

**Confidential**

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# RUSSIA

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Vadim Kozyulin reports from Moscow:

MILITARY ROBOTICS IN THE UNITED STATES, CHINA AND RUSSIA:

START OF UNDECLARED COMPETITION

## SUMMARY

*According to scientists' forecasts, technologies accumulated by the human race can radically transform warfare already during the next decade. Military robotics is gaining a critical mass to make a huge qualitative leap.*

*Vadim Kozyulin, Senior Researcher at the PIR Center, believes that nowadays the United States, China and Russia are already entering an undeclared competition, a robotic arms race. Currently, forces are not equal: the technological leadership of the United States seems to be unachievable; China has started a hot pursuit to catch up with the leader; and Russia, although lagging far behind the leading powers in developing advanced autonomous systems, possesses a huge potential for upgrading the existing Soviet developments, a rich experience in asymmetrical confrontation, and recognized achievements in the development of radio electronic warfare systems.*

*In this article, Vadim Kozyulin offers examples of marine and aerial robotic systems developed by the leading powers that make it possible to speak about the forthcoming robotic revolution in warfare, and explains why one should beware of a new, robotic, arms race.*

The human race has accumulated considerable amount of technologies that can dramatically transform warfare already during the next decade. These include military robots, and the first signs that a robotic arms race is starting, with the United States, China and Russia joining it, can be clearly seen already today.

**The United States** are the current leader in the development of advanced autonomous systems, spending annually approximately 70 billion US dollars on military R&D. Their global technological leadership enables the Pentagon to make plans regarding *the third strategy of deterrence* (the U.S. military believe that the first two strategies, the one relying on nuclear weapons and a later one relying on precision-guided munitions in combination with a missile defense system, are becoming obsolete). Furthermore, the Pentagon is already considering a significant reduction in military forces by putting military robots into service. The U.S. Department of Defense arranged a close cooperation with the developers from the Silicon Valley, establishing the so-called *military-information complex*.

**China** is also trying to *bestride the military robotic horse*, allocating for military R&D approximately 10 billion US dollars from overall government and private R&D spending that totaled 216 billion US dollars in 2015. Similarly to the United States, the Chinese People's Liberation Army (CPLA) closely cooperates with research institutions that develop, among other things, prototypes of robots for military applications.

As regards **Russia**, its military research budget is confidential. However, Western experts estimate that Russia annually spends approximately 4-5 billion US dollars on military R&D and, in terms of overall expenses on civil R&D, ranks eighth in the world.

#### MARINE ROBOTICS: FROM AUTONOMOUS TORPEDOES TO UNMANNED SURFACE VEHICLES

Some examples enable the assessment of the scope of forthcoming robotic revolution in warfare. First, let's have a look at the marine industry.

- ✓ ***Military underwater glider - an autonomous vehicle that can swim on one lithium battery in the glider mode, using changes in its buoyancy, for more than a month, traveling at distances of hundreds and even thousands of kilometers.***

**Russia** has several developers designing vehicles of this kind, with Russia's underwater glider development programs based on significant Soviet developments. For example, the multifunctional robot *Futlyar-2* is being currently tested.

**China** has a family of gliders of different weights, from 70 to 200 kg, such as *Haiyan*, *Zhishui* and *Petrel*. Equipped with temperature, optical and acoustic sensors, they can travel 1,000 kilometers in 30 days at a speed of 4 knots per hour. Their task will include defending water areas and searching for mines or submarines. In the future, a military glider will have a high-speed engine with a warhead in addition to flying wings, which will enable it to perform a torpedo attack.

The greatest progress in this field has been achieved by **the United States** with their advanced *Littoral Battlespace Sensing Glider (LBSG)* being in development, an autonomous underwater glider able to cross oceans. The effectiveness and cost of such *underwater reconnaissance drone* are incommensurate with the existing conventional systems, which will make it possible to manufacture and use dozens or even hundreds of such drones. 150 US companies are involved in *LBSG* development.

- ✓ ***Underwater positioning system. During the cold war years, the United States and the Soviet Union had to deploy bulky systems to communicate with their submarines, with submariners having to resurface from time to time to make course adjustments. Today, advanced technologies allow using very low frequency and low frequency waves for both data transmission and underwater positioning.***

The **United States** Defense Advanced Research Projects Agency (DARPA), in cooperation with a number of private companies, is implementing the *Posydon Program* to create an

underwater analogue of the Global Positioning System (GPS). Tests of the marine positioning system are expected to start in 2018. It will enable submarines and unmanned vehicles not only to orientate underwater, but also to exchange information.

There are no reports about Russia's work in this field, but it is known that commercial developments are underway, and private companies already offer underwater positioning systems for small waters. Information about **Chinese** underwater positioning projects is confidential.

#### ✓ Modular autonomous underwater vehicles.

Designed to fit in torpedo tubes, the **US** REMUS 600 AUV has aboard a set of sensors similar to those installed on *Virginia* multipurpose nuclear-powered submarines. The exact purpose of this robot is unknown. Supposedly, it will perform reconnaissance functions, demining operations and submarine detection (and destruction) missions. Such mobile platforms will be able to work in a group, exchanging information and distributing tasks and functions. During the war in Iraq, underwater vehicles proved to be effective in demining ports; they were also useful when searching for remnants of the missing Malaysia Airlines flight MH370. The fact that underwater platforms can be programmed makes them an extremely flexible tool having a huge potential for further development.

To protect the disputed islands in the South China Sea, the Chinese Navy initiated the *Underwater Great Wall of China Project*, a network of floating, bottom and underwater sensors for detecting foreign submarines. Underwater robotic vehicles are expected to play an important role within this ambitious plan. Some of them are torpedo-sized and have aboard a passive radar system (*Semi-Autonomous Robotic Vehicle - SARV*). Others look like a vertical twin-hull catamaran, with different anti-submarine electronic equipment installed in the upper hull. There are also models with a hybrid propulsion device that enables a vehicle to travel either in an energy-saving gliding mode or using a propeller. Finally, there are Chinese heavyweight underwater robotic vehicles of 5-10 tons (similar to the *US Large Displacement Unmanned Undersea Vehicle - LDUUV*), which are designed for lengthy reconnaissance, demining and anti-submarine operations. In addition, Chinese scientists are working to design underwater communication and positioning systems, and also develop algorithms for autonomous work and group interaction of underwater robotic vehicles.

#### ✓ Unmanned surface vehicles.

**The United States** *ACTUV (Anti-Submarine Warfare Continuous Trail Unmanned Vessel)* is a DARPA project aimed to design a completely autonomous anti-submarine warfare vessel able to achieve a speed of 27 knots. A 140-ton unmanned vessel costs 15,000-20,000 US dollars to operate per day compared to 700,000 US dollars per day for a destroyer. Such vessels are expected to be used in a *swarm* of 10-15 vessels to find and destroy enemy submarines. One unmanned vessel will cost approximately 20 million US dollars, an order of magnitude cheaper than an advanced ship having the same functions. This will make it possible to build up the Navy's capacity *n-fold* with the same budget. The first vessel, *Sea Hunter*, has already arrived to the Naval Base San Diego for tests. The United States fleet will receive the first group of *unmanned hunters* in 2018.

In **Russia**, unmanned surface vehicle developments include a dozen of small-sized patrol boats and minesweepers, mainly remote controlled (e.g. *Typhoon* boat). The Russian Navy seems to have no clear concept of using such exotic vehicles, and the future of Russian unmanned fleet is obscure.

With a delay, **China** started chasing the leader in this field, the United States, and Chinese achievements up to date are confidential. From official interviews given by their developers, it can be understood that China considers reconnaissance and patrolling as the key functions of unmanned surface vehicles. So far, Chinese samples of high-speed remote-controlled boats, demonstrated at different exhibitions, can be

used only for detecting illegal fishing boats. However, territorial disputes in the South China Sea obviously raise the stakes in unmanned vessel building. It is known that 15 research teams develop unmanned surface vehicles in China.

✓ Additive Manufacturing - the technology of manufacturing torpedoes, drones, spare parts and munitions on 3D printers aboard the ship.

According to the *Global Marine Technology Trends 2030 Report* prepared by UK developers from *Qinetiq*, the production of metal, plastic and graphene articles on a 15-meter printer will dramatically reduce the cost of weapons and equipment storage, repair and upgrade and will make it possible to get the most advanced weapons on demand. So far, only one case is known when a drone printed on a printer was launched from a UK aircraft carrier. However, it is expected that during the next few years the new area of manufacture will be widely used by the **US** and **UK** navy.

As far as one can judge, **Russia** and **China** have not yet started mastering this field that promises a revolution in military logistics.

MILITARY AIR ROBOTS: SURPRISES THAT THE HUMAN RACE WILL FACE

The development of military air robots is one step ahead of marine robotics. Here, there are surprises for the human race too.

✓ Aerial refueling of drones.

The **United States** unmanned air vehicle X-47B can take off from the aircraft carrier deck and perform aerial refueling. This enables aircraft carriers to perform extra long-range bombing, without entering the area where they can be hit by enemy's aircrafts or missiles.

No other country has similar technologies. In **Russia**, there are no unmanned combat air vehicles as a class, although several companies work in this field. **China** has an impressive family of unmanned combat air vehicles, very similar to their US counterparts.

✓ Gremlins Program.

The **United States** developed small drones that are expected to be launched in *swarms* directly from a bomber aircraft. *The Gremlins Program* will make it possible to return swarms of small drones to the aircraft after they complete their mission. Each *Gremlin* will have a service life of 20 launches, and technicians will prepare them for the next mission within 24 hours. This will protect secret technologies of the United States and provide budget savings. Four companies are willing to enter into a contract with DARPA in connection with this project, and the manufacturer of *Gremlins* will be selected by 2020.

✓ Swarming.

According to these tactics, military robots will act as a swarm of ants or bees that have no central command, but have a kind of collective intelligence. It is impossible to destroy the swarm's command center, as it does not exist. All elements are interchangeable and are aimed at fulfilling a particular task. A swarm of military drones is completely autonomous. Currently, almost all major armies of the world are working in this field.

✓ Centaur Warfighting.

These tactics are based on team work of a human and a machine, combining the capabilities of human intellect and the capabilities of machines to communicate,

coordinate and act synchronously for achieving an absolute superiority over the enemy. **US** strategists work to elaborate a data transfer algorithm and ways for real-time processing of huge amount of information for automatic development of a set of scenarios to solve military (and other) tasks and choose the optimal solution.

#### START OF UNDECLARED COMPETITION

*A robotic arms race has in fact already begun. It is invisible, as it is taking place at laboratories, with achievements demonstrated only during festive shows of illuminated drones. So far, the US "military-information complex" is not afraid of any competition: the scientific, technological and financial leadership of the United States seems to be unachievable. The CPLA, successfully following the ancient Chinese principle "anyone who can copy master's work, is a master himself", is snapping at the heels of the Pentagon.*

*In September 2015, the Russian Ministry of Defense adopted the complex target program "Robotization 2025", with the "development of unmanned machines in the form of military robotic systems and complexes for application in different environments" declared as its priority. Although its contents are confidential, September 2015 may be regarded as the beginning of Russian participation in the undeclared competition. Russia's strengths include its experience in asymmetrical confrontation and recognized achievements in the development of radio electronic warfare systems, for electronics are the Achilles' heel of robotics.*

Having a considerable technological advantage over their closest pursuers (first of all, China and Russia), the United States insist that *killer robots* are a purely humanitarian (not technical) issue. The US representatives are ready to address it by adopting annexes to relevant international treaties, which would clearly formulate the requirement that machines should not be allowed to *pull the trigger* without human's decision. Over the last three years, several international events dedicated to this issue have been held: officially within the discussion of the Convention on Certain Conventional Weapons (CCW), as well as within international conferences organized by the International Committee of the Red Cross (empowered to pursue such activities by the CCW).

Meanwhile, humanitarian aspects and rules of warfare are rather comprehensively laid down in the Protocol Additional (Protocol I) to the Geneva Conventions of 12 August 1949, and relating to the protection of victims of international armed conflicts. Nowadays, much closer attention of the global community should be paid to the technical aspects of military robotics, i.e. new military technologies leading to an arms race, disturbing the existing balance of power, destabilizing international security and increasing the conflict potential in the world.

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[...]

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3.1. Individual club members are entitled to:

3.1.3. Receive a copy of the Russia Confidential exclusive analytical newsletter by e-mail in chosen language (English or Russian). According to the Club Terms and Conditions, the transfer of the bulletin to third parties is not allowed.

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3.2. Corporate Club members are entitled to:

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4.1. All members of the Club must:

4.1.6. Not to share the Russia Confidential analytical newsletter, as well as the Password to the Club section of the PIR Center web-site with individuals and legal entities who are not members of the Club.

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6.1. The Russia Confidential exclusive analytical newsletter is issued by the Trialogue Ltd for the Club members' private use only.

6.2. The newsletter contains exclusive analytical materials on international security, foreign and domestic policy of Russia and the CIS, prepared by the leading experts specially for Russia Confidential.

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6.5. The newsletter is disseminated via e-mail between the Club members once a month in Russian or in English, depending on the choice of the Club member.

6.6. The Club member can also receive a paper copy of the newsletter in chosen language.

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*Dear members of the Trialogue Club International,*

The 2016 Club season continues, and we are glad to **invite you to prolong your membership for 2016 or 2016-2017**, if you have not done so yet.

In 2016, the *Triologue Club* members will continue to receive our exclusive information on the foreign policy priorities of the Russian Federation, and on current threats and challenges to global security. **Five meetings of the *Triologue Club International*** are planned for 2016 (four in Moscow and one abroad); Club members will receive 4 issues of the Security Index quarterly journal in electronic form and 2 issues in print (in 2016 only in Russian), **12 issues of the *Russia Confidential* exclusive analytics bulletin**, our informational and analytical newsletters.

As before, experts of the *Triologue Club International* and of its partner organization PIR Center are open to an exchange of views on key international problems.

Fees for the *Triologue Club* membership since 2016 are as follows:

<b>Period</b>	<b>Individual membership</b>	<b>Corporate membership</b>
01.01.16. – 31.12.16. (1 year)	50 000 rub.	80 000 rub.
01.01.16. – 31.12.17. (2 years)	90 000 rub.	140 000 rub.

We would like to remind you that the corporate membership is based on “**1+1**” **scheme** when **two representatives** of the organization participate in the work of the Club.

On all questions concerning the *Triologue Club International* membership, please contact us by the e-mail [secretary@trialogue-club.ru](mailto:secretary@trialogue-club.ru) or by phone: +7 (985) 764-98-96.

Sincerely,

**Chairman,  
*Triologue Club*  
International**

**Dmitry Polikanov**