THE SYSTEM OF SIMULATORS FOR ANTI-AIRCRAFT MISSILE COMPLEX «KVADRAT» (SA-6 GAINFUL)
PURPOSE OF THE SYSTEM OF SIMULATORS
Providing the multilevel complex training for gunners, combat crews, coordination of anti-aircraft missile batteries and regiment, armed with anti-aircraft missile complex “Kvadrat” of various types
Simulators are being developed as for servicing arms and upgraded ones

STRUCTURE OF THE SYSTEM OF SIMULATORS
- Simulator for combat crew of reconnaissance and aiming self-propelled emplacement (1S91)
- Simulator of combat control cabin (9C416)
- Simulator for operator of P-18 radar station
- Simulator for operator of P-19 radar station
- Simulator for operator of P-40 radar station
- Training-and-modeling complex of anti-aircraft missile battery
- Training-and-modeling system of anti-aircraft missile regiment
Simulators of workplaces and gunnery compartments include models of real controls and indication facilities, devices and equipment of anti-aircraft missile complex “Kvadrat” firing facilities, providing adequacy of a sensory-motor field of combat crew workplaces and characteristics of devices and equipment.

Set of the general and special software, computing facilities, interface devices connecting simulators of devices and equipment with computing facilities of a simulator represents a hardware-and-software complex of a simulator.
Simulator for combat crew of 1S91 reconnaissance and aiming self-propelled emplacement

Structure:
- Search operator workplace
- Battery commander workplace

Software-and-hardware complex
- Aiming operator workplace

Simulator provides:
- High adequacy of a workplaces’ sensory-motor field and anti-aircraft missile complex operation process to real combat equipment
- Full conformity of trainees’ battle work algorithms in all anti-aircraft missile complex operating modes to corresponding algorithms on combat equipment
- Imitation of air targets characteristics, air and obstacle conditions corresponding to real ones
- Imitational firing with anti-aircraft guided missiles according to anti-aircraft missile complex battle capabilities
- Formation and perfection of combat work skills of combat crew numbers
- Co-education, training and coordination of anti-aircraft missile complex combat crew in a wide spectrum of air and obstacles conditions, in various terrain and weather conditions, in a day and night
Structure of training-and-modeling complex for anti-aircraft missile battery of anti-aircraft missile complex “Kvadrat”

Training-and-modeling complex of battery provides:

► combat coordination of the anti-aircraft missile battery with full set in a wide spectrum of air and obstacle conditions

► the objective control of a battery’s attainment and coordination level, maintenance of combat work and coordination skills at required level during all training period
Simulator for combat crew of self-propelled mount of reconnaissance and laying 1S91 (index TBR-1S91)

- Computer of commander's work place
- Computer of the first operator work place
- Computer of the second operator work place
- Output-input adapter
- Monitor (precision target designation indicator)
- Monitor (circular scan indicator)
- Monitor (laying indicator)
- Monitor (range indicator)
- Video switchboard
- Sound system
- Computer of the first operator's workplace devices and equipment
- Computer of the second operator's work place devices and equipment
- Imitators of commander's of battery work place devices and equipment
- Imitators of the second operator's work place devices and equipment
- Output-input adapter
- Monitor (videoreceiving device indicator)
- Instructor station
- Computer of instructor work place
- Monitor
- Monitor
- Printer
- Keyboard
- Mouse
- Local area network
- Inter-communication device
Structure of training-and-modeling system of anti-aircraft missile regiment armed with anti-aircraft missile complex “Kvadrat”

1 anti-aircraft missile battery

2 anti-aircraft missile battery

3 anti-aircraft missile battery

4 anti-aircraft missile battery

5 anti-aircraft missile battery

1S91 simulator

2P25 simulator

Layout of training-and-modeling complex of anti-aircraft missile regiment (variant)
Capabilities of training-and-modeling system of anti-aircraft missile regiment armed with anti-aircraft missile complex “Kvadrat”

Training-and-modeling system of anti-aircraft missile regiment provides a capability to coordinate all sub-units of a regiment in common simulated air and obstacle conditions in a real time.

Capabilities of training-and-modeling system:
- training of a regiment’s command post in planning, organization and conducting operations of a regiment on the basis of using the models of efficiency assessment of operations, and also the objective accounting for the real level of attainment of reconnaissance, control and firing sub-units;
- usage of the educational-information models including the scripts of actions of the air opponent with a various complexity level (fig. 1), and a wide spectrum of air and obstacle conditions;
- improvement of the most effective ways to estimate air and obstacle conditions, an adoption of a decision on reflection of the air opponent attack, a target distribution, control over fire of regiment’s sub-units;
- coordination of actions of reconnaissance, control and fire sub-units of a regiment during anti-aircraft battles;
- improvement of interaction questions of regiment’s sub-units during reflection of the air opponent’s attack.

Fig.1. Variant of regiment’s military disposition
Multilevel combat training system of anti-aircraft missile regiment armed with anti-aircraft missile complex “Kvadrat”

<table>
<thead>
<tr>
<th>Training stages</th>
<th>Categories of trainees</th>
<th>Categories of trainees</th>
<th>Categories of trainees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual training (technical, reconnaissance, special, tactic training)</td>
<td>Combat crews, Commanders of batteries</td>
<td>Interactive educational software on design, operation of weapon and combat work</td>
<td>Interactive educational software on combat work, Firing rules and Gunnery course</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Workplaces of SURN, SPU and radar stations combat crew’s numbers in simulators of battery and radar station</td>
<td>Simulators of regiment’s commander his deputies workplaces in simulator of Command Post of anti-aircraft missile regiment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Simulators of Command Post of anti-aircraft missile regiment</td>
</tr>
<tr>
<td>Coordination of combat crews</td>
<td>Simulators of SURN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combat coordination of sub-units</td>
<td>Training-and modeling complexes of anti-aircraft missile batteries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combat coordination of regiment</td>
<td>Training-and-modeling system of anti-aircraft missile regiment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Change of an orientation and time distribution of combat training to various training methods due to the application of system of simulators into practice of combat training

- Field engagements and tactical studies
- Tactical-combatant studies
- Coordination in crews during combat work on regular equipment
- Coordination in crews On SURN simulators
- Formation of skills of combat crew’s numbers on simulators
- Coordination in a battery and regiment On training-and-modeling facilities
- Individual theoretical training

| Traditional form | Combined form |
The effectiveness of multilevel combat training system of anti-aircraft missile regiment armed with anti-aircraft missile complex “Kvadrat”

Increase of educational-methodic capabilities on preparation of regiment’s sub-units

- The effective solution of more than 80% tasks in the Combat training program.
- Improvement of educational exercises of special and tactical training in a wide spectrum of air and obstacle conditions, in day and night conditions, in the winter and summer, in various weather conditions.
- Change of combat training orientation to formation of combat work skills and coordination of combat crews, batteries and a regiment on the basis of training-and-modeling facilities in air and obstacle conditions, close to real ones.
- Maintenance of the training principle «from simple to complex», realization of an individual approach to training, maintenance of a continuity of training and education process.
- Organizational and methodical interrelation of exercises and trainings on simulators with tactical-special training, tactical exercises with combat firing.
- Objectivity of attainment level assessment of each specialist, combat crew, the battery and a regiment, defining the dynamics of a skills level and coordination.
- Controllability of the training process and the trainings, essential increase of training process intensity.
- Decrease of training and education conditional character, approximation of training conditions to combat ones.
- Full and duly taking into account the evolution tendencies of anti-aircraft defence sub-units and units combat application ways in modern antiaircraft battle.

Realization of multilevel combat training system of anti-aircraft missile regiment allows:

1. To realize the main principles of combat training
   - to make a combat training the real basis of all forces activity
   - to exclude simplification during studies and manoeuvres
   - to create the study conditions approximated to the real combat ones
   - to provide the intensive training of all sub-units staff
   - to provide the objective control of crews training level, battery and regiment coordination level

2. To solve the combat training tasks
   - to teach crews with different tricks and methods of combat operations in the sub-unit, effective use of armament in air and obstacle complex battle situation, in the day or night
   - to work-out commander skills of continuous control over sub-units and fire in a battle
   - to prepare sub-units for running the effective and coordinated actions in modern battle
   - to form the crews’ high fighting morals

3. To decrease the combat training expenditures by 70-80% on conditions of necessary attainment and combat coordination level achievement
# Main characteristics of simulators

<table>
<thead>
<tr>
<th>Type of simulator</th>
<th>Number of combat crews numbers trained concurrently</th>
<th>Integral adequacy figure</th>
<th>Power consumption (kW), not more</th>
<th>Weight (kg), not more</th>
<th>Required area (sq.m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational computer class</td>
<td>&gt;20</td>
<td>-</td>
<td>12</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Simulator for operator of P-19 radar station</td>
<td>1</td>
<td>&gt;0,8</td>
<td>1,2</td>
<td>120</td>
<td>6</td>
</tr>
<tr>
<td>Simulator for operator of P-18 radar station</td>
<td>1</td>
<td>&gt;0,8</td>
<td>1,2</td>
<td>120</td>
<td>6</td>
</tr>
<tr>
<td>Simulator for operator of P-40 radar station</td>
<td>1</td>
<td>&gt;0,8</td>
<td>1,2</td>
<td>120</td>
<td>6</td>
</tr>
<tr>
<td>Driver’s simulator on a motion platform</td>
<td>1</td>
<td>&gt;0,8</td>
<td>3,5</td>
<td>500</td>
<td>15</td>
</tr>
<tr>
<td>Simulator for 1S91 combat crew</td>
<td>3</td>
<td>&gt;0,8</td>
<td>2,0</td>
<td>300</td>
<td>20</td>
</tr>
<tr>
<td>Simulator for anti-aircraft missile battery</td>
<td>Combat crew of SURN, 4 operators of SPU</td>
<td>&gt;0,8</td>
<td>4,0</td>
<td>500</td>
<td>30</td>
</tr>
<tr>
<td>Simulator of commander post of anti-aircraft missile regiment</td>
<td>4</td>
<td>&gt;0,8</td>
<td>3,0</td>
<td>300</td>
<td>20</td>
</tr>
<tr>
<td>Training-and-modeling system of anti-aircraft missile regiment</td>
<td>5 batteries, commander post of anti-aircraft missile regiment</td>
<td>&gt;0,9</td>
<td>16,0</td>
<td>3000</td>
<td>120</td>
</tr>
</tbody>
</table>

**Operational characteristics**

- Simulator and training-and-modeling facilities power supply is conducted from AC network with 220V voltage, plus 10%, minus 15% and 50Hz frequency.
- Power consumption of training-and-modeling system – not more than 16 KWH
- Training-and-modeling facilities comply to the following operating conditions:
  - increased working and maximum temperature – up to +35°C;
  - decreased working temperature – down to +5°C;
  - relative humidity – up to 80% at temperature of +25°C.
- Computing facilities are provided with UPS
- Time of pre-starting procedure after switching-off for training-and-modeling facilities – not more than 5 minutes
- Continuous work time makes up 12 hours per day with 15 minutes breaks in every 2 working hours

**Warranty**

- Warranty period - 1 year
- Lifetime - 8 years