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# PROSPECTS OF DEVELOPMENT OF ANTIAIRCRAFT MISSILE TROOPS TECHNICAL SUPPORT SYSTEM

***In article considers the state and prospects of development of logistics to anti-aircraft missile forces, identifies areas for further development in the application of information technology for intelligent life cycle of military products. Theoretical bases of material and technical maintenance from the point of view to models of their life cycle are opened. Modern approaches to logistics are analyzed, considerable attention is paid to information technologies, tools that support this approach, and in particular process management according to the technical condition. It is noted that the main area of improvement should be the use of intelligent management of operation of technical condition and restoration of military products, which will allow during the life cycle of the sample on armaments and military equipment using projected indicators of its technical condition, determine the frequency and scope of maintenance, repair and providing them with military and technical property. There is an objective need to equip troops with an automated control system for dynamic analysis and effective planning of the life cycle of equipment. The advantages of forming a mobility park on the basis of the modular principle are highlighted. It is shown that during the operation of intelligent systems, solving the problem of providing military products, there are a large number of limitations that must be taken into account during its development. Recommendations for improving the logistics of armaments and military equipment, developing a methodology to ensure a higher quality of the life cycle of military products and effective life cycle management, which will achieve maximum performance of these types of military products. Theoretical bases of material and technical maintenance from the point of view of models of their life cycle are opened.***

***Keywords*: technical support system, air defense weapons, management of operation, technical state and recovery of a military product, CALS / IPV technology.***

**Introduction.** Modern information and intellectual technologies allow to change approaches to the organization of preparation, use and comprehensive support of combat, to increase efficiency and substantiation of the made decisions, in particular concerning support set level of serviceability and technical readiness of the surface-to-air missile systems (SAM-systems) during operation [1].

Modern samples of antiaircraft missile armament (AMA) are complex technical systems with hierarchically branched structure. The AMA samples combine components of different physical execution and appointment.

Technical support is organized for the maintenance of combat readiness of Antiaircraft missile troops (AMT) by support them of armament and military equipment (AME), missiles, ammunition, military and technical facilities, their maintenance in constant readiness for employment, recovery (repair) of AME in case of damages (breakages) and to return them to an operation.

The main actions of technical support are: provision of troops by AME, missiles, ammunition, military and technical facilities; preparation of AME for combat use; organization of AME operation; carrying out maintenance and replacement of the AME blocks, units, nodes which completed the specified life resource , repair of the damaged (faulty) AMA samples and return them to an operation; control of technical support; the greatest possible attraction of local industrial base for carrying out of AME repair [2].

**Formation of the problem.** The existing system of technical support which remained from the Soviet Union envisages use of the regulated strategy of maintenance and repair (M&R) of AMA samples and provides carrying out of all types of planned repairs in a network of repair plants of the USSR Ministry of Defense. Such system does not correspond the existing opportunities of the plants of defense industry complex and state of the Ukraine economy. The made stores, spare part kit, tools and accessories (SPTA) do not provide carrying out a complex of actions concerning maintenance (or recovery) an operating (serviceable) condition of AMA samples.

**Analysis of previous studies.** Now operation of samples of AME is carried out on the basis of the decision on continuation of the assigned reliability indexes. The decision is accepted on the basis of an estimation of the current technical state of its radio-electronic means (REM) [3]. The perspective direction of maintenance and recovery of an operable (serviceable) condition of AMA is introduction of adaptive strategy of maintenance and repair of AMA samples. For example, the strategy of maintenance and repair according to state [4,5] which provides the appointed reliability indexes the REM of SAM-complexes and cost decrease of their operation.

Introduction of strategy of M&R for a state in process of operation of AME demands performance of procedures of technical diagnosing by means of built in (or external) the automated test systems (control of technical state). The existing automated test systems (control of technical state) are ineffective and do not meet the requirements of present time. The assessment of indicators of reliability of products by results of operational supervision is significantly complicated because of impossibility of the accounting of conditions and modes of operation of concrete accessories in structure REM of SAM-complexes, lack of statistics of the moments of transitions of SAM-complexes and their REM in a limit state demands from experts of technical ensuring use of rather difficult mathematical apparatus.

**Main part.** The efficiency of realization of adaptive M&R strategy, substantially, depends on existence built in (or external) the automated diagnostic systems (monitor of technical state) of products, fitness of monitor objects to diagnosing (monitor of technical state), a technique of diagnosing (monitor of technical state), possibilities of timely detection of the transition moments of REM of AMA samples in a limit state.

In the leading countries of the world adaptive M&R strategy are introduced in the form of the relevant systems of the life cycle (LC) support of complex technical systems.

The system of Continuous Acquisition and Life cycle Support (CALS) covers all LC of a product, from development of tactical and technical requirements of a perspective AMA samples to its write-off and utilization. Development of perspective AMA samples is carried out according to the CALS standards. The M&R system of AMA samples, which a long time are in operation, is brought into step with the CALS standards. The subsystem of the integrated logistic support (ILS) is one of components of the CALS system. In the similar way the system of intellectual support of life cycle of the knowledge-intensive products (ISLC) in the Russian Federation provides all LC stages of military products [6].

Now ideas of CALS / ISLC are documentary realized by IPV in the form of the ISO standards, national (state) standards and normative documents of branches and the separate enterprises [7] on the basis of which the concept of increase of operational reliability of difficult technical systems which allows to consider in real time a lag effect of information processes and intensity of use of the appointed operational resource is formulated and to provide information support of difficult industrial products and samples of AME [8-10].

Basis of systems of intellectual support of LC of the knowledge-intensive products are databases about products where statistical data, arrived from military units with AMA sample, is saved. Results of processing this statistical data and developments of recommendations of further operation of AMA sample and other data arrays about a product [11] are kept in these databases.

In work the option of structure of technical support system of AME of the Air Force of Ukraine is offered. The structure provides control of operation, technical state and recovery of military products in a common information space.

Basis of information support system is the AME database of Ukraine (AME the Air Force of Ukraine) which is created at a development stage and scientific and technical maintenance of the corresponding AMA sample. The database is stored and refined during production, operation, combat use, write-off, utilization. It comprises all technical information about a military product and its components, with obligatory use of the database of the Logistic of the Armed Force of Ukraine concerning existence and the movement of stores. Correctly organized database allow to includes new data which come during the operation of military products, to accumulate and process big data arrays, to calculate necessary reliability indexes of products. At the same time for AMA samples that

already for a long time are in operation, it is expedient to build databases by creation of electronic operation and maintenance documentation with use of electronic copies of paper operation and maintenance documentation.

Information communication between the AME databases of Ukraine with all subscribers is provided by the specialized network created with application of elements of an electronic network of a unified automated control system of Armed Force of Ukraine.

The Control Center of operation, technical state and recovery of military products (analog of the center of logistic support of life cycle of complex technical products) is created in the Logistic of the Air Force Command. The main tasks of the Control Center are: collecting and the analysis of technical data on a state, service conditions and resource expenses of AMA samples, types and causes of failures, level of readiness of attending personnel; elaboration of the nomenclature of military and technical facilities and the set of spare parts, tools and accessories which is contained in storehouses of military units of AMT; determination of work amounts, use of repair bodies and use of military and technical facilities during intermediate and capital repairs of AMA samples (as necessary), big interval maintenance of AMA samples, maintenance (scheduled works / preventive maintenance) of anti-aircraft guided missiles, monitor and recovery works on AMA samples which are subject of transfer to operation on technical state, control of a limit condition of AMA samples which are operated on technical state; support applications for repair (replacement) of knots, blocks, subblocks, units with the plant facilities, repair bodies, support centers of the Logistic of Ukraine, storehouses, bases and arsenals of Arms of Ukraine.

Devices for monitor and diagnostic of technical state of a military product are one of basic elements of perspective technical support system of AME of the Air Force of Ukraine. Elements of these means as a part of the automated test system have to be constantly in AMA samples and provide timely receiving, processing and transfer of data about the product technical state for formation of control decisions with use of the AME databases of Ukraine and support system of decision-making (SSDM) of the person which makes the decision [12].

In the offered SSDM the estimation of a military products state is carried out by the following indexes: total number of AME and completeness of military unit taking into account regular requirements and the appointed readiness degrees, including stores of the center; completeness of military storehouses and storehouses of the center by missiles, ammunition, military and technical facilities; technical state of AME park of different types (on serviceability, a resource left and an obsolescence); the predicted indexes of a state of AME park for a certain period (on serviceability, a resource left and an obsolescence); degrees of compliance of the existing AMA samples (complexes, systems) to foreign analogs; degrees of compliance of potential efficiency of the existing AMA samples to modern and perspective requirements to the task performance levels [13,14].

In the offered system of technical support of AME of Ukraine the M&R strategy for a state, in particular, in the conditions of incomplete basic data about military products reliability (about reliability of an AMA sample, about statistics of random processes of its parameters changes, about accumulation of faults, etc.) is used. At the same time the control acts on a military product which is in operation is formed taking into account additional information on technical state of a product which comes during the monitor and diagnostic of the corresponding parameters at operation.

Technical realization of the offered structure of technical support of AME of Ukraine requires the solution of the following tasks:

the choice of information characteristics of military products which will allow to provide formation of basic data about objects of control with the set reliability and accuracy;

development of requirements to structure and program information support of control devices and diagnostics of technical state of military products of the test system;

justification and the choice of a method of creation of the database and a method of data processing of military products during formation of the AME Armed Force of Ukraine only database of Ukraine;

justification and the choice of a method (methods) of forecasting of indicators of technical state of military products, including in the conditions of incomplete basic data about reliability of objects

of control;

development of algorithm of the solution of a problem of management of operation, technical state and recovery of military products which will provide essential decrease in temporary, labor, material and cost expenses on maintenance of operating state and the set level of their reliability;

improvement of system of technical support AMT Air Force Armed Force of Ukraine to the level which provides management of operation, technical state and recovery of military products by introduction of CALS / IPV of all stages of LC of objects of control.

**Conclusions.** Thus, as a result of the analysis of the existing condition of system of technical support AMT and systems of support of life cycle of difficult technical products realized in the leading countries of the world the general structure of perspective system of technical support AMT is offered. Requirements to the database of system, an order of interaction of components of system and SSDM and problematic issues which solution will provide a possibility of realization of the offered structure of technical support antiaircraft rocket troops are formulated. Existence of advanced system of technical support AMT Air Force Armed Force of Ukraine raises potential opportunities of AME park and provides maintenance of operating state and the set level of reliability of military products during operation.

The results of the solution of the given tasks received in Control center of operation, technical state and recovery of military products with use of the listed basic data are intended for use in Command of Air Force during justification of sets of AME necessary for the solution of settlement fighting tasks and sets of utilities which promote their performance.

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## ПЕРСПЕКТИВИ РОЗВИТКУ СИСТЕМИ ТЕХНІЧНОГО ЗАБЕЗПЕЧЕННЯ ЗЕНІТНИХ РАКЕТНИХ ВІЙСЬК

***У статті розглянуто стан та перспективи розвитку матеРріально-технічного забезпечення зенітних ракетних військ, визначено напрями подальшого розвитку щодо застосування інформаційних технологій інтелектуального забезпечення життєвого циклу військової Зазначається, що основним напрямком удосконалення має бути застосування інтелектуального забезпечення управління експлуатацією за технічним станом та відновленням військової продукції, що дозволить протягом життєвого циклу зразка озброєння та військової техніки з використанням прогнозованих показників його технічний стан, визначати періодичність і обсяги робіт з технічного обслуговування, ремонту та забезпечення їх військово-технічним майном. Наведена об'єктивна потреба щодо оснащення військ автоматизованою системою управління для динамічного аналізу і ефективного планування життєвого циклу техніки. Висвітлені переваги щодо формування парку рухомості на базі модульного принципу. Показано, що під час функціонування інтелектуальних систем, розв'язанні завдань забезпечення військової продукції, діє велика кількість обмежень, які необхідно враховувати під час її розробки. Запропоновані рекомендації щодо удосконалення матеріально-технічного забезпечення озброєння та військової техніки, розробки методології забезпечення більш високої якості життєвого циклу військової продукції та ефективного управління життєвим циклом, яке забезпечить досягнення максимальних показників експлуатаційної ефективності зазначених типів військової продукції. Розкрито теоретичні основи матеріально-технічного забезпечення з точки зору моделей їх життєвого циклу.***

***Ключові слова: система технічного забезпечення, озброєння протиповітряної оборони, керування експлуатацією, технічний стан та відновлення військового виробу, технологія CALS/IPV.***