Trends in the global arms market, development of the combat drone market: impact and consequences for Ukraine

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Abstract

This study shows the dynamics of GDP and defense expenditures of the world's leading countries over the past few decades. The issue of rearmament with the main types of weapons of the world's leading countries in military terms is revealed. The growth dynamics of the military drone market is shown. The latest developments of military drones by leading defense companies in the United States and China are presented. The experience of using drones in the war between Ukraine and Russia is presented. Weapons such as tanks, armored personnel carriers, large surface ships and aircraft can be destroyed by a much cheaper and easier to manufacture drone. This approach allows not only to save resources and inflict much greater material losses on the enemy, but also to save personnel. Another advantage of unmanned aerial vehicles is that they integrate into any other system and allow online transmission of the necessary information from the battlefield, monitoring the enemy, aiming high-precision weapons and artillery, maintaining communication, providing control, striking enemy targets and perform many other useful functions.

Key words: drone, defense budget, GDP, market, weapons.

Introduction

Russia's war against Ukraine has prompted the world's leading countries to increase their defense spending and increase defense orders. If we look at the trends in disarmament, the world's leading countries have mostly reduced the number of ground-based weapons, while maintaining almost the same level of air and sea capabilities.

Over the past decade, more and more attention has been paid to unmanned weapons systems, and Ukraine's war against Russia has further fueled interest in this type of weaponry.

Today, the leading defense companies developing combat drones are located in the United States, the EU, and China. However, the war shows that even inexpensive drones produced by Iran can be an effective weapon, or drones such as FPV, which cost several hundred dollars, can be used to destroy weapons and military equipment worth several million dollars, and most importantly, to inflict painful losses on the enemy.

Material and methods

The following research methods were used in this study: analysis of defense expenditures of the world's leading powers, trends in rearmament and development of the market for unmanned combat systems; induction method for assessing and drawing conclusions about current trends in

the use of combat drones in the Russian war against Ukraine and the development of the market for unmanned combat systems.

Result and discussion

The full-scale invasion of the Russian Federation (RF) into Ukraine could not but affect the change in trends in the global arms market. First of all, the war affected the European countries, which felt a direct threat to themselves from the Russian Federation, especially the countries of Eastern and Central Europe. The combined defense budget of European countries as of 2022 increased by 13% compared to the previous period, and global defense spending increased by 3.7% and reached 2.24 trillion dollars USA or 2.2% of world GDP (SIPRI: In Europe). It is already possible to say with confidence that the trend to reduce defense spending, which began after the collapse of the USSR, has ended, and the world has been arming itself more and more in the last ten years. From the beginning of 2022, even the countries of Western Europe, which tried to reduce defense spending as much as possible, which more than once led to criticism from the United States, began to increase defense orders (Fig. 1).

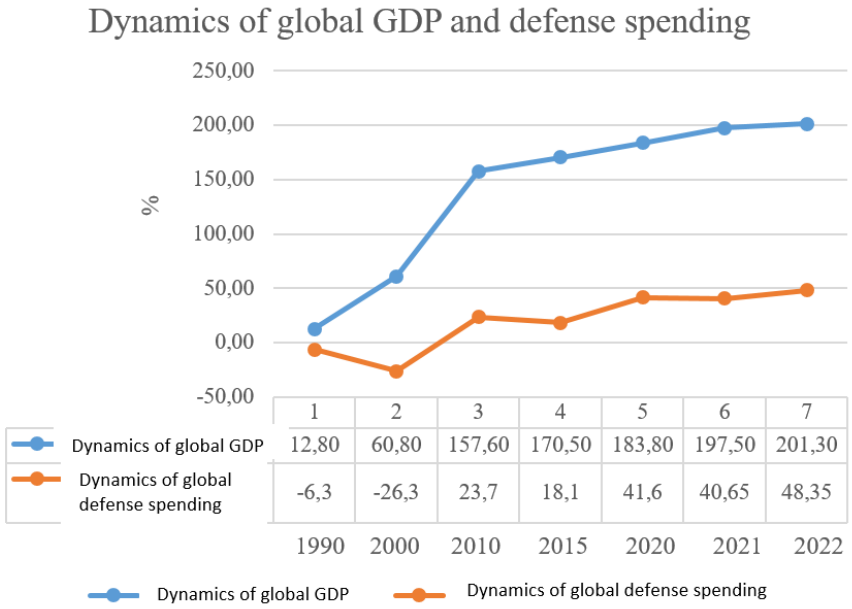

Figure 1 – Dynamics of world GDP and world defense expenditures
(World GDP 1960-2023; Trends in world military expenditure)

The USA has been the leader in defense spending for several decades, and as of 2022, defense spending will amount to $877 billion. USA, compared to 2021, they increased by 0.7%. In second place was China, its defense spending in 2022 amounted to 292 billion dollars. USA and increased by 4.2% compared to 2021. In the world ranking of defense losses, in 2022, the Russian Federation took third place with the amount of 86.4 billion dollars. USA, its defense budget was increased by 9.2% compared to 2021, at the same time, the Russian Federation spent about 167 billion dollars on the war against Ukraine in 2022. USA (this amount includes compensation for personnel and loss of equipment) (In a year and a half). The leaders in defense budget growth in 2022 were the following states: Great Britain by 3.7% (US$68.5 billion); Japan by 5.9% (US$ 46 billion); Ukraine by 640% (US$ 44 billion); Canada by 3% ($26.9 billion); Poland by 11% (US$ 16.6 billion); the Netherlands by 12% (12.6 billion US dollars); Qatar by 27% ($15.4 billion). If we look at the continents, the largest increase in defense spending in 2022 was recorded in Europe, especially

in Eastern Europe, South and East Asia, as well as in the Middle East (Fig. 2) (Trends in world military expenditure, 2022).

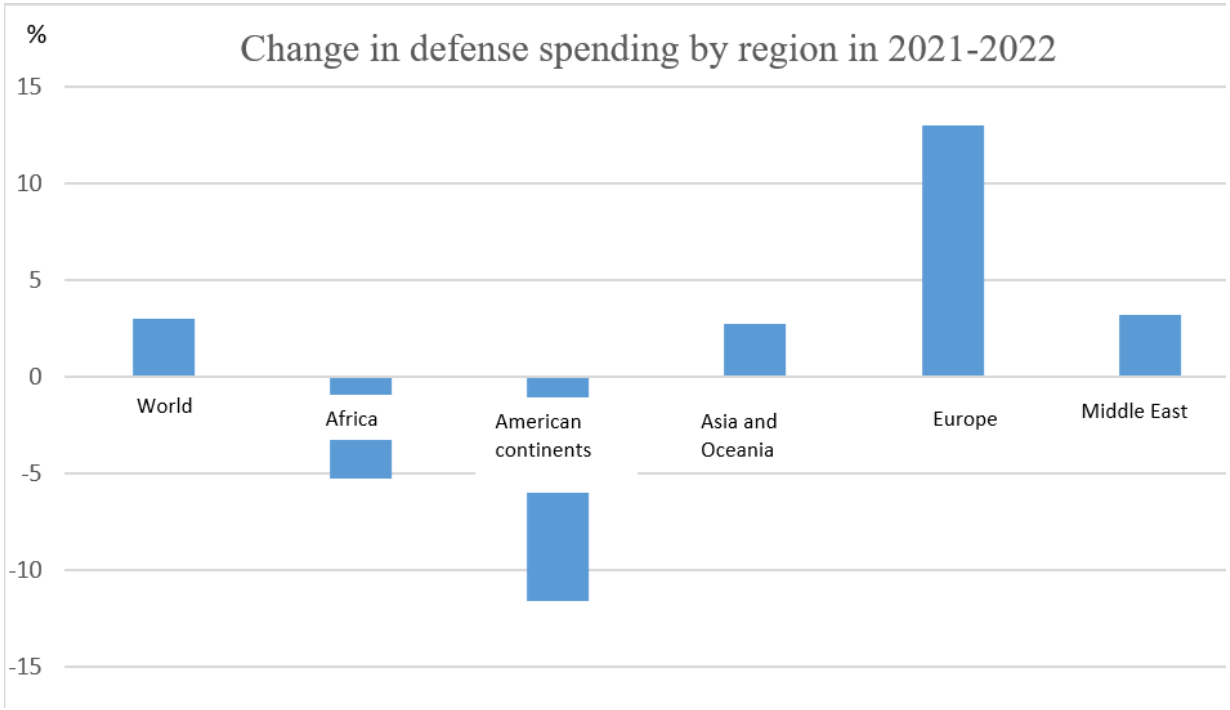

Figure 2 – Dynamics of global GDP and global defense spending

The increase in defense spending also affected the level of defense orders. Countries such as the USA, China, Great Britain, France and Germany, as well as some countries in the Middle East, are increasingly paying attention to high-tech weapons and are also switching to new generation weapons.

In recent years, from 2000 to 2023, the number of traditional types of weapons in the world's largest armies (USA, Russian Federation, China, E4 – Great Britain, France, Germany, Italy) has drastically decreased. Thus, the total number of main battle tanks (MBTs), artillery systems and rocket launcher systems (MLRSs) has decreased. The number of infantry fighting vehicles (IFVs) in service in the countries mentioned above has also decreased, the only exceptions being China and India. In the last 20 years, the number of battle tanks and artillery systems in the US Army has significantly decreased, as well as the number of armored personnel carriers by a quarter, although a significant amount of weapons that have been decommissioned remain preserved. The situation is similar in the E4 countries, the number of tanks and artillery decreased by three quarters, the situation is a little better with armored personnel carriers, which were reduced by a third. China and the Russian Federation also reduced the number of weapons, but at the same time they still have large stocks of old equipment. It should also be said that the Russian Federation lost a significant amount of military equipment in Ukraine. Compared to other countries, on the contrary, India has increased the number of battle tanks, almost doubled the number of armored personnel carriers and reduced the number of artillery by 25%, which is due to the abandonment of towed artillery and the transition to self-propelled artillery installations, which are more mobile and autonomous (Fig. 3).

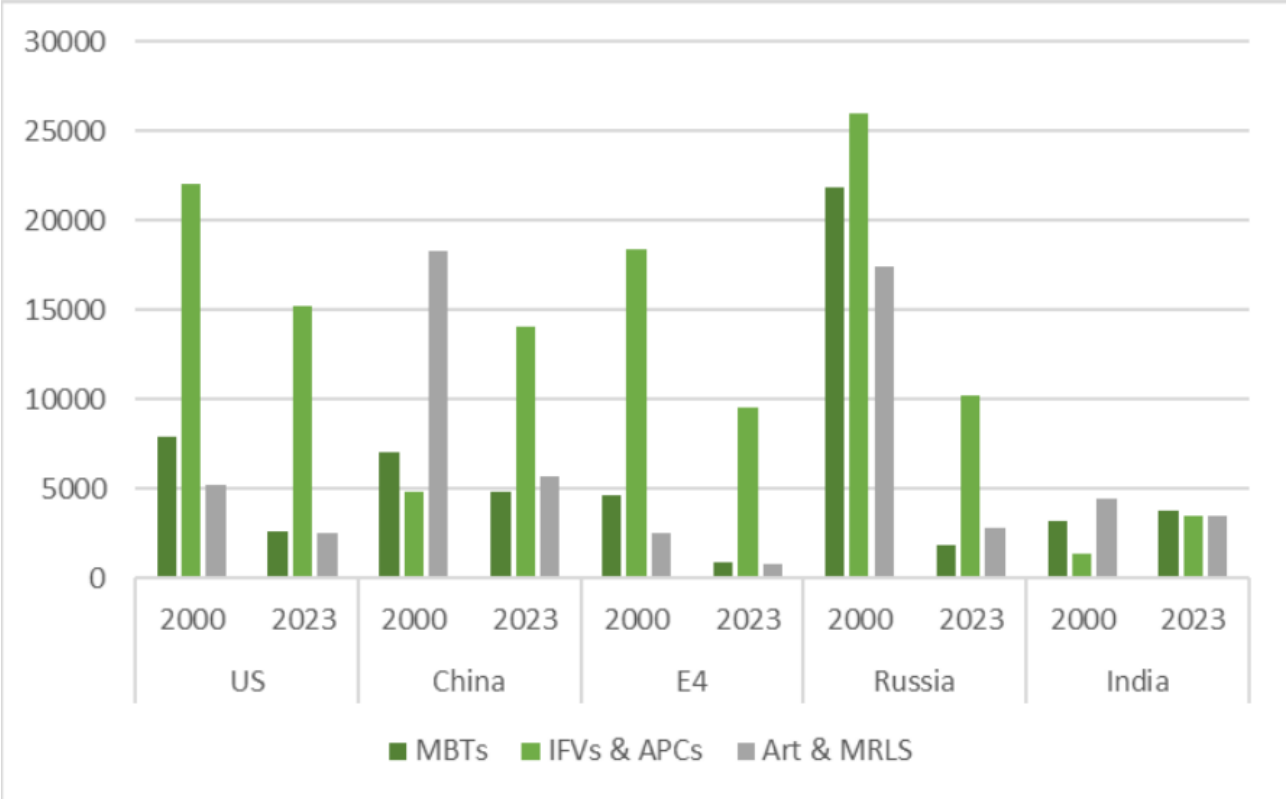

Figure 3 – The dynamics of changes in the armament of the main types of ground weapons of the world's largest armies. Diagram from the resource (Defense Economic Outlook 2023)

As for naval capabilities, the world's largest armies are focusing their efforts on their development. If we take into account the existing ships and those under construction, it can be stated that by 2030 most armies will increase their naval fleets. Taking into account the launched projects for the construction of warships, China plans to increase the number of surface and underwater vessels from 203 to 242 pieces, the main attention is paid to the construction of tactical submarines, squadron destroyers and frigates. At the same time, the US, on the contrary, is reducing the number of ships from 198 to 192, mainly due to the decommissioning of cruisers. The main European E4 countries are also increasing their fleet of ships from 112 to 119, the main focus is on the construction of frigates and submarines (France plans 6 new submarines, Great Britain and Italy 8 new submarines each), which are being prepared to replace the existing ones. India plans to increase the number of warships from 51 to 67 by 2030, currently almost all types of surface and submarine vessels are under construction, except for cruisers, with special attention being paid to strategic submarines. The Russian Federation will reduce the number of ships from 135 to 125 by 2030, this trend is completely different from the plans that existed until 2020. Existing problems with financing, technological "famine", negative consequences of the war for the Black Sea Fleet and reaching the end of their life cycle by some ships (destroyers "Suchasny" and "Udaloy"), in the aggregate, will negatively affect the surface capabilities of the Russian Navy, although in the same time, the number of submarine nuclear submarines is planned to increase from 10 to 12 (Fig. 4).

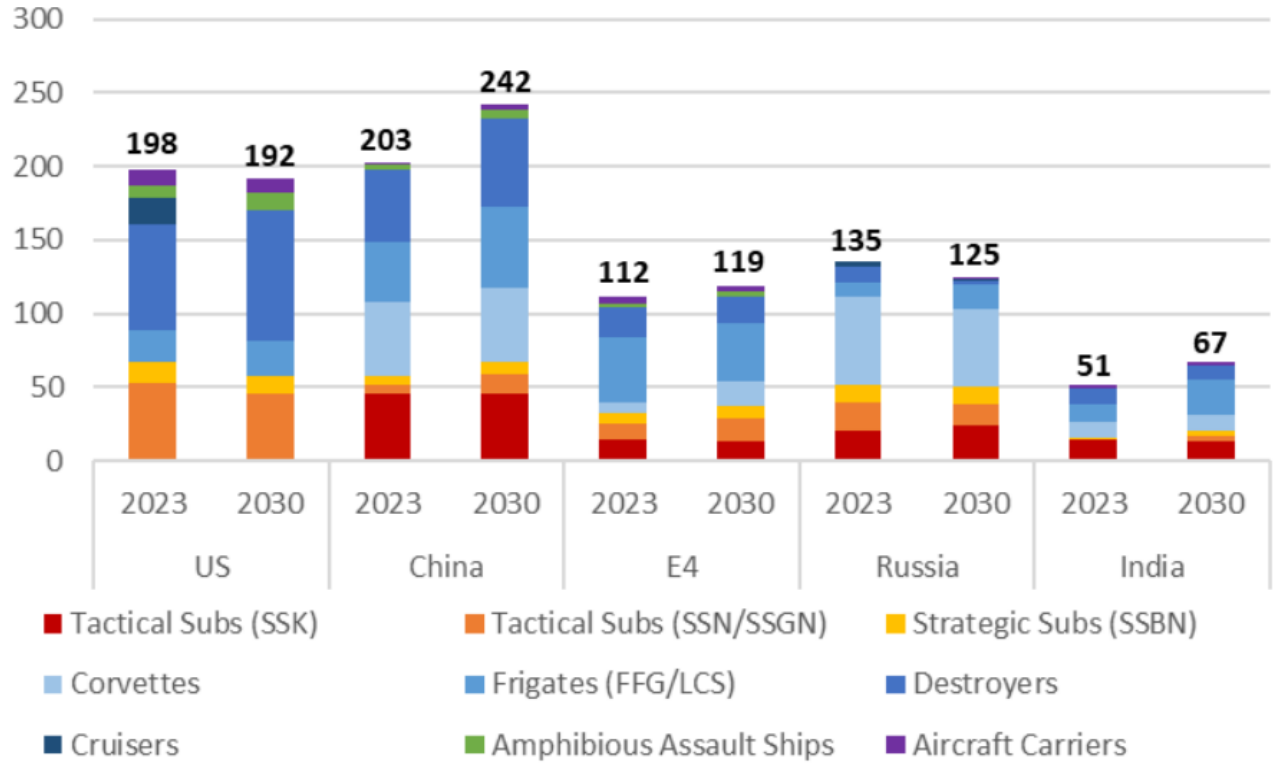

Figure 4 – The dynamics of changes in the armament of the main types of ground weapons of the world's largest armies. Diagram from the resource [6]

As it was said earlier, the war of the Russian Federation against Ukraine made adjustments to the global arms market. The experience of the war shows that unmanned systems – combat drones, both flying and surface, underwater and ground – are becoming more and more widespread. These systems are used for reconnaissance and reconnaissance, targeting, striking enemy targets, delivering small loads, maintaining communication and control, demining, mapping, etc. Drone manufacturers are increasingly paying attention to the development of autonomous systems using artificial intelligence (AI), it is expected that autonomous systems with AI will contribute to the development of the military drone market in the future.

In 2022, the global market for military drones was estimated at $12.55 billion. It is projected to grow from USD 14.14 billion in 2023 to USD 35.6 billion by 2030, exhibiting a CAGR of 14.10% during the forecast period (Military Drone Market Size).

In terms of market segmentation, fixed-wing drones are expected to hold the major share of the market due to their advantages such as payload capacity, flight range, and economy. This means that they are better suited when used at long distances for reconnaissance, mapping, surveillance and, if necessary, strikes on enemy targets.

By range, drones are divided into unmanned aerial vehicles (UAVs) with extended line of sight (EVLOS), visual line of sight (VLOS) and beyond line of sight (BLOS). The extended visual line-of-sight (EVLOS) drone market is expected to grow at the fastest rate compared to other types of drones due to their long-range applications for combat control and critical information gathering in electronic warfare environments, as well as potential applications for electronic jamming. (Fig. 5).

Figure 5 – EOS C VTOL unmanned system. Photo from the resource [8]

Types of drones can also be classified according to the degree of autonomy in control, so currently there are semi-autonomous, remotely controlled and autonomous UAVs. Remotely controlled drones are expected to dominate the market, but autonomous drones will grow at the fastest rate.

At the same time, the market of rotary UAVs also has its own perspective, primarily due to the improvement of the wing itself, convenient take-off and landing (vertical), the spread of use at the tactical level for reconnaissance, combat management and striking the enemy. As the war experience showed, the mass use of FPV drones (First Person View) radically changes the course of the war. Drones, which were developed for the civilian market, after certain technical improvements (placement of explosives or ammunition), have become weapons that destroy armored vehicles and enemy manpower. Drones are capable of flying into enemy trenches and dugouts, building windows, doors and hatches of enemy equipment. Such drones allow hitting targets at a distance of up to 10 km, and some even more (Fig. 6) (FPV Drones). FPV drones have become a formidable force on the battlefield, and considering the cost of upgrading to $1,000. USA and the possibility of using such a drone to destroy the enemy's weapons worth several million dollars. USA, they become super-efficient.

Figure 6 – Operator with FPV drone. Photo from the resource [9]

The use of kamikaze UAVs is becoming more and more widespread. In the war against Ukraine, the Russian Federation uses Iranian Shahed-136 UAVs to strike military facilities and critical infrastructure throughout Ukraine. The Russian Federation also successfully uses Lancet unmanned barrage munitions to destroy our armored vehicles and artillery systems.

Despite the global trend in the development of military drones, the United States continues to dominate this market. The largest global manufacturers of UAVs are such American companies as Northrop Grumman Corporation, General Atomics Aeronautical Systems, Inc., AeroVironment, Inc., Boeing, Textron Systems, and others.

It should also be noted that the European UAV market has also started to grow significantly thanks to countries such as Great Britain, Germany and France. These countries are increasing purchases of tactical and operational drones, primarily to expand their intelligence and surveillance capabilities.

The largest European manufacturers of UAVs are companies such as Thales Group (France), BAE Systems (Great Britain) and SAAB Group (Sweden).

It should also be said that Israel remains, and in the future will remain, a key player in the market of military drones. Currently, the largest Israeli companies are Elbit Systems Ltd and Israel Aerospace Industries Ltd.

The market for low-budget models of drones produced in China, Iran or Turkey, which are already beginning to dominate the UAV market, is also developing. Drones like the Bayraktar TB2, manufactured by the Turkish Baykar Corporation, are available for any country, making them more attractive compared to more expensive American or European drones. These drones have been used in various conflicts, including in Ukraine, Libya, Syria, Ethiopia and Karabash. The availability and availability of these UAVs has already affected the ways of conducting hostilities and their course (Mass-market military drones).

The war of the Russian Federation against Ukraine further accelerated the development of the military drone market in the world. More and more defense companies are repurposing and launching a new line of weapons, as drones will be the decisive factor in the wars of the future. The advantage will be on the side of the army that will have high-tech and multifunctional drones or will prevail in them quantitatively.

Currently, the most technologically advanced are the drones of companies from the USA. General Atomics Aeronautical Systems, Inc. (GA-ASI) is one of the most famous in the world and has the most experience in the production of drones (General Atomics Aeronautical). The most famous products of this company include such UAVs as:

- The MQ-9B SkyGuardian is a remotely piloted aircraft system that provides constant intelligence, surveillance and reconnaissance (ISR) around the world. SkyGuardian is designed for over-the-horizon flights via satellite, with a flight duration of more than 40 hours under any weather conditions (Fig. 7);

Figure 7 – MQ-9B SkyGuardian UAV. Photo from the resource [11]

- MQ-9B SeaGuardian is a naval version of the MQ-9B SkyGuardian;

- MQ-9A "Reaper" is a multi-purpose remotely piloted aircraft that can stay in the air for up to 27 hours and carry a load of more than 1,300 kg, allows for long-term surveillance and strikes against the enemy;
- Predator C Avenger is a long-range, medium-altitude and high-altitude remotely controlled aerial vehicle that can perform surveillance over large areas, strike missions over land and sea, as well as a number of other complex military and civilian missions;
- Gray Eagle Extended Range (GE-ER) is the next generation of the improved derivative of the combat-proven Gray Eagle unmanned aerial system. Intended to perform surveillance, communication relay and long-range weapons delivery missions to support hostilities;
- The Sparrowhawk is a fast glider that provides a multi-purpose capability – ISR, SIGINT / ELINT (information gathering and analysis, surveillance of activity and changes in the environment, terrain reconnaissance, collection and analysis of signals such as radio communication or radar, studying enemy electronic systems) and jamming. The size of the Sparrowhawk makes it difficult for the enemy to see, an aircraft such as the MQ-9 can carry the Sparrowhawk under its wing.

Another of the most famous American drone manufacturers is Northrop Grumman Corporation, the main types of drones of this company include the following (Northrop Grumman Corporation):

- The MQ-4C Triton is a long-range and high-altitude reconnaissance UAV of the US Navy. Designed to monitor a wide sea area, capable of providing intelligence in real time;
- RQ-4 Global Hawk– strategic reconnaissance UAV. The first flight was made on February 28, 1998. The first Global Hawk was transferred to the US Navy in 2004 and began to perform combat missions in March 2006. The device can patrol for 30 hours at an altitude of up to 18,000 meters;
- X-47B is a multi-purpose attack UAV capable of taking off and landing, and even performing some tasks without the intervention of the operator, using the capabilities of the on-board computer;
- MQ-8 Fire Scout is a multipurpose military unmanned helicopter used for reconnaissance and strike purposes;
- The Bat is a medium-altitude unmanned aerial vehicle originally developed for use by the United States Armed Forces. Designed primarily as an intelligence gathering tool, the Bat has a payload capacity of 14 kg.

The American company AeroVironment produces a variety of military drones, each of which is designed for specific operational needs and operating conditions. Here are some of the unmanned aircraft systems produced by AeroVironment (AeroVironment):

- T-20 Jump – a tactical unmanned aircraft complex with the possibility of vertical take-off and landing;
- Puma LE is a small, long-range unmanned aerial vehicle designed to perform multi-purpose tasks;
- Vapor 55 MX is a universal unmanned aircraft complex with advanced capabilities for performing various missions;
- Raven is a small hand-launched unmanned aerial vehicle used for low-altitude surveillance and reconnaissance.
- Each of these drones is designed with specific features and capabilities to meet the needs of various military operations, including intelligence, surveillance and reconnaissance. AeroVironment drones are known for their practicality, versatility and advanced technological capabilities, making them suitable for a wide range of military applications.

The Chinese military-industrial complex has also been developing at an accelerated pace in recent years, companies that produce drones deserve special attention, such companies include the following:

- AVIC (Aviation Industry Corporation of China) is a state-owned enterprise involved in various aerospace developments, including military drones of the Wing Loong series, Cloud Shadow (Fig. 8) and others;

Figure 8 – Chinese UAV Cloud Shadow. Photo from the resource [14]

- CASC (China Aerospace Science and Technology Corporation) is the prime contractor for China's space program and is also involved in the production of CH (Cai Hong or Rainbow) military drones such as the CH-3, CH-4 and CH-5 (Figure 9);

Figure 9 – Chinese UAV CH-5. Photo from the resource [15]

- CATIC (China National Aerospace Technology Import and Export Corporation) exports Chinese aerospace technology, including military drones;
- CAIG (Chengdu Aircraft Industry Group) is involved in the development of various military aircraft, including the Wing Loong series of drones;
- Ewatt Technology Co., Ltd. – focuses on various solutions for UAVs, including military applications for surveillance and reconnaissance;
- SZ DJI Technology Co. (DJI) is primarily known for its civilian drones, but also explores

technologies that can be used in the military. Currently, UAVs of this company are widely used in the Russian-Ukrainian war, as reconnaissance and strike;

- Northwest Institute of Mechanical & Electrical Engineering (Northwest Institute of Mechanical Engineering and Electrical Engineering) – is engaged in the development of various missile systems and military drones of the BZK-005 type and others (Fig. 10).

Figure 10 – Chinese UAV BZK-005. Photo from the resource (BZK-005 Chang Ying)

These companies have played an important role in the development of China's military drones, producing UAVs from tactical to strategic, with different payloads and flight ranges.

Since 2014 (the beginning of the first phase of the Russian Federation's war against Ukraine), some Ukrainian arms manufacturers have also become interested in the production of drones. But already with the beginning of a full-scale war, Ukraine becomes one of the world's hubs for the production of combat drones.

The most famous manufacturers of military drones include the following (10 domestic drone manufacturers bringing victory to Ukraine):

- AeroDrone – specializes in agricultural drones, but has already started production of two models of drones for the Armed Forces of Ukraine (AFU). Drones such as the D80-Discovery and E-300 Enterprise have been developed, capable of carrying a significant payload and being used for various military purposes;
- Blackraven (BLACK RAVEN) – a non-profit organization that produces kamikaze drones and other military technology. Their drones, such as the eVOSH 7, are designed to destroy enemy buildings and lightly armored vehicles;
- UA Dinamics – developed the "Karatel" light reconnaissance and strike unmanned complex for the Armed Forces. The drone is capable of autonomous flights, equipped for both reconnaissance and strike missions;
- Spaitech is one of the largest manufacturers of UAVs in Ukraine, producing Sparrow-type UAVs designed for various military and civilian purposes;
- Ukrspecsystems (Укрспецсистемс) – produces Shark-type drones, equipped with cameras and capable of operating behind enemy lines at high speeds;
- DeViro – specializes in the development and production of UAVs, in particular, such as SaiKonia and Leleka-100, designed for reconnaissance and precise determination of geographic coordinates;
- ASU (Aviation Systems of Ukraine) – produces Valkyrie-type drones, fully autonomous UAVs intended for military and civilian use, capable of aerial photography, search and

rescue operations, as well as military intelligence and support;

- Athlon Avia (Athlon Avia) – manufactures UAVs of the "Fury" type, designed for various military purposes, including reconnaissance.

It should be noted that each company has its own unique offers, capabilities and specializations in the sector of unmanned technologies, contributing to the military and technological progress of Ukraine. The listed companies are not an exhaustive list of all UAV manufacturers in Ukraine, their number is constantly growing, which increases competition on the market and positively affects the development of the technology and quality of combat drones.

In addition to UAVs, Ukraine also began to produce naval drones, which have already affected the distribution of forces in the Black Sea, reduced the capabilities of the Black Sea Fleet of the Russian Federation, and forced the redeployment of part of the warships from Crimea to Novorossiysk.

Ukrainian naval drones are a significant advance in military technology, demonstrating practical utility and effectiveness in real combat scenarios. Their design, capabilities and combat use demonstrate Ukraine's innovativeness and adaptability in the field of naval warfare and unmanned technologies.

Conclusions

In modern wars, drones of various types are increasingly being used for military purposes. Weapons such as tanks, armored personnel carriers, large surface ships and aircraft can be destroyed by a much cheaper and easier to manufacture drone. This approach allows not only to save resources and inflict much greater material losses on the enemy, but also to save personnel. Another advantage of unmanned aerial vehicles is that they integrate into any other system and allow online transmission of the necessary information from the battlefield, monitoring the enemy, aiming high-precision weapons and artillery, maintaining communication, providing control, striking enemy targets and perform many other useful functions. All of the above indicates that the market of unmanned drones will develop at an accelerated pace and the armed forces, which will have all types of unmanned aerial vehicles at the tactical, operational and strategic levels, will gain an advantage in the armed struggle against the enemy in the future.

Also, war experience shows that the line between civilian and military drones is blurred, civilian drones such as FPV or Mavic are successfully used for military purposes after some modernization.

We should also not forget that the market of weapons that will oppose drones has also already received an impetus for development. In turn, defense enterprises that are the first to offer effective solutions in the fight against unmanned systems will have the opportunity to become leaders in the arms market in the future.

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