MINISTRY OF DEFENCE OF UKRAINE

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

CENTRAL RESEARCH INSTITUTE OF ARMS
OF THE ARMED FORCES OF UKRAINE

COORDINATION PROBLEMS OF MILITARY TECHNICAL AND DEVENSIVE INDUSTRIAL POLICY IN UKRAINE. WEAPONS AND MILITARY EQUIPMENT DEVELOPMENT PERSPECTIVES

V International Scientific and Practical Conference

Abstracts of reports

October 11–12, 2017

Kyiv

ORGANIZING COMMITTEE

Chairman of the Organizing Committee

Chepkov I. B. DEng, Professor, Chief of the Central Research Institute of Armaments and Military Equipment of the Armed Forces of Ukraine

Deputy Chairman of the Organizing Committee

Sliusar V.I. DEng, Professor, Principal Research Fellow of the Central Research Institute of Armaments and Military Equipment of the Armed Forces of Ukraine

Members of the Organizing Committee:

Lapytskyi S.V. DEng, Professor, Principal Research Fellow of the Central Research Institute of Armaments and Military Equipment of the Armed Forces of Ukraine

Sotnyk V.V. Ph.D. in Eng., Senior Research Fellow, Deputy Chief of the Central Research Institute of Armaments and Military Equipment of the Armed Forces of Ukraine for Scientific Affairs

Koliennikov A.P. Deputy Chief of the Central Research Institute of Armaments and Military Equipment of the Armed Forces of Ukraine for Development and Trials

Storozhyk I.V. Deputy Chief of the Central Research Institute of Armaments and Military Equipment of the Armed Forces of Ukraine for Human Resources

Hultiaiev A.A. Ph.D. in Eng., Senior Research Fellow, Chief of the Research Directorate for Military-Technical Policy

Vaskivskyi M.I. DEng, Professor, Chief of the Research Directorate for Development of Weapons and Military Equipment of the Ground Forces

Holovin O.O. Ph.D. in Eng., Senior Research Fellow, Chief of the Research Directorate for Development of Weapons and Military Equipment of the Air Forces

Tverdokhlibov V.V. Ph.D. in Eng., Senior Research Fellow, Chief of the Research Directorate for Development of Weapons and Military Equipment of the Special Operations Forces

Kosiakovskyi A.V. Ph.D. in Eng., Chief of the Research Directorate for Development of Armament and Military Equipment of the Navy

Kapas A.H. Chief of the Scientific and Organizational Department

Kanischev V.V. Chief of the 1st Research Department

Komarov V.O. Chief of the 2nd Research Department

Himber S.M. Chief of the Scientific Information Department

Shovkalyuk V.S. Chief of the Unit of Innovation Activity and Technology Transfer, Ministry of Education and Science of Ukraine

Chayka D.Yu. Ph.D. in Geography, Deputy Chief of the Unit of Innovation Activity and Technology Transfer, Ministry of Education and Science of Ukraine

Ivanov O.V. Main specialist of the Technology Transfer Department, Ministry of Education and Science of Ukraine

Secretary of the Organizing Committee

Chuchmii A.V. Senior Research Fellow of the Scientific Information Department

Slobodianyk V., PhD (engineering), senior researcher,
Sashchuk S.,
Sevostyanov D.
Ministry of Defense of Ukraine (Central Research Institute of armament and military equipment of the Armed Forces of Ukraine)

PROBLEMS AND PROSPECTS OF CREATING A DOMESTIC THERMOBARIC WEAPONS

The analysis use thermobaric weapons in modern military conflicts shows its high efficiency in solving individual combat tasks, particular in conducting of hostilities in urban, mountainous areas, during the storming of strongly fortified structures, and so on.

As result, Russia has developed and adopted a range of thermobaric munitions - from assault grenades to air bombs of various calibers. Appropriate work to find new samples and improve existing ones are actively being continued.

The tasks solved in the course of such work are the search for new, stable and high-energy thermobaric mixtures, reducing the anisotropy of the excess pressure of the explosive wave. Important also verify the time and reducing the heterogeneity at the moment of detonation thermobaric mixture at various points of the cloud, minimizing the difference of the initial velocities of thermobaric combat part, and so on.

As you know, thermobaric weapons were not produced in Ukraine. The possibility of its creation is faced with a number of difficulties, such as:

- lack of experience in the development of such weapons;
- the need to upgrade domestic enterprises with special equipment for the development and production of individual parts and units;
- absence of a modern test base for the development of thermobaric weapons;
- absence of domestic mathematical models capable of high level of reliability and adequacy to describe the processes taking place during the thermobaric detonation and to carry out automated search of new thermobaric compounds;
- financial restrictions on the opening and development of new samples of thermobaric weapons;

The most promising in terms of efficiency / cost criterion are work on the development of “small” samples of thermobaric weapons and ammunition, such as hand-held thermobaric grenades, thermobaric ammunition small calibers, jet infantry flamethrowers.

They are relatively inexpensive and their development and production can be arranged in the shortest time, provided sufficient funding.

Slyusar I.I., PhD, Docent,
Smoliyar V.G., PhD, Docent,
Voloshko S.V., PhD, Senior Research Fellow,
Poltava National Technical Yuri Kondratyuk University,
Slyusar V.I., Doctor of Technical Sciences, Professor
Ministry of Defense of Ukraine (Central Research Institute of armament and military equipment of the Armed Forces of Ukraine)

PRIORITIES FOR DEVELOPMENT OF TRUNKING RADIO SYSTEMS

On this time, after the level of functional possibilities of the system TETRA (TErrestrial Trunked RAdio) with a time division multiple access (TDMA) and APCO25 (Association of Public Safety Communications Officials International) with a frequency division multiple access (FDMA) are on the overhead line of classification of the trunking radio systems (TRS). In each of these standards, the total number of offered voice/data functions significantly exceeds one hundred. The great advantage of digital TRS is the ability to work together with the existing fleet of analogue radio stations, which allows them to be phased-in. In this case, there is a possibility of subtle adaptation of system solutions to the needs of the customer with the help of additional software products, for example, dispatching applications, etc. In this sense, the TETRA and APCO25 technologies, which have been used for many years by the law enforcement agencies of European and other world countries, are the most successful among those that have taken place.

In turn, these TRS standards are technically far behind other telecommunication transmission systems, such as 4G/5G mobile communications systems, unified communications (UC), optical access systems, etc. As a result, the main elements of the TRS infrastructure, including the base stations (BSs), should be built on modern circuit-engineering solutions.

Taking into account the possibility of accepting TETRA as the main standard at the state level, it is advisable to focus on ways to increase the capacity of the TRS BS. This is possible due to the use of new TDMA variants based on modern technology and high-spectral efficiency modulation techniques. As a result, the paper proposes several approaches to solving this problem: the obtaining additional operative amplification due to modification of algorithms of quadrature amplitude modulation (QAM); the work with the existing TETRA equipment fleet; the introduction of multiple access mode based on orthogonal frequency discrete modulation (OFDMA); the implementation of DSP by hybrid OFDM/TDMA or OFDMA/TDMA scheme; the providing multi-standard operating modes, such as DMR, APCO25, etc.

Particular attention deserves the improvement of antenna devices BS and subscriber terminals TRS. In this context, the use of fractal structures, metamaterials, electric-small antennas (ESAs) or their combinations is foreseen to minimize antenna systems and increase the sensitivity to weak signals and provide frequency and spatial selectivity. At the same time, fractal antennas with smaller overall dimensions allow to obtain practically the same gain as ordinary ones. The effect of miniaturization of antennas is most significantly detected only for the first few iterations of the fractal (typically 5÷6), asymptotically approaching a certain limit. In turn, the use of genetic and ant algorithms for the optimization of antenna systems has become widespread, shifting emphasis on such an antenna technology direction as ESA. It is quite promising to use the digital chart formation technology (DCF) based on digital antenna arrays (DAAs). A key feature of the DAA is the digital beam forming of the directivity diagram (DD) of the antenna. In general, the TRS with the DCF on the basis of the DAA has the opportunity to effectively address the following tasks: the improvement of the signal/noise ratio due to the formation of «zeros» of the DD in the direction of interference signals, including from neighboring on-board and ground stations, even in the main petals of the DD; the suppression of interfering signals arising in the case of multipath of radio waves propagation, as well as a significant decrease in the depth of the fading modulation; the achieving maximum efficiency of CDMA systems, spatial seals (SDMA); FDMA and TDMA; the integration into a single information system of different functional subsystems, namely, radio navigation, radio communication, etc.; the increasing the intensity of useful signals by focusing the DD max in the direction of moving correspondents; the solving the problem of electromagnetic compatibility.

Taking into account the intensity of the use of TRS in cities that may be characterized by a complex signal-interference situation, mathematical modeling was carried out to demonstrate the efficiency of the suppression of interfering signals with the use of the DAA and subsequent formation of the maximum DD in the desired direction during the digital processing of the N-OFDM signals (OFDM). The obtained results were confirmed by the provisions discussed in the work.

Thus, on the basis of the introduced classification signs, the priority directions of the further development of TRS: the using instead of one QAM carrier with a multiposition signal of OFDM type based on a QAM rotational signaling constellation modulation scheme; by analogy with systems 5G – the introduction of processing of non-orthogonal signals, for example, N-OFDM; the application of digital diagramming technology (DAA) based on digital antenna arrays; similar to DVB-T2 systems – the introduction of MISO or MIMO terminals; the miniaturization of BS antenna systems and TRS subscriber terminals. In this case, in order to provide multi-standard modes, as the basic technology defined software configuration equipment (SDR) using circuit-based solutions PCI Express.

Synitsyn I.P., D. Techn. Sci., s.r.f.,
Ignatenko P.P., Cand. Techn. Sci., s.r.f.
Institute of Software Systems of National Academy of Sciences of Ukraine

INFORMATION INFRASTRUCTURE OF MINISTRY OF DEFENCE AND ARMED FORCES OF UKRAINE. STATE OF THE ART AND APPROACH TO IMPROVE

In spite of current regulations base of Ukraine regulating informatization over the State and wide range of advanced information technologies with tools to implement them, the state of informatization over Ministry of Defence and Armed Forces of Ukraine do not meet actual challenges. That makes problematic to cope with the tasks of increasing defense capability of Ukraine in current trouble period.

Main causes of such state are the follows.

Non-compliance with basic Automation Principles, being elaborated through many years of home developers' expertise (in particular, principles being formulated by academician V.M.Glushkov).

Neglecting conventional world standards regarding Information and Telecommunication Technologies management and System Engineering rules, in particular those concerning due organizing of Information and Telecommunication Technologies Tools selection, design and acquisition, as well as providing IT-systems Life Cycle due support.