Збірник наукових праць Національної академії Державної прикордонної служби України імені Богдана Хмельницького. Серія: військові та технічні науки № 3(65)/2015

Bambulyak M. P., Bambulyak O.M. ***Recommendations relative to the device anti-tank, anti-personnel and prochitannosti non-explosive obstacles during the antiterrorist operation.***

The emergence of the armed conflict in Ukraine, the need created by the destruction of illegal armed formations on the South-East of the country and direct invasion of the Russian Federation with the widespread use of their military equipment leads to the need to define recommendations for the methods of non-explosive obstacles with the purpose of increasing the combat effectiveness of engineering barriers and complications to the enemy's ability to overcome them. The article highlights recommendations for the design of the main types of non-explosive obstacles by the engineering divisions of power structures of Ukraine. Implementation of the proposed recommendations in daily activities of troops, performing tasks in the areas of warfare, combined with mine-explosive obstacles, will improve the combat effectiveness of the engineering obstacles that in turn will hamper the ability of the enemy to overcome them.

Keywords: *engineering, non-explosive, anti-personnel, anti-tank, protirelin boom.*

Bratko A.V. ***Methods of action reserves of the State border guard Service in terms of the antiterrorist operation***

Forces of the State border guard Service of Ukraine in terms of fighting involved destruction for subversive and terrorist groups in the immediate border protection, and security zone along the clashes within the Donetsk and Lugansk regions, the administrative border of the territory temporarily occupied AR Crimea others.

The relevance of this topic is that the content of tasks and corresponding methods of action units of the State border guard Service of Ukraine in the area of antiterrorist activity is influenced by many factors and conditions, which requires consideration of scientific analysis.

Action research reserves of the State border guard Service of Ukraine and ways of their use during the ATO shows that there are many options correctness response to changes in the environment. Therefore, methods of application capabilities are constantly improved according to the changing tactics of the offender. In the future, it is advisable to develop options for common actions typical subdivisions reserves of the State border guard Service of Ukraine on common tasks of protection and defense of the state border.

Keywords*: methods of actions, special events, reserves, antiterrorist operation.*

Gorodnov V.P., Pavlenko S.O., Ovcharenko V.V. ***Choice the indicators of the financial support and execution of service and combat missions by units and subunits of National Guard***

Text annotation: Represented calculating expressions are the models and indicators of effectiveness of the financial support and execution of service and combat missions by units and subunits of National Guard. They correspond to known requirements for efficiency indicators, namely, they correspond to goals and objectives for the implementation of SCM (represent a quantitative measure of the impact of financial support to the possibility of the SCM), they have a clear physical meaning, they are sensitive to meaningful actions at the SCM organization (food shortages, limited the amount of fuel, availability of ware property not of adequate quality, etc.). Formed efficiency indicators and calculated expressions create conditions to further solving the problem of choice the best ways of additional funds attraction and determination their primary application.

Keywords: *financial security, indicator of the effectiveness of the financial support, the general fund, special fund*

Kyrylenko V. A., Petrov V. M. ***Model parameter estimation and management organizational structure of highway border crossing point across the state border of Ukraine***

The aim of highway border crossing point (HBCP) is to perform a controlled crossing the state border of Ukraine persons, motor vehicles and cargoes (control objects), and detecting and preventing attempts of illegal movement across the border.

Controlled vehicles vary in types - cars, trucks, trucks carrying over 3.5 tones, buses, and operational control. Therefore, in the organizational structure of HBCP for each type of vehicle, call it "object of control" or application (request) for maintenance, when they departure and enter Ukraine they must go through specific groups of lanes equipped with means of border and customs control. Number of lanes in a group can vary from one to n> 1. More than this, each lane is a separate "channel" of border control (channel service).

Every vehicle entering the service channel (border control) is not known in advance (random) time. The combination of these vehicles creates flow applications (requirements) for service.

For law-abiding citizens border controls must meet European standards, in accordance with the criteria can be expressed requirement of minimum length of time stay in control objects of HBCP and quantity can be estimated duration of operations control, the length and duration of stay in the queue.

Therefore, to ensure that the process of border control European standards need time to adjust current state of organizational structure of HBCP which depends on the intensity of the input stream of cars.

At low intensity of flow of control objects separate lanes may be closed. By increasing the intensity of the flow of objects of control the senior of border guard details in HBCP should promptly increase the number of working lanes, and at an

even greater increase in the intensity of the flow of control objects - move to the use of methods reduced inspections without breaking regulations.

However, the composition of each vehicle (object of control), not known in advance, can include both the vehicle and driver, and cargo and passengers with a different set of controlled features, making the length of each control - previously unknown (random). This indicator parameter for decision-making - the intensity of input flow of control objects are characteristic statistical (mathematical expectation of the number of claims per unit of time) for its evaluation required a long period of supervision over the work of lanes, which can lead to loss of efficiency of decision-making management of HBCP in general.

Therefore, to assess the current performance of HBCP and timely decisions on adjusting its organizational structure and regime of operation (degree of completeness checks) can be useful to develop an appropriate model.

But the problem is that such a model, according to the observed process parameters of HBCP must allow to carry out an assessment is not "visible" intensity values input flow of objects of control and other statistical characteristics of the traffic lanes and HBCP, which determine its effectiveness.

Unresolved problems and the purpose of work. *The task of identifying the hidden parameters of the facility and management of organizational structure of HBCP should be solved on current observable data, in this case - random values.*

In this case it is necessary to solve the problem determination process (method) and algorithm construction scheme for the formation of information processing tools and their use to legally obtain estimates of current and projected values of hidden parameters of the real object of HBCP. The aim of this work is the solution of formulated problems.

Conclusions: *The obtained value calculated to assess the statistical value of the intensity of the input of stream of cars on a private lane and the whole group of lanes in HBCP, allow time to identify the need for changes in the number of employees in each group of lanes in the HBCP.*

These correlations allow quantifying the value expected by the length of queues and waiting time in the queue in accordance with the decisions taken options on changing the operational structure and number of employees in groups of lanes in HBCP, determining the organizational structure of HBCP.

According to calculation formulas (9) in case of approaching the meaning of the coefficient of downloads ρ to 1 ($\rho \to 1$) length of the queue and waiting time rush to infinity, which can paralyze the work of HBCP. Therefore, the current value of the load factor is an indicator of stability in the HBCP and requires constant monitoring. Further, to solve the problem of instability in the HBCP should consider the characteristics of the transition to a reduced set of inspections of cars in the HBCP with minimal loss of information content of the results to detect offenses.

Keywords: *model parameter estimation, algorithm of construction scheme for the formation of information processing tools, highway border crossing point.*

Demidchyk A.A., Panov V.H., Sytnik O.V. ***proposals on engineering roadblocks, checkpoints and observation posts***

During the ATO important part of software engineering were roadblocks, PPC and aircraft that are equipped to oversee and guide their own message about any situation, action and NFP DRG terrorists or incidents that may occur in the area of responsibility of the connection. Company engineering roadblocks, PPC and SP is to create the necessary conditions for stationing units, the performance of the tasks of daily activities, keeping them in constant combat readiness, protection and means of attack NFP DRG. In the article the proposals on the content and scope of engineering tasks based on the situation, the availability of forces, means of artificial arms, terrain and time of year with the extensive use of machinery Engineering armament and fortifications of different types and materials.

Keywords*: checkpoint, checkpoint, FS, engineering software.*

Zalozh V.V., Meiko O.V. ***Analysis of the Effectiveness Components of the Border Detachment Management.***

The topicality of the article is stipulated by the fact that the issue of the effectiveness of the border detachment management has not got adequate reflection in the scientific literature yet; the researches have no co-ordinated and systematic character and it has a direct affect on the management practice.

The effectiveness of the border detachment management is a many-sided concept and the evaluation of its efficiency should be carried out by competent managers according to many parameters. In particular, the effectiveness of the management should be evaluated: by means of synthetic (generalising) indicators which cover different aspects of detachment activities; from the point of view of the work organisation and the managerial personnel functioning; by the degree of the border detachment achievement of the indicators which characterise the main objectives of its activities; by the degree of managerial work influence on the results of the border detachment activities on the whole; by the degree of requirements satisfaction of all the groups which are interested in the results of the border detachment activities.

Thus, it is necessary for the evaluation of the effectiveness of the border detachment management: firstly, to define precisely the objectives, which the border detachment aspires to attain and secondly, to carry out the diagnostics of the existing system of the border detachment management as for the conformity to the objectives and tasks. The management should be so effective that the border detachment could attain the defined objectives.

Keywords: *the state border guarding, border detachment, management of the activities, effectiveness of the management, effectiveness parameters.*

Kurashkevych A. P. **Recommendations for a chief of state border detachment as to organization of operational and service activity during enhanced state border protection**

Nowadays one of the priorities of operational and service activity of the State Border Guard Service of Ukraine is timely detection of threats and risks, which appear at the state border and may lead to the need for enhanced state border protection at certain areas of responsibility.

That is why it is important to develop and implement analytical approach to estimating the probability of achieving the boundary values of indices of situation aggravation at the state border. Given that border armed conflict is the most dangerous manifestation which calls for the need of enhanced state border protection, it is logical to solve the issue of assessing the possibility of an armed conflict at the state border and its successful combating by the forces of the State Border Guard Service of Ukraine.

Effective prevention of any armed border conflict as a form of illegal activity at the state border may be possible under the condition of early detection of informational indicators of certain illegal activities and transmission of quality (accurate and complete) information to the administrative system for its processing and transformation to the form required for working out of managerial decisions.

Thus, prevention of unlawful activities at the state border first of all requires data collection of informational indicators about typical activities which may be a prerequisite for the situation, leading to enhanced border protection.

Using basic informational indicators of such situation it is possible to develop recommendations for timely prevention of reaching the boundary values of situation aggravation at the state border, as well as to offer a certain order (execution of algorithm) of methods for assessing the probability of reaching the boundary values of situation aggravation at the state border in the process of organizing operational and service activities and taking decisions by a chief of state border detachment.

Implementation of practical recommendations allows more efficient use of forces and means involved in detection of illegal activities and timely reaction to the threat of achieving the boundary values of situation aggravation at the state border.

Keywords: *operational and service activity, armed conflict, enhanced protection of state borders, index.*

Mahas H. A. ***Research of function in gof managemen tofborderguardorganwithinthesystemofobtaining (extracting) andprocessingofdataonsituationregarding newapproaches to state border defence***

In the period of structural and political transformations in Ukraine there is a necessity of improvement of national security system including border security.

The Strategy of development of the State Border Guard Service of Ukraine until 2020 determines that the main aim of development of the State Border Guard Service of Ukraine is ensuring of efficient implementation of security policy in the

sphere of protection and defence of Ukrainian border and protection of sovereign rights of Ukraine in its exclusive (marine) zone with the use of the mechanism of creation of system of integrated management of security of state border of Ukraine. Also while designing the system of border management it is expected to implement the joint mechanism (with the EU countries) concerning information exchange, risks analysis, and improvement of information analysis and evaluation system.

One of main methods of enhancing the efficiency of state border protection is increasing the quality of state border management. The implementation of decision making system based on the substantiated and structural situation analysis – complex of actions oriented towards detection, identification and evaluation of possible threats and risks in the state border sector, tendencies of their changes; possible scale of conflict situation, the most probable scenarios of their development; factors affecting events and their interrelation.

The system of obtaining (extracting) and processing of data on situation is an element of management activity and supplies the chiefs of all levels with the information which is necessary for organization of operation and service activity, making of reasonable management decisions.

Today the comprehensive situation analysis is a relatively new process for headquarters of all levels. We assert that the scientifically substantiated quantitative methods of situation analysis are required during organization of operation and service (combat) actions in different form in order to make reasonable decisions.

Also the analysis of activities of headquarters of border guard organ with regards to obtaining and processing of data in the existing model of border guard security showed that today's system of obtaining (extracting) and processing of data on situation in the headquarters of border detachment has not been organized properly; and the methods of processing of data on situation and methods of formation of decision elements in the headquarters of border guard organs have not been formulated.

We have outlined the controversies substantiating the further directions of improvement of management of border guard organ in the system of obtaining (extracting) and processing of data on situation while using new approaches to state border protection: operation, operation and tactical, military.

Keywords: *system of obtaining (extracting) and processing of data on situation, border guard security, operation and service activity, organs of management, information and analytical unit.*

Mazur V. Yu, Andrushko A. V. ***Powers of the State Border Service of Ukraine on Criminal Procedure Code of Ukraine***

The article analyzes the criminal procedural powers of the State Border Service of Ukraine on Criminal Procedure Code of Ukraine in 2012. On the basis of the comparison types investigated criminal procedure of the State Border Guard of the previous and the new criminal procedure legislation. Revealed certain

legislative, theoretical and practical problems of the criminal procedure authorities of the State Border Guard at the present stage.

Keywords: *state border protection agencies, operational unit, criminal procedure*

Maistrenko A. V., Stuzhuk P.I., Primirenko V. M., Adamenko M. V. ***Analysis of approaches to determining the possibility of formation of missile troops and artillery***

The article analyzes the scientific and analytical tools to identify opportunities of formation of Missile Forces and Artillery. The article gives a detailed analysis of existing approaches to determining these opportunities and stated that they do not meet modern conditions of warfare and do not include new factors that may significantly influence the successful application of missile troops and artillery. The aim of the article is to find the basic ways of scientific and analytical tools to identify opportunities of military units, including missile troops and artillery. The contradictions in the conceptual apparatus of evaluation capabilities formation of missile forces and artillery are studied in the main part of the article. Moreover, the article stands the discrepancies and contradiction in addressing the same issues in different ways and approaches with the example of comparative ratios. These issues are: determining military capabilities of warring parties, bringing firepower and ammunition to one unit of account; assessment of the balance of forces and means and the extent permissible deadweight losses in combat (operations); predictions of the results of fighting through the use of simulation.

The advantages and disadvantages of each approach are observing in this article based on the analysis of existing approaches to identify opportunities for military forces. For example, the main drawback of the quantitative evaluation is the impossibility of their application for evaluation of qualitative side of possible formation. At the same time it was stated that the quantitative evaluation of existing military formations is the approach that was used in military command with limited access to the information processing. At the timeof the superiority of computerized technology in issues of determining the optimal solution simulation fighting is defined as the most accurate method.

Also, the different approaches to the structure of existing military formations are analyzing in this article. The author of this research is defining the advantages and disadvantages of different approaches to determining the groups mentioned issue. The main advantages of these approaches are: the assessment possibility of military variable structure formation, including the illegal armed formation, the consideration of qualitative indicators of firepower and ammunition, the possibility of carrying out planning fighting actions (operations) at various levels of the hierarchy of military command and control.

A general conclusion of the article is basing on all the analyses done during the research, and it is the definition of the most perspective approach to solving the issues mentioned in the article, namely quantitative and qualitative assessment of capabilities of military formation.

Keywords: *scientific-methodological apparatus, opportunities, military units, artillery and rocket forces, factors, a set of features.*

Mentus I.E., Yendrievich O.M. ***Features of application of mine-explosive barrages in the conditions of the armed conflict***

In the article the analysis of looks of specialists of field engineer-engineer business is conducted on basic tasks on a device and overcoming of barrages. The analysis of features of application of mine-explosive barrages in the conditions of the armed conflict is given by possibility to perfect organization of the effective engineering providing on a device and overcoming of mine-explosive barrages at the actions of parts and subdivisions in the conditions of the armed conflict. In the article given to recommendation on the device of mine-explosive barrages for the protection of districts of location and positions of troops, blockhouses, important districts and objects in the conditions of the armed conflict.

Taking into account the requirements of Protocol II the order of providing of safety of civil population, and also features of application and maintenance of antipersonnel mine-explosive barrages, is exposed Genevan Convention, including at the actions of troops in raid detachments.

The features of organization of accompaniment of columns and overcoming of barrages are considered in the conditions of prosecution of mine war.

Keywords: *mine obstacles, armed conflict, non-explosive obstacles.*

Jasko V. A., Azarov I.S. ***The Problems of prognostic abilities of cadets of higher military educational institutions.***

This article deals with such issues as the prognostic ability formation of military specialists and their daily routine performance, the variety of prognostic techniques and their application. Those techniques will help to increase accuracy of negative consequences forecasting while completing daily routines without any casualties. Prognostic abilities and set of prognostic techniques that are used by military specialists are to be applied to military education system and to all military exercises. Military specialist prognostic ability is a complex of knowledge and skills combined with an up to date way of thinking.

Many military specialists have some problems at their daily routines, particularly during combat operations which are often associated with poorly developed skills to predict the outcomes of such operations. They lack of skills in fast and correct respond in unpredictable situation during performance of their professional military activities. Also, they lack of forecasting experience at their daily routines and especially during combat operations.

Keywords: *Armed Forces of Ukraine, the higher military educational institution, foresight, forecasting, prognostic abilities of military specialists.*

Jasko V. A., Osadchy A. N., Jasko A.V. ***The Complex of measures for the analysis of mine safety and counter-mine warfare***

Wide application in the South-Eastern part of Ukraine illegal armed groups and subversive groups mine-explosive devices of various types that are installed in

different ways, leads to the need for effective response. As a consequence, it is necessary to develop a set of measures aimed at a thorough study of the mine situation in the area of upcoming actions, deter mining the enemy routes of movement of troops, terrain, objects, and destruction (neutralization) of mine-explosive devices, the preservation of life and health of servicemen and civilians.

The article highlights recommendations for the development of complex of measures for the analysis of mine safety and counter-mine warfare. Implementation of the proposed recommendations in the daily activities of the troops, performing tasks in the areas of warfare, will kick the ability to save the life of the personnel, to reduce the number of explosions and casualties from mines and explosive devices.

Keywords: *mine warfare mine, land mine, the object of mining.*

Androshchuk A. S., Buyalo A. V., Pilipchuk V. V. **Model organization of educational process higher military educational institutions on the basis of mathematical tools petri nets**

One of the ways to improve learning in higher military educational institutions and law enforcement Ukraine – introduction in the educational process computer systems of the educational process, defining one of the leading areas for development of new information technologies in teaching.

Among the components of the educational process that significantly affect the increase of its efficiency, an important place monitoring and evaluation of academic achievements of the learner – a Pedagogical management training and cognitive activity, in which the regular stepwise evaluation and adjustment of training in order to improve the educational process in general.

The system of management of educational process in higher education in the Bologna process, the basis of which the information-analytical system of monitoring and evaluation of educational activity of students. Management processes represented Petri nets that allows to build simulation models of the learning process and to determine the optimum parameters of control.

The structure of the model learning management system. Since learning management system higher education institution complicated structure defined model of the system and highlighted its submodel.

The model of the educational process should reflect the following main functions of AIS monitoring and evaluation of educational activity of students:

tracking performance curriculum direction (specialty) students;

evaluating the quality of the educational process in the direction (specialty);

formation of proposals for decisions on the management of educational process.

The basic model submodel learning management system:

submodel of the educational process throughout the semester;

submodel of the educational process at the level of discipline;

submodel control attendance by students;

submodel control debts academic students per semester;

submodel decision to transfer the student to the next semester;

submodel decision on the implementation of student curriculum and awarding him a diploma.

Petri nets are a means of formalizing that sufficiently describes the processes that occur during learning activities of students. Modeling of management of educational process in higher education provides an opportunity to identify gaps in the educational process and management of the process and to determine the optimal settings management.

Keywords: educational process management model, Petri nets, monitoring, evaluation, simulation.

Batsamut V. M. ***Requirements for taskforce of the National Guard of Ukraine, who are creates to perform their combat missions for public security***

The goal of National Guard of Ukraine (NGU) are the maintenance of public order and public security. In the case of the territory of Ukraine of an emergency social, regional or state level, with the aim of locating and neutralizing creates taskforce NGU. This grouping is summarized in a certain system and hosted (deployed) properly in some regions of the country compounds military units NGU with its own control system and a single management body.

During the creation of such groups, army controls NGU must clearly understand how groups must comply with the requirements to complete the process of creating them as property groups directly affect the efficiency of the performance of service and combat missions.

This question has been studied carefully in the Armed Forces of Ukraine to establish appropriate groupings of troops (forces), but NGU solved considering its service and combat missions, it has not found sufficient study, which confirms the relevance of this article.

List of requirements to be met by the taskforce National Guard of Ukraine, created for public safety are substantiated. The groups of requirements to be met by the individual functional subsystems operative group of forces are defined. The content of each requirement are disclosed.

The direction of future research is to develop the scientific and methodological apparatus for the study of rational composition, structure, population groups, and to evaluate the level of compliance groups and their individual subsystems, the specific requirements.

Keywords*: requirement, functional subsystem module, the taskforce, the National Guard of Ukraine.*

Blinnikov H. P., Traskovetska L. M., Shevchuk V. ***M. Wave properties of ultrasound distribution in elastic media***

In the fifties of the 20th century the ultrasound Rayleigh waves with frequencies ~10^{10} Hz started to be used intensively as means of comprehensive, indestructible control of surface and surface layer of samples and materials (determination of defects, measures and depths of thermal temper, residual mechanical stress, quality of processing of surface, etc.). That means that speed, attenuation and structure of Rayleigh waves are inseparably linked with

mechanical, thermal and other characteristics of surface layer of a sample in which it extends. Therefore, by the speed and attenuation of Rayleigh waves it is possible to receive information on condition of the sample surface layer. Except for equipment, Rayleigh waves are widely used in purely physical experiments as the tool for studying properties of surface and surface layer of solid body, including its "electric" characteristics, for example, electronic surface states in semiconductor crystal. Use of Rayleigh waves has opened essentially new opportunities. Thus, in ultrasonic defectoscopy the application of Rayleigh waves has made ultrasonic control universal - applicable for parts and blank parts of any form, as it became possible to control surface (flat and curvilinear) and surface layer of sample. It has allowed the ultrasonic control to take the leading place among other methods of indestructible control. This work considers researches of distribution of Rayleigh waves in elastic media by means of Chladni figures. Research of Chladni figures has shown that length of standing wave depends on thickness of plate and mechanical properties of material of plate. The analysis of distribution of ultrasonic waves (interference, diffraction, dispersion) in plates from different materials has been accomplished. It has been shown that the speed of distribution of ultrasound in the plate is proportional to the square root from the wave frequency.

Keywords: ultrasound, Chladni figures, elastic environment, speed of wave distribution, frequency of wave, interference, diffraction, dispersion.

*Goroshko A.V., Royzman V.P. «**Statistical methods for solving linear ill-posed problems in the case of multimodal probability distribution of the measured data**».*

The paper suggested statistical approaches to solving linear ill-posed problems. In particular, in the case of multimodal probability distribution of the measured free members of the system of equations to justify the passage of such systems to systems of equations with normally distributed vectors free members. The advantages and disadvantages of the method of least squares estimation for solving ill-posed problems. To ensure the stability of solutions of linear ill-posed problems prompted the use of the method of truncated estimate. The method is based on the involvement of principal component as linear filtering estimate of least squares. The essence of the filter is in such an action on the LSE, which would substantially narrowed the scatter ellipsoid estimate of least squares using the compression of the information contained in the scattering matrix, thanks to the "truncated" "tail" of the spectrum of the Fisher matrix. The effectiveness of the method of truncated assessments demonstrated for solving the inverse problem of determining unknown eccentricities compressor rotor aircraft engine АИ-20 by the influence coefficient and experimentally measured deflection of the rotor.

Keywords: *inverse problem, incorrectness, multimodal probability distribution, estimation of least squares, principal component, eccentricities, rotor*

*Hunko A. V. «**Technique of estimation of technical efficiency of transport means of border detachment»***

The author has developed the technique which allows us to determine the level of technical efficiency of transport means of border detachment. The article concerns the approach of determination of the particular reliability level of transport means of border detachment in order to find out indices of reliability of transport means. Also the author supposes that determination of reasons of possible decrease of technical efficiency level and he explains how to make appropriate management decisions for improvement of technical.

Operation and service activity of border detachment units is characterized by dynamics and fast changes of surrounding. Timeliness of reaction upon situation changes within the area of border detachment is ensured owing to supply of border units with reliable and highly mobile means of transport. Capabilities of transport means to stay in the state of permanent availability is realized by functioning of the system of technical maintenance of transport means.

The efficiency of technical maintenance of transport means is determined by its capability to maintain and restore vehicles and to ensure specified level of mechanical availability of transport means in the case of optimal time spending, labour expenditures and costs. It is necessary to have appropriate technique in the order to determine and correct the level of efficiency of the system of technical maintenance of transport means of border detachment. This technique will allow us to maintain mechanical availability of transport means at the specified level and to optimize costs of technical maintenance.

The offered technique establishes the connection between values of technical availability and expenses on maintenance of specified level of availability. Such connection will allow to determine conformity and expediency of financing of technical maintenance of border detachment. Obtained results can be used during the procedures of estimation of mechanical availability of transport means of border detachment and efficiency of functioning of the system of technical maintenance of transport means of border detachment. As a result of the research we offered the technique estimating efficiency of the system of technical maintenance of transport means of border detachment. The given technique allows to determine timeliness of supply with spare parts, quality of repairing works by service technicians, expediency of number of technicians regarding transport means being maintained, level of reliability of transport means, etc. Complex consideration of indices of technical maintenance system is possible as a result of using enhanced coefficient of technical application.

Keywords: *technique of evaluation of technical efficiency, efficiency coefficient, refusal index, transport means.*

Doroshenko V.O., Lysyi M.I., Strelnytskyi O.E., Strelnytskyi O.O.
Investigation of the slotted conical antenna of the doppler microwave sensor fot the local objects protection

The results of experimental research and mathematical modeling of a slotted conical antenna that permits to form cardioid radiation pattern are presented. Such antenna for creation of doppler microwave sensor guard for roadblocks, position surveillance and other local objects could be used.

Based on the results of experimental measurements of the radiation pattern of cardioid form is built. The standing wave ratio of the antenna with the longitudinal conical slot within the operating range of the antenna 8.7-10 GHz is.

A mathematical model of the process of excitation slotted conical antenna by pointed monochromatic source to the edge of the electrodynamic problem in a rigorous formulation is reduced. The solution of which is using the apparatus and method of integral transformations of the Riemann-Hilbert. As a result of the boundary problem solution diagram the calculated spatial distribution depending on the width of the gap is shown. The comparison of measured and calculated normalized charts satisfactory agreement in form and meaning are shown. The experimental and theoretical results for the design of advanced broadband and ultra-wideband antenna systems detect hidden objects and determine the direction of movement goals could be used.

The prospects for further research is development of the Doppler sensor protection of local objects, intended to detect and determine the direction of a moving object. As the object detection a person, group of people could be. A block diagram of the sensor, as well as the generalized tactical and technical requirements for the prospective development of the sensor are proposed.

Keywords: *Conical antenna, microwave sensor, cardioid radiation pattern.*

Dostanko A. P., Korobko Є. V., Kuzmin V. O., Zoya N. A. ***Development of fixing method of non-magnetic details on the magnetic table***

This article presents the experimental results on the development of technology fixing of samples of details from non-magnetic materials (aluminum, glass, ebony, PCB) on a standard planar magnetic table, which is based on the creation and use of magnetosensitive adhesive layer between the component and the substrate, changed its state from the quasi-solid to fluid. It is shown that unit shear forces of detail adhesion with glue increase on three orders under the influence of the magnetic field.

Keywords: magnetosensitive adhesive composition, fixation, non-magnetic samples

Bogorosh A., Voronov S., Royzman V., Shayko-Shaykovskya A.

Domain formation under the influence of electric and thermal field defects in devices based on ferroelectrics

Polarizes the presented results of theoretical research of influencing of the charged defects on local reversirovanie in segnetoelectricians.

Keywords: *domains, electrical and thermal field, defects, polarization, ferroelectrics.*

Royzman V. P., Drach I. V., Tkachuk V. P. ***Differences of automatic balancing for rotors with horizontal and vertical rotation axes***

The article deals with the work of a liquid auto-balancing unit for rotors with variable imbalance, looked like cavity chamber partially filled with working bodies (liquid) and a passive regulator of the direct action that doesn't require

power supply and control system for or correcting masses movement. It analyses ideal and viscous liquid cases.

To establish the reasons of inclination of automatic balancing effectiveness by passive ABU horizontal rotors compared with vertical ones, mathematical model of liquid behavior in auto-balancer including outside dampening and gravity has been made.

It has been shown that influence of gravity during the movement of horizontal rotor defines decrease of angular velocities and automatic balancing is possible by rotor's liquid and also decrease of tangential component of equal centrifugal inertia and gravity which displace liquid into position opposite to misbalance to cause decrease of balancing accuracy.

Keywords: rotor, vibrations, passive automatic balancing, auto-balancing unit (ABU), balancing effectiveness.

Royzman V. P., Kovtun I. I. ***Developing acoustic emission methods for non-destructive strength testing parts and units of technics***

The paper represents experimental research of acoustic emission properties of various materials, parts and units, applied in machine-engineering and other branches of technics, as result of which the following acoustic emission methods for non-destructive testing have been developed: strength testing glass-plastic parts, applied for manufacturing pump rods; strength and air-tightness testing microwave assembles in manufacturing and exploring conditions, when onboard assembles sustain inner pressure drops at pulsating cycles; strength testing units composed of different composite materials at example of compounded ceramic capacitors K 15-5 explored in conditions of termocycling; verifying strength effect in steel produced by hydrogen embrittlement technology and in hard-alloy plates produced by ion nitriding technology. Besides, paper contains development of hard-software acoustic emission measuring complex, applied for experimental and applied strength testing; and portable acoustic emission depressurization alarm device to signal beginning of depressurization or destruction in controlled parts and units of onboard flying systems.

Keywords*: method, acoustic emission, non-destructive testing, strength, parts, units.*

Royzman V. P., Petrashchuk S. A. ***Rapid method wheel balancing vehicles without removing it from the work axis in operational conditions at operating speed***

Paper represents developed mathematical model for calculating mechanical stress in component-compound system, which allows evaluating strength of electronic components having revolution shape and also compound irrespective to shape of its formation in varying temperature. The stress is calculated in transient temperatures owing to finding temperature distribution law in the whole volume of sealed unit, and solving problem of non-stationary radial temperature distribution in electronic component and surrounding compound layer within sealed unit.

Keywords: *micro-unit, electronic component, compound, stress, heat conduction, temperature distribution.*

Savchenko O. O., Prokopenko E. V. ***Method of estimation of efficiency of communication of organ of guard of border network***

The communication system organ of state border protection is a large and complex system, and operates within the larger system - the control system of the State Border Service of Ukraine. The effectiveness of its functioning significantly affects the quality of management of the State Border Service of Ukraine, simplifies the management of command and staff subordinate units in different conditions of border protection.

One of the basic requirements of the communication system put forward the need to transfer messages in a timely manner with a probability of not less than required for a given probability and stealth.

The existing system of communication OODK not fully meet the requirements of the management in various conditions - especially during the execution of the tasks of border protection in the period of threat.

Naturally put forward the task of improving the effectiveness of the communication organ of state border protection in order to achieve compliance with its increasing operational performance and operational requirements of combat management subordinate organs and bodies of the State Border Guard.

Based on the fact that the communication system is put forward a number of requirements, which are based on a wide range of indicators, the author proposes to analyze the state of the communication system of state border protection authority for one of them – namely, the effectiveness of the security indicator calculation - intelligence welfare.

Proceeding from the above for the qualitative characteristics of the communication system OODK encouraged to use the main index characterizing the efficiency of the communication system and an additional indicator of the average time of the disclosure of the communication system, which characterizes the intelligence of its welfare. As an indicator of the efficiency of the system is proposed to use the coefficient of efficiency of communication direction.

Keywords: *communication system, the average opening time of the communication system, the coefficient of efficiency of communication direction, the efficiency of the probability model.*

Some questions of system information protection synthesis in information and telecommunication systems of border agencies at the stage of modernization

Building a system of security and protection of the state border on the basis of the hybrid war challenges requires deployment of a new type of border departments with specific functions that are inherent in the functioning of the border agency in a particular period in the zone of the antiterrorist operation.

These units are created under the reforms of the State Border Guard Service of Ukraine to strengthen the security of the state border taking into account the

new security sphere, as well as basic approaches to the reforms of public administration, the defense and security sector of Ukraine, its integration into the European and the global democratic community.

In accordance with the main activities and further development of the State Border Guard Service the following functions are expected: deployment and operation of cross-border service centers and connection of checkpoints, entry (exit) control posts to a single international system of wanted criminals - the Interpol databases.

All of the above-mentioned leads to the need for continuous upgrading of telecommunication networks as well as information and telecommunication systems of the border agency, the introduction of equipment and technologies that meet modern international standards and recommendations. One of the major problems that arises when upgrading the corporate network of the State Border Guard Service of Ukraine is system protection.

Thus, the question of system information security synthesis in heterogeneous information and telecommunication systems at the stage of modernization requires additional research, namely solving the inverse problem of the system of information security.

In practice this means that the development of the technical project for the modernization of "Hart", the integrated information and telecommunication system, (introduction of new information and telecommunication systems or their upgrading) State Border Guard Service of Ukraine defines the requirements for the security of departmental systems as a whole and indicates what is already implemented concerning individual possible information leakage channels. The developer as a result of surveys, analysis and simulation received the value weights of possible information leakage and determined project decisions on the choice of means of protection for the vulnerable MKVI to ensure security standards of the system.

The solution of this problem in general is uncertain, and has infinitely many solutions if additional conditions are not impose, many of which are related to the model violator.

However, in terms of "Hart", the integrated information and telecommunication system, in general, such a model is missing.

This greatly complicates further research and reduces its effectiveness.

In fact in this case the protection of information is based on a hypothetical offender. To find one of the solutions to this inverse problem, we shall accept the most unfavorable for us hypothesis of the violator, which is that he has sufficient resources to obtain information from any possible information leakage channel at any time.

With this hypothesis of the violator systematic data protection should be equable, that means permissible leakage through all possible channels of information leakage has to be the same. This research allowed us to form functional relations that will allow to form requirements for the security of modified (new) corporate departmental components at the stage of technical project formation for the modernization of integrated information and

telecommunication systems to provide a given level of total security of the system as a whole.

Further research is expected on the departmental information security system Ii accordance with the model of the violator, as well as the rational distribution of information security for the possible channels of information leakage.

***Keywords**: synthesis, information security, information system.*

Traskovetska L. M., Borovik O. V. ***Aanalysis methods and capabilities for finding objects obstacles that are implemented in the technical means of border control.***

The strategic course of Ukraine's integration into the European Union, Ukraine's entry into European political, economic and legal space leads to changes in all areas, including in the area of border security. Regarding the latter, special attention has been and remains confined to checkpoints across the state border of Ukraine. With the adoption of the Law of Ukraine "On Border Control" clearly defined its main goal, which is to counter trafficking of persons across the state border, illegal migration, human trafficking and trafficking of arms, narcotics, psychotropic substances and precursors, ammunition, explosives materials and items prohibited for movement across the border. Units performing border control during the operational performance using technical means of border control (TZPK) that are designed to improve its efficiency. Analysis TZPK use in operational performance suggests that there are cases insufficient to ensure the efficiency of border controls because it is the inadequacy of TZPK. In this regard, attention needs further improvement in technical capabilities TZPK.

According to the authors, the study of this issue should begin with building effective mathematical models that would determine the parameters of electromagnetic waves passing through the transparent medium of various composite structures to the changing values of parameters of the systems, the various disturbances and initial conditions.

The paper analyzes the methods and ways to find hidden objects opaque nature in different environments with different structures implemented in modern technical means of border protection. The analysis of areas of use. The urgency of constructing a mathematical model that would determine the parameters of the electromagnetic field distribution in the composite opaque media.

***Keywords:** methods, technical means of border control, hidden objects, environments of different structures, mathematical model.*

Chesanovskii I. I. ***The theoretical foundation of channel model with signals coherent interperiod processing in systems with impulse radar channels***

The article devoted to the research and development task of interperiod correlation processing channel model that work with incoherent narrow-band radar signals. It helps to improve the efficiency of pulse radar systems. It should be noted that current trends in the development of radar pulse technology aimed at improving the probe signal. Therefore, it is shown that there is an alternative way

to improve the efficiency of such systems. Namely, by applying the correlation processing in the secondary (interperiod) processing stage in a separate channel of interperiod pulsed radar signal processing. According to results of the research, use of this approach along with signals from neighboring sensing periods as a reference signals allows to increase the effectiveness of reflected signals processing in several times. This statement is also valid in a number of additional conditions. Such as: randomness of target scattering surface complex characteristic; low radar channel coherence.

In this paper were obtained a number of detection characteristics obtained using the criterion of Neyman-Pearson. pulsed radar channel effects on detection probability, provided relatively large false alarm probability. The detection probability gets closer to the detection characteristics of classical correlator at the coherent reception. The difference in characteristics position is increasing when the given false alarm probability reduces. This is due to the increase in difference between the interperiod correlation processing threshold levels and classic correlator at a constant reference signal. By cause of the large extent of the resulting noise probability distribution function threshold values at interperiod correlation processing rises much faster than classical correlator threshold.

It is also shown that increasing the integration period in correlation algorithm, effect on normalization of noise instantaneous values probability distribution. Therefore, detection characteristics at such treatment will depend on the integration time (the number of sensing periods taken into account when processing). As established, the advantage of the receiver with the interperiod correlation processing is the possibility of unknown signal optimal processing. It is also correct for any radar signals type, including narrowband.