



UDC 623.76(092)

© Bezel Ya. V., 2015

Development and improvement of automated control systems of aerospace defence and testing facilities interspecific test site Russian Defence Ministry

Approaches are considered to the development and improvement of the automated systems of aerospace defence and the unification of system tools for the formation of a single information field of these systems. The paper presents proposals to upgrade the joint-force firing range, which, if implemented, will allow testing of automated systems on a wider scale.

Keywords: automated control system, aerospace defence, pass-through unification, security of information transfer, joint-force firing range, test base.

Development and upgrading of automated control system of aerospace defence

Control system of aerospace defence (ASD) of the Russian Federation (RF) is a system of automated control facilities and posts deployed on the ground, at sea, in airspace and cosmos, integrated by functional links and ensuring unified strategic and operating (combat) management of troops, material and human resources, solving the ASD tasks.

Automated control system (ACS) of ASD forces shall be an integral part of ACS of military forces (MF) of the Russian Federation and ensure execution of tasks assigned to the functional subsystem of ASD forces. For this purpose the ACS of ASD forces comprises the following:

- automation equipment systems of command posts (CP) from strategic to tactical level;
- communications and data link system.

A number of research and development (R&D) projects performed by the MNIIPA Centre of JSC “GSKB Almaz – Antey” justified the methods of comprehensive commonality of ACS facilities of air defence troops and development prospects of these facilities in ASD ACS. ACS facilities produced within the R&D framework for creation of ACS for aviation and AD forces provide for the following:

- comprehensive automation of aviation and AD control posts during all types of their activities including automation of all tasks in peace-time, period of threat, and during combat operations;
- integration in created systems and correlation of control processes in all activities of the troops, as well as consistency of automated

management of the troops, material and human resources of aviation and AD;

- security of data transmission due to implementation of a uniform data protection system;
- automated communication control based on the principles effective in the integrated automated digital communication network of the RF AF.

As shown in the performed R&D works, the following shall be considered in the process of ASD ACS development and upgrading:

1) unified information space (UIS) is a system of information resources of the RF AF, structured according to uniform principles and rules of generation, formalization, storage and transmission;

2) UIS is done as a single information and communication infrastructure combining interrelated distributed multi-user computing systems, local area networks, communication networks, data bases, computer and network security systems, user training aids, and other elements intended for centralized management of the troops.

R&D results revealed that in the course of ASD ACS upgrading at the same time the aviation and AD (ASD) control posts get equipment with such automation equipment systems (AES) that their action covers all periods of activity, end-to-end automation of control is achieved in the daily operations of military forces, thus providing full implementation of CP capacities for troop command and control. Herewith UIS is formed and used on the basis of the uniform automated data acquisition system, uniform data bases, uniform protocols of functional interaction, and uniform user interface. All these provide for integration of all information resources.

To provide uninterrupted operation, communication and data exchange systems shall be developed in UIS, namely the following is to be done:

- creation of organizational and engineering structure of field communication centres on the basis of modular unification principle;

- application of digital communication means and systems with integrated condition monitoring and control means;

- upgrade of intra-centre communication network based on wide employment of wireless access;

- creation of a large data exchange network in real time.

Such building method of control automation systems of all levels will ensure seamless and smooth integration of ACS means of AD troops into ACS of ASD troops.

Development and upgrading of test base of joint-force test range of the Ministry of Defence of Russia (RF MoD)

Nowadays the most highly developed test base is the 4-th Central Joint-Force Test Range of the RF AF. Further upgrading of this test base is reasonable to be carried out with due regard for the following:

- test samples of the integrated automation systems included in ASD ACS, submitted to interdepartmental tests shall be tested as a single article and moreover as part of the test area of ASD created there;

- during tests of AES from the set of ASD ACS (or separate functional elements of AES) at the test sites of RF ASD system it is necessary to check the quality and efficiency of their interface with interacting means and performance of experiments (semi-physical simulation) on system engineering coupling of the ASD system elements to each other and the interacting means;

- official tests of the advance area of RF ASD system shall be performed in full scope.

All stated above will, of course, require the execution of a great amount of works for scientific engineering and technological issues providing the full-scale experiments and semi-physical simulation in order to ensure efficient interaction of all

facilities from the set of ASD ACS and to obtain objective evaluations of taken decisions.

It should be noted that a grand-scale ACS has been developed in 1970–1990 within the framework of research and development works carried out by the MNIIPA Centre of JSC “GSKB Almaz – Antey”. The means of all control levels of different subdivisions and units had to be interlinked in the system. The experience of similar R&D explicitly proves the necessity of creation of modelling and test tools which will enable to carry out experimental and test works with the purpose of obtaining objective robust assessment of engineering solutions. Results of some other works aimed at production of similar facilities mainly provide for organization and performance of all types of tests and a fair trial of task solution by the tested object in order to achieve more sustainable and efficient solutions; at present all these facilities have been operated at the firing range. But it must be kept in mind that construction of advanced firing range is beyond interests of some single type or branch of armed forces. Its whole-of-the-military approach, complex territory-distributed structure of the test complex, necessity of coordinated planning of its use, resources’ provision and control of the entire corpus of firing ranges of the MoD of RF require, among other things, coordinated operations of different types of RF AF.

Prospective R&D works were carried out for construction of Integrated Test Simulation Facility “KIMU-M”. The main objectives of the R&D were:

- validation and testing of engineering solutions concerning informational interfacing of different means of the system;

- system-wide integration of different-type control automation facilities (including newly developed), intelligence (warning) and destruction (neutralizing) facilities and systems with the aim of their coordinated functioning within the RF ASD system.

The necessity of construction of a fragment of RF ASD system section at the 4-th Central Joint-Force Test Range of the RF MoD during the R&D was conditioned mainly by the fact that at actual deployment of troops it was impossible





to carry out full-scale experiments with involvement of aviation for simulation of enemy's airspace attack weapons (ASAW) from outside the test range both in terms of aircraft types and quantity and by conditions of air flight safety. At the same time the testing of data/technical interfacing and joint functioning of different-type control automation facilities, data and firing systems for ASD task solution in the estimated combat conditions shall be checked with involvement of simulating and modelling systems for simulation of advanced ASAW, jamming facilities and own developed facilities which are unavailable at the test range during tests.

Actual combat firing by the element of the advance area of RF ASD system at targets which are similar to ASAW is possible at the test range only.

Construction of the fragment of RF ASD system section allowed to solve the following tasks during experiment research (and during actual combat firing as well):

check of possibility and estimation of efficiency of independent and joint functioning of the control, reconnaissance and warning, destruction and suppression systems elements when responding to expected ASAW attacks;

quality check of data/technical interfacing of existing and developed different-type automation systems, protocol execution, and their functional interaction;

training of communication between the system facilities, including shaping and transmission of warning and external target designation signals;

evaluation of the fullness and quality of input and output information of AES CP of different control levels in case of their functioning at nearly maximum load;

serviceability check and evaluation of functioning quality of the combat control and data processing algorithms and functioning of ASD facilities, making proposals on their updating;

development of combat documents on ASD system test results.

The maximum use of available research and technological groundwork obtained during the R&D enabled to create a fragment of RF ASD system section at the 4-th Central Joint-Force Test Range of the RF MoD in the shortest time possible.

Open architecture of the fragment of RF ASD system section on the test range provides for quick extension of its capacity to solve tasks during further R&D on ASD system construction.

Conclusions

1. To provide seamless inclusion of AD ACS into ACS of ASD troops it is necessary to ensure unification of all data processing means within the data exchange network in real time.

2. To carry out tests of ASD ACS at the RF MoD test firing range and to avoid expensive full-scale raid of aviation, ballistic and cruise missiles it is reasonable to additionally equip the firing range with simulating and modelling systems for simulation of operations of advanced aerospace attack weapons.

Submitted on 29.12.2014

Bezel Yakov Vladimirovich – Doctor of Engineering Sciences, Professor, Full Member of the Russian Academy of Rocket and Artillery Sciences, Head of Research at JSC "GSKB Almaz – Antey", Moscow.

Science research interests: development and upgrading of control systems of air force, navy, air defence and aerospace defence.