NUCLEAR WEAPONS

Discussion Paper | A Russian Perspective

Militarization of AI

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The Robotization Program in Russia

The term "artificial intelligence" manifested itself loudly at the state level in Russia in 2017. "Artificial intelligence is not only the future of Russia, it is the future of all mankind. There are enormous opportunities and threats that are difficult to predict today. The one who becomes a leader in this sphere will be the ruler of the world," President Vladimir Putin said on September 1, 2017.[1] The topic immediately became popular in the Russian media scene, businessmen and government officials discussed prospects of AI development in Russia at various forums, and a wave of information-technology forums for specialists and startups swept across the country. The Russian government has released a national strategy for artificial intelligence.[2] That decree directed the government to formulate and approve a Federal Project on Artificial Intelligence as part of the national program called Digital Economy of the Russian Federation. Up to 90 billion rubles ($1.4 billion) will be spent for these purposes in six years.[3]

The Russian military began to use the term "artificial intelligence" around 2017, when the Ministry of Economic Development held the roundtable "Artificial intelligence" at the Military-Technical Forum ARMY-2017.[4] Since then, no conference held by the Russian Defense Ministry has avoided this topic.

Until 2017, what is now associated with military artificial intelligence was associated with robotics in Russia. The Military Encyclopedic Dictionary on the official website of the Russian Ministry of Defense (MoD) cites the concept of "combat robot" as a "multi-functional technical device with anthropomorphic (humanlike) behavior, partially or fully performing functions of a person in executing certain combat missions. It includes a sensor system (sensors) for acquiring information, a control system, and actuation devices."[5]

The Russian military divides combat robots into three generations:

- First-generation robots have software and remote control that can only function in an organized environment.
- Second-generation robots are adaptive to changes in their environment, having a kind of sensory organs and an ability to function in a random environment.
- Third-generation robots are smart robots equipped with an AI-based control system. So far, such robots are only available as laboratory models.

Unmanned tanks and torpedo boats, robot soldiers, and others that are used to support combat activity of troops in conditions adverse to humans should be regarded as the simplest combat robots.

In 2000, the Russian MoD adopted an integrated target program, Robotization of Weapons and Military Equipment—2015. The program allowed for successful research and development, with experimental mock-up models of ground-based robotic systems produced and tested. However, development and engineering never started, which led to the suspension of research and development in ground-based military robotics.[6]

In September 2015, the MoD started the program Creation of Advanced Military Robotics for 2025. The program prioritized "designing of unmanned vehicles in the form of robotic systems and complexes for military use in various environments of application." The General Staff of the Russian Armed Forces developed a plan for the use of robotic systems for military purposes until 2030 and approved the general technical requirements for military ground robotic systems. According to this plan, about 30 percent of Russian military equipment should be remotely controlled by 2025.[7]

Following the measures taken by the MoD on December 16, 2015, Putin signed a decree establishing the National Center for Development of Technologies and Basic Elements of Robotics, which entrusted the Foundation for Advanced Research to furnish the center's activities.

In December 2016, the Russian government adopted the *Strategy of Scientific and Technological Development of the Russian Federation*, which named as priorities "the transition to advanced digital, intelligent manufacturing technologies, robotic systems, new materials and methods of construction, development of systems for big data processing, machine learning and artificial intelligence."[8]

Finally, Russia finished shaping the network of organizations responsible for military blueprints. That network or structure currently consists of:

- The MoD Commission for the Development of Robotic Systems for Military Purposes: Headed personally by Russian Defense Minister Sergei Shoigu, the commission develops a common model and procedures for designing robotic systems, reducing their types, and unification and coordination between various departments.

- The Main Department for Research and Technological Support of Advanced Technologies (GUNID): Part of the Russian MoD, GUNID is the prime contract specifier of military robots, and it also develops unified ideology and engineering procedures.

- The Main Research and Testing Robotics Centre of the Russian Ministry of Defense (MRTRC): The center is one of the most secretive military organizations in the country and rarely reports its achievements. It is known that the center creates the Russian marine information and measurement network intended for regular observations in the Arctic. According to the head of MRTRC, Sergey Popov, "the trend 'smart, small, many, and inexpensive' has gradually gained a realistic status, which is proven by specific achievements in modern robotics. "[9]

- The Advanced Research Foundation: According to Putin, "the Foundation's projects are designed to play a decisive role in the development of key elements of the new generation of weapons, military, and special equipment. They should become the basis of the national weapons system at the turn of 2025–2030 both for the Army and Navy, and for a number of other industries and law enforcement agencies."[10]

- The Military Innovative Technopolis "ERA": By 2020, twelve scientific companies of the MoD with approximately 600 personnel will work at this new research campus.[11] The technopolis will conduct research and development in priority areas, including information and telecommunication systems; automated control systems; robotic systems; artificial intelligence systems; computer modeling; information security; technical vision and pattern recognition; nanotechnology and nanomaterials; computer science and computer technology; energy, technologies, devices, and life-support machines; and bioengineered, biosynthetic, and biosensor technologies.[12] More than 80 leading Russian research and industrial enterprises plan to open laboratories and engineering units in the technopolis.

Russian manufacturers of military equipment follow their colleagues from the United States, Israel, and South Korea in designing autonomous combat robots and extending their capabilities, like reconnaissance and surveillance, patrolling, fire support, protection of objects and the breaching of penetrations in the barriers, delivery of ammunition and medevac, installation of minefields and demining, setting smoke screens, and even mobile audio propaganda. The Russian military has already learned to increase the effectiveness of combat systems through use of AI technologies. The Central Research Institute of Aerospace Defense Forces and the Research Institute of Electronic Warfare conducted research that demonstrated a twofold increase in the efficiency of air and missile defense when working hand in glove with early warning systems.[13]

Modern neural networks allow autonomous weapons systems such as unmanned aerial and ground combat vehicles to not only come to independent decisions but also to adapt to the changing environment. Russian manufacturer Kalashnikov has designed a ground-based "battle module based on neural networks" that is able to "gain targets and make decisions" without the operator's engagement.

The BAS-01G Soratnik combat automated system, armed with a PKTM tank machine gun and Kornet-EM antitank missiles, utilizes "lessons learned" when performing new combat missions.[14]

In February 2019, Kalashnikov was the first Russian manufacturer to develop a loitering munition—the KUB-BLA. Six months later, Kalashnikov revealed a new high-precision, unmanned complex called the ZALA Lancet. Such weapons are known as kamikaze drones because of their capacity to independently detect and attack targets. The website Kalashnikov Media defines the Lancet as an intelligent, multitasking weapon that can independently acquire an assigned target and attack it.[15]

The Russian defense industry and the Russian Armed Forces have made a concerted push to close the technological gap that has formed over what they perceive as two decades of inattention and underfunding. A view persists, including among arms manufacturers, that Russian engineers have to redouble their efforts to not lag behind the leading states in such areas as drone "swarming." This issue is couched as a technical task with no focus on moral or philosophical dimensions. National security interests and technological rivalry provide the Russian military with a reason to postpone moral considerations, which could further intensify arms race dynamics.

Consequently, Russian civil society does not pay much attention to the problem of human control over lethal autonomous weapons systems, and its understanding is limited about the debate that takes place through the Convention on Certain Conventional Weapons on the legality of such systems in military conflicts.

While the development of AI opens up new opportunities for the military, it is also fraught with new risks. The opportunities and risks have yet to be fully comprehended.

Combining emerging technologies with existing military resources increases efficiency in new ways. However, the speed of technological changes amplifies the arms competition that is present in rival militaries.

Future Threats to Crisis and Strategic Stability

In June 1990, the Washington Summit Joint USSR-US Statement on Future Negotiations on Nuclear and Space Arms and Further Enhancing Strategic Stability defined strategic stability as a state of relations between the two powers where, even in a crisis, neither side has serious opportunity and incentive for a nuclear first strike.[16] Arms race stability depends on whether there are incentives to build up a country's strategic potential. The principles of strategic stability formalized in the 1990 statement were considered as guidance for arms control.

This view on strategic stability obviously only takes into account the nuclear capabilities of the two leading nuclear powers—the United States and Russia—and leaves arsenals of other countries out of the formula. There are attempts to define strategic stability considering multilateral military capabilities today. Some offer new concepts of "multilateral" and even "cross-domain strategic stability."

Military artificial intelligence could undermine the foundation of strategic stability in any concept, including the classic American-Russian version. Some senior Pentagon strategists have already made statements that the most cutting-edge technologies and systems—especially from the fields of robotics, autonomous systems, miniaturization, big data, and advanced manufacturing—can provide military dominance.[17] Several technologies have the potential to impact global security today.

US missile defense is one of the most technically complex military projects in history. Automated launch and targeting is a key capability within systems like the Aegis Ballistic Missile Defense System.[18] Although the Russian military has repeatedly stated that US missile defense does not pose a threat to the Russian nuclear triad, doubts grow stronger as the number of deployed US antimissile systems and their capacities improve.[19] It incentivizes Russia to look for new ways to guarantee its nuclear deterrence. Russia responded to this threat at its borders by accelerating the development of a variety of innovative weapons systems, primarily hypersonic missiles. The competition between these heavily automated defense and attack systems further undermines strategic stability.

New, potentially AI-based, long-range, antiship missiles—such as the Russian 3M-55 Onyx[20] or the US LRASM—represent a class of autonomous ship killers. Using AI and datalinks, these missiles make decisions on their own, conducting a coordinated attack on an enemy fleet. They size up the enemy fleet, locate the target, and calculate the desired point of impact.[21]

Interconnection of space tracking and surveillance system with command and control, battle management, and communications by means of AI-based programs opens new possibilities for interception of ballistic missiles. The deputy chief of the Russian General Staff, Viktor Poznikhir, underlined that US radars can monitor flights of Russian ICBM warheads. In addition, US missile defense poses a threat to almost all Russian low-orbit satellites within the reach of the system.[22]

In the near future, fleets of unmanned robotic systems could flood the oceans in order to detect and trace ships and submarines. The prototype of such drones is the Sea Hunter, recently deployed by the US Navy. Should the autonomous marine hunters become a component of antisubmarine warfare, the global oceans would become more transparent, and the invulnerability of nuclear submarines would be questioned, as would their ability to provide strategic deterrence.[23]

Machine learning and autonomy open up the possibility of using nuclear weapons—like the B61-12 low-yield, high-precision nuclear bombs—to accomplish tactical tasks. If AI applications result in improved targeting and coordination, then they could enable precision strikes with low-yield weapons to destroy key command, control, and communication assets—including nuclear force and space monitoring systems—without the use of high-yield nuclear weapons. Similar capabilities could enable the use of nonstrategic, precision weapons to execute strategic operations. New types of nuclear weapons and deployment of ballistic missiles with nonnuclear warheads make arsenals unpredictable and affect strategic stability.

Swarms of unmanned vehicles could open a new page in the history of noncontact warfare without the battlefield presence of human combatants. Inexpensive, expendable drones could quickly map an adversary's combat systems, targeting and destroying key components of its C2 and defense systems with relatively little cost. Threats of this kind require militaries to closely monitor new technologies and to develop new means of defense, which ultimately fuel arms race dynamics.

The inexpensive escort drones for combat aircraft could serve as carriers of weapons or "consumables" in case of combat and would significantly increase combat effectiveness.[24] More-sophisticated air defense and early warning capabilities would shape a response to such a threat, ultimately leading to militarization of the parties at a higher technological level. The introduction of technology for air refueling of attack drones, as well as deployment of unmanned refueling aircraft, could increase force projection range and reduce risks to pilots and aircraft carriers. It would increase tension in regional conflicts and incentivize development of new means to neutralize the remote threat of this kind.

Technological progress makes military strategists think about the permanent removal of pilots from cockpits where a human becomes a hindrance.[25] Preliminary sketches of the prospective sixth generation fighter show an autonomous vehicle capable of fully robotic flight at hypersonic speed, with improved stealth technology across the full electromagnetic spectrum, protected by laser systems and equipped with powerful electronic warfare.

Great prospects exist for military AI in outer space. Unmanned reusable space aircraft (like the Boeing X-37B Orbital Test Vehicle, XS-1 Spaceplane, or X-43A Hypersonic) could shape a new model of space confrontation. Even without weapons on board, these vehicles will cause concern for many militaries and incentivize the development of new defense systems to protect against unknown threats, primarily against spacecraft capable of disabling satellites.[26] For example, France reportedly plans to equip Syracuse telecommunications satellites with cameras and self-defense devices, such as blinding lasers or machine guns for breaking solar panels of an approaching satellite.[27]

Outsourcing of Command, Control, Communication, Intelligence, Surveillance, and Reconnaissance to AI

AI learns to cope with increasingly complex tasks as it accumulates experience and absorbs new technologies. It is already able to not only collect but also to analyze intelligence.

In 2014, the National Defense Operations Center of the Russian Federation was inaugurated in Moscow. It is designed to collect, summarize, and analyze information on the military and political situation in the world and conduct centralized control of the Russian Armed Forces.[28] Based on requests, its software and hardware system monitors and analyzes information from open sources, simulates forecasts of key world events, and prepares recommendations in an automated mode.[29]

The United States and the United Kingdom have similar centers, while other countries are seeking the capability. As the amount of information to be processed increases and the dynamics of events accelerate, the temptation grows to place AI in charge of not only developing recommendations but also drafting and choosing the right scenario for crisis situations. Participation of AI in assessing the situation and responding to threats would increase the risks of unintended military conflict.

Currently, the Russian military is rather reluctant to introduce AI into military affairs. The president of the Russian Academy of Missile and Artillery Sciences, Professor Vasily Burenok, makes reference to the risks of design errors, physical damage, and hostile software impact on AI-based systems. Burenok believes that it is almost impossible to create algorithms suitable for all combat scenarios. In his opinion, AI might only be used in military operations for preparing initial information for decision making by the commander.[30]

In the meantime, the improvement of software, the advancement of learning programs, and the time pressure on decision makers in crisis situations could incentivize using military artificial intelligence. The development of military technologies dramatically reduces the time available to decision makers for assessing threats. The transfer of this function to the AI-based machine may not be a military or political decision but rather a purely technical unwitting one.

Commercial Companies in the Military Domain

Commercial projects based on AI are increasingly being used in the military domain. For example, unmanned vehicle control programs and visual recognition algorithms are equally suitable for commercial vehicles and combat autonomous systems. Military contractors create a new market and new technical horizons for the civilian sector. For their part, commercial companies can offer projects that are interesting to the military, including analysis of satellite images, internet traffic, social network data, global media, air and sea traffic, and even bank transfers.

Russian Defense Minister Shoigu said at the conference "Artificial Intelligence: Problems and Solutions" that military and civil scientists must develop organizational proposals that should be aimed at collaboration between the scientific community, the government, and industrial enterprises.[31]

Meanwhile, the share of private science in Russia is rather small. State research institutes account for 72 percent of domestic research and development (R&D) expenses, and they employ about 80 percent of all Russian researchers.[32] *The Strategy of Scientific and Technological Development of the Russian Federation*, approved by presidential decree on December 1, 2016, admits that "there is a problem of immunity of the economy and society to innovations, which prevents the practical application of the R&D results (the share of innovative products in the total output is only 8-9%; investments in intangible assets in Russia are 3 to 10 times lower than in the leading countries; the share of Russian high-tech products in world exports is about 0.4%). There is virtually no transfer of knowledge and technology between the defense and civilian sectors of the economy, which hinders the development and use of dual-use technologies."[33]

Unlike in Russia, where the state is making its first attempts to attract commercial companies to military contracts, it has become a trend in China, the United States, and other countries. For example, the United States has expanded what President Dwight Eisenhower called in his farewell address a "military-industrial complex."[34] American companies such as Amazon, Microsoft, IBM, Oracle, and Google are now involved in defense projects. Tech giants Google, Apple, Salesforce, and IBM realize the prospects of systems with artificial intelligence and seek to acquire companies engaged in AI.[35] Military AI represents a large market for advanced companies, and the market is undergoing radical changes. "We used to talk about numbers of tanks, planes, ships, troops, but now we have to add components like data centers, supercomputers, simulation speed, and recognition speed to the equation," says Holger Mueller, principal analyst and vice president at Constellation Research Inc.[36] The US Defense Advanced Research Projects Agency plans to invest up to $2 billion in artificial intelligence systems in 2019–2024.[37]

The US Air Force believes commercial space capabilities can improve nuclear triad operations. "Whether it's Silicon Valley or commercial space, there's unlimited opportunities ahead right now for us in terms of how we think differently on things like nuclear command and control," says Air Force Chief of Staff Gen. David Goldfein.[38]

Among the negative side effects of involving civilian companies in military projects, one can mention that the use of civilian infrastructure for military purposes makes civilian objects—such as satellites, transport infrastructure, production facilities, and design bureaus—justifiable targets in the event of a military conflict. According to the United Nations, the United States has more than 1,900 satellites in orbit around the Earth.[39] The Pentagon is actively using their data for military purposes, which raises serious concerns.

The Risk of the Arms Race

In light of the unfolding global race of military technologies, Russia faces a difficult choice between the upcoming reduction in military spending and the need to maintain technological parity with leading states. According to the Stockholm International Peace Research Institute, Russian defense expenditures decreased 19 percent in 2017 compared to 2016, and an additional 3.5 percent in 2018.[40]

On July 4, 2019, Putin, in an interview with the Italian newspaper *Correra Della Serra*, gave rather divergent interpretations of the Russian military development plans:

"Compare the Russian spending on defense—about 48 billion dollars—and the US military budget, which is more than 700 billion dollars. Where is the arms race? We're not going to get involved in it. But we also have to ensure our security. That is why we are bound to develop the latest weapons and equipment in response to the US increase in military spending and its clearly destructive actions."[41]

However, the Russian war chest for military inventions is modest. According to official data that Russia submitted to the United Nations within the Military Expenditures Report, its research and development spending amounted to 687 million rubles in fiscal year 2016 (about $11 million). By comparison, the United States spent $69.04 billion on military research and development in 2019.[42] The Pentagon spends much more on R&D than the Russian MoD, even taking into account that some items of expenditure are not published. Secret and top-secret expenses amounted to 3 trillion rubles in the Russian draft federal budget in 2019. This was 16.9 percent of the expenses for the fiscal year, or 2.9 percent of the gross domestic product. Experts at the Russian Presidential Academy of National Economy and Public Administration and Gaidar Institute estimated in 2018 that the share of classified budget expenditures will grow from 11.6 percent in 2012 to 20.6 percent in 2021.[43]

Russia cannot afford to save on military AI because today's savings could result in a catastrophic strategic loss tomorrow. The famously forward-thinking CEO of Salesforce, Marc Benioff, explained, "Today, only a few countries and a few companies have the very best AI. Those who have the best AI will be smarter, healthier, richer, and their warfare will be significantly more advanced. … Those without AI are going to be weaker and poorer, less educated and sicker."[44]

Asymmetric Response as a Refuge for Laggards

Deployment of new weapons by technologically advanced powers has always made a strong impression on rivals. Unfortunately, it rarely produces the intended effect that deploying powers expect. Any new, potentially existential threat forces rivals to increase expenditures and find more-destructive ways to ensure security. This is how new missile and nuclear powers were born, and how exotic and dangerous asymmetric responses emerged. In the 21st century, many countries will find themselves lagging behind in military AI. We cannot predict what AI technology may be the most suitable for the implementation of such a "loser strategy." History shows how the world lived with an asymmetric gun to the head throughout the latter half of the 20th century. A military technology race is dangerous in that the perception of falling behind often provokes an asymmetric response.

On November 21, 2017, the head of the Russian Federation Council Committee on Defense and Security, Viktor Bondarev, confirmed deployment of an intercontinental range, nuclear armed, liquid fueled, ballistic SS-N-23 (Skiff) missile emplaced on the ocean floor.[45] In February 2019, Putin announced the end of a key stage of testing of the nuclear powered, unmanned, underwater vehicle *Poseidon*, which can deliver a conventional and a thermonuclear cobalt bomb of up to 100 megatons against an enemy's naval ports and coastal cities.[46]

Military AI could provoke a new generation of asymmetric responses that will add threats to the world. There are virtually no legal restrictions on the use of naval drones in the world. Projects under development might have a significant impact on strategic stability and international security.

Proposals

Development of military AI obviously cannot be stopped. As it develops, international regulation is clearly needed to compel the military AI to follow human laws. It is time for states to consider new governance approaches to mitigate the possible risks of military uses of AI.

- It is necessary to define what experts mean by the term "military artificial intelligence." It is obvious that this is not a new type of weapons but rather a qualitative improvement to known types of weapons that gives them new capacities, like autonomy, better sensors, and reliable communication that ultimately allow the hardware to adapt to the environment.

- Where AI qualitatively improves known military systems, we might consider applying traditional arms control measures—transparency and confidence building.

- States could increase the transparency of global military activities by agreeing to publish data on new items in air, land, sea, and underwater arsenals with the function of unmanned operation, as it was specified in the Vienna Document for some conventional weapons. According to the Vienna Document, participants should exchange data on the main weapons and equipment systems in the zone of application for confidence- and security-building measures, as well as regular information on their plans to deploy them.

- In such transparency measures, states could agree to include data on demonstrations of new types of remote-controlled and autonomous weapons and prior notification of certain military activities.

In distant futures, military AI may gradually displace human responsibility in international security. Human societies may not traditionally compete with each other, but the whole of humanity may start competing with technology for the right to make decisions and determine its own destiny.

Artificial intelligence will gradually change the shape of states' militaries. Traditional military units will gain new strike capabilities through modern means of command and control, intelligence, accelerated collection and exchange of information, and automation of data processing. New service branches and new weapons systems have been introduced in a relatively short period of time, including missile defense systems, cybercommand, space forces, AI-based intelligence, surveillance and reconnaissance, information warfare, electronic warfare units, electronic countermeasures, laser weapons, autonomous vehicles, unmanned underwater vehicles, antidrone units, and hypersonic vehicles.

These war novelties serve as a signal that future conflicts will be more fleeting, lethal, sudden, and unpredictable. To date, humans have voluntarily delegated functions to artificial intelligence where it facilitates their work. Perhaps we are approaching a moment when decision making on defense and security will be increasingly delegated to artificial intelligence as a necessary measure, since limited human capabilities simply will not allow enough time for military and political leadership to make deliberate decisions. Before that future comes to pass, today is the time to make decisions on the safe future for our planet—as long as humanity is able to discuss it and compromise.

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