with the military or the defence industry might be perceived.

The Pentagon, whose image has greatly suffered in recent years, especially with the revelations by Edward Snowden in 2013, is very keen to improve relations with Silicon Valley. This is motivated by self-interest, as key military technologies are no longer being invented in the military's own workshops, but within large tech companies. The Pentagon is greatly afraid of being overtaken by China in military technologies.

At the same time, the Pentagon has expressed criticism of the business conducted by some large tech companies in China: when Google opened an AI research centre called the *"Google AI China Center"* in Beijing in the spring of 2018, it was accused of having an unpatriotic or even treasonous attitude by the former Deputy Secretary of Defense Robert Work[67] and billionaire Peter Thiel. The latter claimed that Google was making its AI technology available to China while simultaneously refusing to work with the Pentagon, an attitude which they described as harmful to the United States. A similar accusation could be made of Microsoft, which is collaborating on surveillance technology with the *National University of Defense Technology* (NUDT), which is financed by the Chinese military.

Corporate initiatives for a responsible approach to AI

In a joint initiative, Amazon, Apple, Facebook, Google, DeepMind, IBM, and Microsoft founded the **Partnership on Artificial Intelligence to Benefit People and Society** (PAI) towards the end of 2016. The initiative now counts more than 75 members, including technology groups, start-ups, NGOs, and science and research institutes from 13 countries. BAIDU was the first Chinese company to join the partnership but departed in 2020.[68] Another Chinese organization that is currently still a member is the Hong Kong University of Science and Technology. The PAI sees itself as a non-profit organization rather than

a lobbying organization. Tesla CEO Elon Musk and investor Sam Altman ("Y Combinator") have launched a similar initiative called **OpenAI** whose goal is also to conduct responsible research into artificial intelligence.

4. Negotiations on the regulation of LAWS within the framework of the CCW

Since 2014, the signatory states of the CCW in Geneva (Convention on Certain Conventional Weapons) have been negotiating regulations and a potential prohibition on autonomous weapons systems. The Group of Governmental Experts (GGE) was established for this purpose in 2017. In September 2019, the GGE presented an interim report.[69]

However, a binding international treaty has not yet been concluded, and the fronts between actors are becoming increasingly hardened: a group of 30 states is advocating a **LAWS-Non-Proliferation Treaty** that would immediately prohibit all research, development, and use of LAWS. This group is supported by thousands of scientists and leading AI and robotics experts, more than 160 international NGOs in 63 countries – coordinated by the *"Campaign to Stop Killer Robots"* and the *International Committee for Robot Arms Control* (ICRAC) – 21 Nobel Peace Prize laureates, the UN Secretary General, the European Parliament, and a clear majority of the population in global opinion polls.

On the other hand, states including the USA, China, Russia, France, Great Britain, Israel, and India strictly reject a ban because they do not want their research and development into LAWS to be slowed down. These countries argue that weapons systems that do not yet exist cannot be banned or regulated.[70] In total, twelve countries are refusing any form of regulation of LAWS within the framework of the CCW and are consequently preventing a decision from being reached, as this would require unanimity.

Position of the European Union

The *European Parliament* (EP) passed a resolution (Res. 2018/2752) in September 2019 with a large bipartisan majority[71] calling for an internationally binding ban on LAWS. The EP also asserted that LAWS should not be funded by the European Defence Fund. It called upon the European Commission, the European Council, and the member states to develop a common EU position on LAWS and submit it within the CCW process to advocate for human oversight over critical functions of autonomous systems. However, differences in the positions of the member states have prevented such a consensus from being reached. The EU has currently not submitted a joint position paper within the CCW process. Great Britain has consistently been opposed to regulation, so its departure from the EU may represent a new opportunity to establish a common position.

Position of the USA[72]

The United States wishes to ensure that any development or application of LAWS is consistent with international humanitarian law, including the principles of humanity, discernment, and proportionality. The US argues that advances in autonomy and machine learning might even facilitate and improve the implementation of international humanitarian law. One of its goals is therefore to better understand how this technology is evolving and how it can be applied in the future. On this basis, the US very clearly opposes any regulation or prohibition of LAWS.

Position of China[73]

In April 2018, the Chinese delegation submitted a position paper to the GGE supporting a global ban on LAWS. Later, this position was nuanced to specify that, although the use of LAWS in combat should be prohibited, research and development were permissible. However, these diplomatic statements are in stark contrast to the political reality: China has been deploying weapons technology with an increasingly level of autonomy. It has also been exporting this technology on large scales.

Position of Russia[74]

Since 2017, Russia has taken a fairly consistent stance on LAWS, supporting the international consensus that humans should maintain control over the use of weapons.

Russia also advocates regulating the use of LAWS, while opposing the regulation of research and development. Consequently, it has boycotted any attempt at global regulation or prohibition.

The new "Guiding Principles on LAWS"

At the most recent CCW annual meeting in November 2019, at least one small step was made towards progress. The 125 CCW signatory states adopted a set of **Guiding Principles on Lethal Autonomous Weapons Systems**.[75] This is the first time that political guidelines have been presented to address key aspects such as human accountability and responsibility, human control within the chain of command, and the unrestricted applicability of international law to all future weapons systems. As they currently stand, the guiding principles require a more detailed interpretation and a normative and operational framework. To this end, consultations will continue through 2020/2021 within the framework of the CCW/GGE.[76] The CCW signatory states have been given until August 1, 2020 to submit national position papers on the Guiding Principles. Many countries, including Germany, have taken advantage of this opportunity.[77]

The Guiding Principles include many of the recommendations that Germany and France had previously submitted to the GGE as part of a joint political declaration in 2017.[78] Both countries wish to act as mediators between the opponents and proponents of a prohibition treaty and work towards a ban on LAWS in the medium term through a gradual negotiation process.

Critics have described the Guiding Principles as a completely inadequate responsible to the very real dangers posed by LAWS. Above all, criticism has focused on the fact that the Guiding Principles do not establish any prospects for a legally binding agreement on LAWS, despite this being demanded by the majority of CCW signatory states.[79] According to critics, seeking unanimity has led the CCW to manoeuvre itself into a dead end. A subset of around a dozen states is undermining the efforts to achieve effective regulation. Accordingly, an effective ban on LAWS can only be achieved outside of the UN-CCW. Past bans on land mines and cluster munitions show that this approach could be very promising.

Outlook

The Group of Government Experts (GGE) has been given a mandate to develop recommendations for a comprehensive "framework" by the Sixth Review Conference of the CCW in December 2021. If no measurable progress has been achieved by this milestone, the CCW negotiations risk permanently failing.

5. Political demands

The German federal government and its European partners should exploit every avenue to ensure the successful continuation of CCW negotiations in Geneva on the regulation of fully autonomous weapons system so that this dangerous arms race may be brought to an end. The implementation of the following demands is therefore of high priority:

Implement a global ban on lethal fully autonomous weapons systems (LAWS)

A prohibition of LAWS is advisable for legal and ethical reasons:

In November 2019, with the adoption of the **Eleven Guiding Principles on Lethal Autonomous Weapons Systems**, the 125 CCW signatory states recognized that the rules of international law, and in particular international humanitarian law, are fully applicable to the development and use of LAWS. However, since the use of LAWS cannot be reconciled with fundamental principles of international humanitarian law, such as the principle of distinguishing between combatants and non-combatants and the proportionality of deployed means, it inherently contradicts international law.

From an **ethical** perspective, the decision about a person's life or death must not be delegated to an algorithm. This is incompatible with human dignity, as is for example enshrined in German Basic Law, as well as the UN Charter and the Universal Declaration of Human Rights.

Introduce the principle of "meaningful human control" in LAWS as a universal standard

There is a broad consensus among nations that new weapons systems cannot be allowed an unrestricted level of autonomy and that *"meaningful human control"* must continue to be present in certain functions. Concretely, it must be established which functions in the five-stage targeting cycle (find, fix, track, select, engage) may be performed by a machine and which must be decided by a person. The answer depends on the mission context and the objective. The CCW

signatory states have an urgent responsibility to reach an agreement on the quality and extent of human control and on criteria for compliance. Various expert suggestions have already been proposed.[80]

The principle of *"meaningful human control"* not only guarantees compliance with globally applicable standards of ethics, but it could also close the so-called "responsibility gap". It ensures that there is a responsible party who may be held accountable for non-conforming behaviour by autonomous systems.

Develop adequate technological approaches for arms control and verification of LAWS[81]

The performance of modern weapons systems is increasingly determined by software rather than hardware. As a result, conventional arms control, which heavily relies on the examination of physical objects (mines, ammunition, small arms, conventional weapons, weapons of mass destruction, and delivery systems) and simple procedures such as inspections, flyovers, and measurements, is no longer sufficient.

The performance of LAWS is determined by their "degree of autonomy", which lies in their complex source code and not any physical hardware. This code needs to be inspected to determine whether it includes options for human oversight and control or is exclusively autonomous. In other words, a verification system that is able to retrospectively determine whether a questionable attack was directly controlled by a person is required. To achieve this, representatives of technology companies need to be more commonly recruited to play a role in arms control. These representatives need to explore the technological possibilities of new arms control measures more thoroughly.

Develop a military AI strategy for Europe

The development and use of artificial intelligence for military purposes has currently not received enough attention within EU institutions and the governments of member states. Unlike in the USA and China, there has been little debate about the ways that AI will transform warfare and military organizations. And unlike in China and the USA (with the exception of France), little attention has been paid to the geostrategic importance of military AI. AI-based military technology has been primarily addressed within the context of arms control, e.g. with bans on so-called *"killer robots"*. But military AI extends far beyond LAWS. In the meantime, AI systems are becoming increasingly common in arms production.

Especially in the context of their efforts to achieve greater strategic sovereignty and establish the *European Defence Union*, the EU institutions and member states need to incorporate military AI much more thoroughly into their political and strategic considerations and develop a common position on LAWS. During preparations for the *"strategic compass of the EU"*, which seeks to consolidate the various geostrategic interests within the EU, there will be opportunities to address defence-relevant disruptive technologies more intensively.

Introduce international/European standards for the development, use, and export of armed and arms-capable drones

The global market for military drones is growing rapidly. Their rapid spread and use in conflict regions and *counter-terrorism* operations (targeted strikes) represents a major challenge for international security. They also raise major legal, political, and ethical concerns. Existing control regimes for military drones and related technologies, such as the *Missile Technology Control Regime*, the *Wassenaar Arrangement*, and the *Arms Trade Treaty*, are insufficient. These regimes vary greatly in terms of scope, participation rates, and relevance, and they are only binding for their members and signatories. The new drone-manufacturing and exporting countries – with China at the forefront – are typically not members.

Likewise, the EU member states have not yet developed a common set of standards, despite more and more of them deploying armed or arms-capable drones. The Eurodrone currently being developed is the first example of a European combat drone. As early as February 2014, the *European Parliament* (EP) passed a resolution on the use of armed drones[82] that condemns targeted killings by drones outside of war zones and other acts as illegal. Even in the context of armed conflict, humanitarian guidelines must be strictly observed. Furthermore, armed drones should be immediately and comprehensively included in all relevant European and international export control regimes. Since passing this resolution, the EP has repeatedly reiterated the need for a common EU position, submitting its own detailed proposal in June 2017.[83] However, neither the EU Commission nor the European Council have taken any steps to regulate the use and acquisition of armed drones. According to these institutions, this responsibility falls to the member states. But the member states themselves refer back to the multilateral level. The result is a dangerous regulatory gap at both European and international levels.

Classify fully autonomous drone swarms as weapons of mass destruction

Armed, fully autonomous drone swarms must be classified as *weapons of mass destruction* (WMD) because they are essentially infinitely scalable (which means they can cause an unlimited amount of damage) and are incapable of differentiating between military and civilian targets. Both characteristics are used to identify a weapons system as a weapon of mass destruction. All WMDs are subject to arms control. They are regulated by the so-called *Seabed Treaty*, which prohibits them from being placed on or under the seabed under international law. They are also restricted by the *Outer Space Treaty*, which states that outer space should only be used for peaceful purposes.

Make the European AI ecosystem competitive

Despite certain location-based advantages, Europe is still operating far below its potential in the field of artificial intelligence and threatens to become dependent on developments in the USA and China. Although the EU's current focus on ethical principles for AI is commendable, it will only be able to survive in the context of global competition if it expands every aspect of AI, which means investing in the promotion of AI talent, AI start-ups, research, and innovation.

Furthermore, the European states will only find the strength to influence the global development of AI if they work together. It is essential for these states to harmonize their AI strategies and intensify collaboration to balance out their various strengths and weaknesses in AI patents, infrastructure, investment capacity, and human resources.

Support a global dialogue on ethical standards for the development and use of artificial intelligence

Reaching an agreement on global standards for the responsible use of artificial intelligence is one of the most urgent challenges of the coming decade.

On the surface, the AI ethics rules presented by the USA, the EU, the OECD, and China have much in common. But there are certain crucial differences. The most important is the relationship between the individual and the community. The *Beijing AI principles* emphasize the interests of the community, whereas the European principles focus more on the rights and autonomy of individuals. Authoritarian and democratic countries are also deeply divided on the question of privacy.

Both the USA and China emphasize the importance of international AI principles and standards in their respective AI strategy papers and demand to be actively involved in their development.

In May 2019, the World Economic Forum (WEF) attempted to build a bridge between East and West by founding a **Global AI Council**. Jointly chaired by the president of Microsoft Brad Smith and the Chinese AI innovation research pioneer Kai-Fu Lee, the council plans to develop a common set of rules. However, China is not represented in the *"Global Partnership on AI"* recently initiated by France and Canada (July 2020).

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75 *GGE on Emerging Technologies in the Area of LAWS*, September 25, 2019 - **Annex IV**: *Guiding Principles on LAWS* https://undocs.org/en/CCW/GGE.1/2019/3
Federal Foreign Office: *Außenminister Maas zur Einigung auf Leitprinzipien zum Einsatz vollautonomer Waffensysteme*, November 15, 2019

[76] In preparation for this, the Federal Foreign Office organized a virtual *"Berlin LAWS Forum"* in April 2020 with participants from more than 60 countries. The report can be found at: https://rethinkingarmscontrol.de/wp-content/uploads/2020/04/Chairs-Summary-Berlin-LAWS-Forum.pdf

[77] Link to all national statements: https://reachingcriticalwill.org/disarmament-fora/ccw/2020/laws/documents; Germany's statement of June 24, 2020: https://documents.unoda.org/wp-content/uploads/2020/07/20200626-Germany.pdf

[78] For consideration by the Group of Governmental Experts on Lethal Autonomous Weapons Systems (LAWS) – Submitted by France and Germany, September 2017

[79] **Human Rights Watch**: *Statement on Guiding Principles, CCW meeting on lethal autonomous weapons systems*, March 29, 2019

[80] **SIPRI/ICRC**: *Limits on Autonomy in Weapon Systems – Identifying Practical Elements of Human Control*, June 2020 – **IRPRAW**: *A Path towards the Regulation of LAWS*, May 2020 – **Human Rights Watch**: *New Weapons, Proven Precedent - Elements of and Models for a Treaty on Killer Robots*, October 2020

[81] **ICRAC**: *Compliance Measures for an Autonomous Weapons Convention*.
This topic is also being addressed by the Federal Foreign Office by organizing two high-quality conferences entitled *"Capturing Technology-Rethinking Arms Control"* in November 2019 and November 2020.

[82] **European Parliament**: *Resolution on the use of armed drones*, February 2014

[83] **European Parliament**: *Towards an EU common position on the use of armed drones*, 2017