Legal status of innovative scientifically-technological organizations in the sphere of military-industrial complex

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Abstract. This article is devoted to the study of the legal status of foreign innovative scientific and technical organizations in the field of the military-industrial complex. It has been proven that the American DARPA (Defense Advanced Research Projects Agency) is the flagship of world scientific thought in the defense industry. The structure and main directions of DARPA research are revealed. It has been substantiated that the key research results have been created in such areas as robotics, biomedicine and network technologies. The legal status of the Defense Technologies Agency (Agency) as a key subject of legal relations in the sphere of the defense industry of Ukraine has been substantiated. An approximate structure of the Agency, the key directions of its activities until 2030 and the foundations of the organizational and legal status of the Agency are proposed. It has been proven that DARPA studies have a dual purpose: their results are applicable both in the military and in the civilian sphere, in particular in the fight against the SARS-CoV-2 coronavirus. Also analyzed the legal status of other similar foreign organizations, in particular in Israel (MAFAT), France (DGA) and Australia.

Keywords: public-private partnership, Military-Industrial Complex, DARPA, Defence Technologies Agency, organizational structure

The draft of the Strategy for the development of the Ukrainian military-industrial complex provides that one of the most important goals of the state military-industrial policy is the establishment of a legal entity for the implementation of innovative projects and the development of critical technologies in accordance with the best world practices - the Agency of Defense Technologies. At the same time, there is no clear understanding of the features for the legal status of this organization, the procedure for the formation of management bodies, financing and the structure of this organization. (Uruskyi 2020)

The main purpose of this article is to study the legal status of foreign innovative scientific and technical organizations in the defense industry and to develop optimal ways in order to solve the relevant problems for Ukraine.

In 2021, Ukraine plans to establish the Defense Technologies Agency (Agency), the prototype of which will be the American DARPA (Defense Advanced Research Projects Agency) - the Office of Advanced Research Projects of the US Defense Department). It is assumed that the Agency will be controlled by both the Ministry for issues of Strategic Industries and the Ministry of Defense of Ukraine. In addition, the National Academy of Sciences of Ukraine represented by the Section for Applied Research will be responsible for the innovative scientific and technical part of the Agency. A part of the property complex and personnel of the Central Scientific Research Institute of Arms and Military Equipment under the Ministry of Defense of Ukraine is also supposed to be allocated for the establishment of the Agency. (NISS 2020).

DARPA (Wikipedia 2021a) was founded in 1958 in response to the launch of the first artificial Earth satellite in the USSR. DARPA was tasked with keeping US military technology advanced. DARPA operates independently of conventional military research institutions and reports directly to the leadership of the Defense Department. DARPA has approximately 240 employees (approximately of which 140 are technicians); the organization's budget is about $ 3 billion. These numbers are approximate, as DARPA focuses on short-term programs (2-4 years), carried out by small, specially selected cooperatives of contractor companies.

The structure of the Agency consists of 7 divisions (Burenok, Ivlev, Korchak 2009):

1) Adaptive Execution Office (AEO) - research in the field of building adaptive platforms and architectures, including universal software platforms, modular hardware, multifunctional information systems and development and design tools;

2) Defense Scientific Office (DSO) - research in the field of fundamental physics, new technologies and devices based on new physical principles, energy, new materials and biotechnology, applied and computational mathematics, medico-biological means of protection, biomedical technologies;

3) Innovations in information technology (I2O) - information monitoring and control systems, high-performance computing technologies, data mining, pattern recognition systems, cognitive machine translation systems;

4) Microsystem Technologies Office (MTO) - technologies of electronics, photonics, micromechanical systems, advanced architecture of integrated microcircuits and algorithms for distributed data storage;

5) Strategic Technologies Office (STO) - communication systems, tools of protecting information networks, instruments of electronic warfare (EW), resistance of systems to cyberattacks, systems for detecting camouflaged targets based on new physical principles, energy conservation and alternative energy sources;

6) Tactical Technologies Office (TTO) - modern high-precision weapons systems, laser weapons, unmanned weapons based on air, space, land and sea platforms, advanced space monitoring and control systems;

7) Biological Technology Office (BTO) - research in the field of engineering biology, including omix technologies, synthetic biology, metabolic engineering, gene therapy (including the artificial human chromosome), and applied aspects of neuroscience.

Most of DARPA's new research programs are aimed at solving the problems of enhancing the interaction of robots and people, as well as information environments and people - for performing joint operations. (Klabukov, Alekhin, Nekhina 2014)

The clearest example of the effectiveness of this approach was the initiative project of Local Motors together with DARPA, created on the basis of a vibrant community of engineers, designers, drivers and mechanics, passionate about the idea of jointly designing the image of the automotive industry of the future. The basis of the software toolkit is the original method of multi-stage selection of ideas and rationalization proposals for the collective formation of the future appearance of vehicles, as well as the implementation of the main stages of the product life cycle in accordance with the concept of "digital production".

Developers from all over the world responded to the first open competition to create a dream vehicle. Local Motors later entered into an agreement with the Manufacturing Technology Association (MTA) to supply the first 3D-printed car. The premiere of this car took place in early September 2014 at the exhibition in Chicago. At the moment, it is known for sure that the original vehicle was created specially for the needs of urban transport. The use of 3D printing in this concept car will also demonstrate the importance of using greener digital manufacturing technologies to create machines that are durable, safe, fast, convenient and economical in accordance with the real needs of people.

In early April 2014, DARPA announced the establishment of a new structural unit - the Department of Biological Technologies. Its task is to put biology at the service of national security. Its priority is to improve the survival rate of seriously injured servicemen. According to the US Army Institute for Surgical Research, blood loss is the leading cause of death on the battlefield. Especially relevant is the development of drugs administered orally in case of severe internal bleeding, which increase blood clotting and make it possible for the victim to be hospitalized. The program for the development of advanced prostheses is completely transferred under the control of the new department. It was launched back in 2006 and is called promisingly - “Revolutionizing Prosthetics”. Developments in the field of prosthesis control using a neurointerface - i.e. the efforts of thought have made great strides in recent times. Achievements in the technology of cortical microelectrodes have made the connection between the nervous system and cybernetic parts of the

body so strong that complex combinations of movements are available for a robotic prosthesis, which differ little from the mobility of biological limbs. However, neuroscientists are working to get the signal in both directions - so that the prosthesis is not only controlled by the mind, but they send tactile signals back to the nervous system themselves, causing a sensation of genuine physical touch. In order to increase the survival rate of soldiers with the help of rehabilitation methods, research is being conducted in the area that traditionally arouses tremendous interest and many questions - the study of the characteristics of the neural work of the brain. By answering the fundamental questions related to functional maps of the brain, it will be possible to restore memory lost as a result of traumatic brain injury, remove or relieve post-traumatic stress disorder, and normalize behavioral functions. The listed basic research will be used in order to create a portable implant placed in the brain of a military man, which will record the entire volume of memories. In the event of severe brain injury, the implant will restore memories. Of particular interest is the fact that the results of brain studies are planned to be used not only to restore lost abilities, but also to improve the existing, unimpaired, qualities of a serviceman. Hippocampus stimulation will be used to improve cognitive skills so important on the battlefield, such as memory, learning new skills, and decision making.

In 2020-2021, the DARPA Accelerated Molecular Discovery (AMD) program is developing new systematic approaches that accelerate the discovery and optimization of high-performance molecules to realize the capabilities of the Defense Department. This includes simulants and drugs needed to counter emerging threats, coatings, dyes and special fuels needed to improve performance. AMD Systems will provide end-to-end computing and experimental tools to design, detect, validate, and optimize new molecules, interactively learning more efficient and effective molecular detection techniques that improve performance in national security applications (DARPA 2021).

AMD executives are partnering with the Walter Reed Army Research Institute (WRAIR) to apply artificial intelligence (AI) techniques to accelerate drug discovery to combat SARS-CoV-2. Through this program, the National Center for the Advancement of Translational Sciences (NCATS) and WRAIR provide MIT and SRI with expertise in medicinal chemistry and in vitro AI prediction testing to validate and inform models.

Researchers at the Massachusetts Institute of Technology are focusing on developing new artificial intelligence algorithms that specifically address the lack of data inherent in the study of a new virus, and are looking to apply such methods to identify synergistic combination therapies in the future. They recently posted on a blog post about the results of their model trained to predict antiviral activity against COVID-19 and efforts to develop machine learning tools that will help identify molecules with therapeutic effects against disease.

AMD specialists at SRI International are developing artificial intelligence tools that incorporate the expertise of chemists, in addition to the knowledge gained from the data, to discover analogues of existing therapeutic agents with efficiency against SARS-CoV-2. They also recently published data on their efforts to use machine learning models to identify virus inhibitors.

DARPA's Make-It program automates small molecule detection and synthesis to advance the field of synthetic chemistry beyond traditional batch and intuition-based capabilities. Make-It develops artificial intelligence-based approaches to planning and optimizing synthetic routes combined with fully automated synthesis techniques that include algorithms for process automation and control, interconnected fluid modules for continuous synthesis, and in-line characterization and purification. Researchers are also working on methods to rapidly explore the vast parameter space associated with synthesis, which until now has been minimally hand-selected. Make-It seeks to provide the basic technologies needed to transform synthetic chemistry into information-driven science, accelerating the pace of chemical innovation and small molecule production (Shakhtman 2012).

DARPA employees create a suite of flexible manufacturing capabilities for the scalable and sustainable production of critical medicines.

On Demand Pharmaceuticals (ODP) specializes in fine chemicals and active pharmaceutical ingredients (APIs), and their technology is based on small chemical production devices that were developed in the DARPA Battlefield Medicine and Make-It programs. Their efforts are jointly funded by DARPA and HHS under the CARES Act, and FDA Commissioner Dr. Stephen Hahn and DARPA Director Dr. Peter Highnam visited the company on December the third.

SRI International is developing an approach that makes it easy to scale pharmaceutical manufacturing from laboratory to production scale in one step.

Virginia Commonwealth University is also developing tools for the analysis and optimization of chemical manufacturing in the United States to ensure that existing land-based process flows can be quickly redistributed to critical APIs when needed (Jones 2009).

DARPA's activities reflect the fact that while the Agency's mission and philosophy have remained unchanged for decades, the world around DARPA has changed dramatically - and the speed with which these changes have taken place has increased in many ways. These changes include some remarkable and even amazing scientific and technological advances that, if having being used intelligently and purposefully, can not only ensure continued US military superiority and security, but also accelerate social and economic progress. At the same time, the world is undergoing some deeply troubling technical, economic and geopolitical shifts that pose a potential threat to US supremacy and stability. These conflicting trends of unprecedented opportunity and

growing threat - and how they can be expected to impact US national security needs ten or more years from now - have profoundly influenced DARPA's latest definition of its strategic priorities for the next few years.

DARPA program portfolios are built from the bottom up: DARPA program managers identify and propose new programs that they believe promise revolutionary change. This is important for several reasons. An effective DARPA program manager is the person closest to critical challenges and possible technological capabilities in their arena, and personal inspiration and commitment to a new idea is the spark needed to ignite a big fire. But ideas also come from the top down, sometimes from the DARPA leadership, and often from the military services themselves, which DARPA is ultimately called to serve.

Today DARPA focuses its strategic investments in four main areas (Popova 2010):

1) Rethinking Complex Military Systems: in order to help accelerate the development and integration of revolutionary military capabilities in a rapidly changing modern landscape, DARPA is working to make weapon systems more modular and easily upgradeable and improved; ensure superiority in the air, at sea, on land, in space and in cyberspace; improve position, navigation and time (PNT) regardless of the global positioning satellite system; and strengthen protection against terrorism;

2) Overcoming the flow of information: DARPA is developing new approaches to obtaining information from massive datasets with powerful tools for working with big data. The agency also develops technologies to ensure the reliability of data and systems through which critical decisions are made, such as automated cyber defense capabilities and methods for establishing fundamentally much more secure systems. In addition, DARPA addresses the growing need for privacy at various levels of need without sacrificing the national security value of having adequate access to network data;

3) Using biology as a technology: in order to leverage the latest advances in neurobiology, immunology, genetics and related fields, DARPA established its Biological Technology Division in 2014, giving new impetus to the Agency's portfolio of innovative biology-based programs. DARPA's work in this area includes programs to accelerate progress in synthetic biology, anticipate the spread of infectious diseases, and master new neurotechnologies;

4) Expanding technological frontiers: DARPA's core business has always been to overcome seemingly insurmountable physical and engineering barriers, and, once demonstrating the resolve of these daunting challenges, to apply the new capabilities made available by these breakthroughs directly for national security needs. Maintaining momentum in this important specialty, DARPA works to reach new opportunities by applying advanced mathematics; invention of new chemicals, processes and materials; and the use of quantum physics.

Defense Science and Technology Australia is an affiliate of the Australian Department of Defense that researches and develops technologies for use in the Australian defense industry.

The organization is the lead agency of the Australian Government responsible for the application of science and technology to safeguard and protect Australia and its national interests. She supports Australia's defense by exploring future technology for defense assets, providing advice on the acquisition of military equipment, the development of new defense capabilities and the expansion of existing systems. Led by the Chief Defense Scientist, the organization has an annual budget of $ 400 million and has over 2,300 employees, mostly scientists, engineers, IT professionals and technicians (Wikipedia 2021d).

Conclusions

Taking into account the above, we consider it expedient and necessary to reform the innovation industry of the domestic MIC by the following actions:

1. **Establishment of the Defense Technologies Agency** as the central executive body of Ukraine, responsible for the implementation of the state innovative military-industrial policy and the organization of scientific research in the defense industry of Ukraine. Controllability - the Ministry for issues of Strategic Industries and the Ministry of Defense of Ukraine, direct subordination - the Cabinet of Ministers of Ukraine. The advantages of this option also lie in the fact that when it is implemented, there are good opportunities for staffing the Agency with highly qualified personnel. The latter can be selected among the employees of structural subdivisions of the Ministry of Defense of Ukraine, the Ministry for issues of Strategic Industry, the General Staff of the Armed Forces of Ukraine, the National Academy of Sciences of Ukraine and scientific research institutions subordinate to them. If necessary, the Agency can include small units, staffed with specialists in certain types of weapons, military and special equipment, inherent exclusively to individual components of the defense forces.

2. One of the priority tasks of the Agency should be considered to carry out a comprehensive audit of the results of research and development works at state, and, by their consent, private enterprises of the defense industry of Ukraine and scientific institutions regarding the creation of innovative models of weapons and military equipment and their implementation in the development and production of military-technical equipment.

3. The organizational and legal form of the Agency is a joint stock company, the authorized capital of which is formed by the Government of Ukraine represented by the Ministry for issues of Strategic Industry and the Ministry of Defense on parity terms. This will allow attracting not only shareholders-partners, but also shareholders-investors to the implementation of innovative projects in the military-technical sphere using public-private partnership models by means of the principle “use it or lose it” (Sina Bruna 2013), as well as using the Triple Helix Model,

that is, more active and wider interaction of state authorities with private structures and scientific institutions.

4. Approximate structure of the Agency:

Department for the development of samples of robotics and automation of processes in the defense industry of Ukraine; department of innovative projects in the field of military weapons and military equipment (small arms, military equipment, UAV design, etc.); department for the construction, repair and equipment of military armored vehicles; department for the production and repair of aircraft; directorate for the production and modernization of missile and space technology and anti-aircraft missile systems; department for Biological, Medical, Information and Digital Technologies; department of International Cooperation.

5. Financing of the Agency's activities: State budget + all sources not prohibited by law. Particular attention should be focused on attracting investment through the implementation of public-private partnership projects, and, accordingly, a wider involvement of private enterprises in the implementation of relevant projects.

6. Management of the Agency: appointed and fired by the decision of the Cabinet of Ministers of Ukraine on the proposal of the Minister of Defense of Ukraine and the Minister for issues of Strategic Industries of Ukraine.

7. The main direction of the Agency's activity is the prevention and elimination of “threats to the future”, taking into account the fact of the Russian Federation's military aggression against Ukraine (following the example of the European Defense Agency).

8. Contractual cooperation with higher educational institutions, in particular with the Kiev Polytechnic Institute of Sikorsky, including with the aim of forming the staff of the Agency and introducing advanced scientific and technical developments in the MIC of Ukraine.

TYPICAL TECHNOLOGICAL PRIORITIES OF THE DEFENSE TECHNOLOGY AGENCY OF UKRAINE FOR THE PERIOD UP TO 2030

1. **Human technologies:** biological protection against previously unknown pathogens; therapy of neurotrauma of the central nervous system; fundamental mechanisms of slowing human aging; computer-aided design systems for living beings.
2. **Robotics technologies:** highly efficient vehicles for the delivery of personnel and cargo; autonomous operations of robots (underwater, ground, air); power supply for long-term autonomous actions; navigation in conditions of electronic countermeasures; robotic transport for air and water space, rough terrain and public roads.

3. Network technologies: processing of structured and unstructured data of huge volumes and significant variety to obtain human-readable results; software implementation of the concept of "systems of systems»; gamification of control of operations in the combat space.

4. Technologies for integrating human and robot capabilities for action in the real world: development of robotics to reduce physical stress on humans; automatic means of monitoring and correcting of health; expanding the capabilities of sense organs through the use of electronic sensory systems;

5. Integrated network technologies for transforming the real world through the interaction of humans and robots: management of the configuration of the cohnectome of the human and animal brain; a single combat space with a universal protocol for conducting militant operations; autonomous resource-independent robotics and supporting infrastructure.

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