MANPADS «Igla» («Igla-S») Section training system

Performances of the training system

- Possibility to conduct sessions with MANPADS section both indoor, and in the field
- Design and functional adequacy
- Complete combat performance cycle of anti-aircraft gunners
- Fire control of MANPADS sections
- High quality of the ground and air environment, detailed 3D terrain models
- The wide range of options for an air and a ground situation development (editing) in shaping of an enemy air strikes
- Automated evaluation of anti-aircraft gunners' and the section's actions
- Recording the results of the firing exercises
- Approximation of the training conditions of anti-aircraft units to the conditions of real anti-aircraft combat

Capabilities of the existing training systems to train anti-aircraft gunners

The composition of existing training systems	*Capabilities of existing training systems*
▪ 2U438 electrified stand ▪ 9F635 anti-aircraft gunners field simulator ▪ 9F636 launch control set ▪ 9F663 training set ▪ 9F631 IFF (NP3) mock-up	▪ Learning the MANPADS structure, operating procedures and use ▪ Training of anti-aircraft gunners (including the imitation of a guided missile launch with an extracting engine) in the field to engage the air targets' mock-ups

Disadvantages of existing training systems

- conventionality in an imitation of air targets
- the lack of imitation of heat and background jamming, various weather conditions
- impossibility to perform the complete cycle of combat performance of anti-aircraft gunners against air targets
- impossibility to conduct collective training of the MANPADS section under the condition of air and jamming environment

Consequences

1. the combat performance operations cycle which is the basic in combat is not practiced (visual detection and identification of air targets, target range finding, analysis of the jamming environment, engagement of maneuvering targets, determination of the moment of switching on the ground power supply, the moment of the missile launch, and an evaluation of firing results)
2. the coverage rate of the combat performance cycle in the course of training is less then 0,6
3. the section leaders do not have any possibilities to practice any actions in initial preparation for firing and the section fire control
3. ***The result of training with existing training systems***: anti-aircraft sections ***cannot be trained*** to perform coordinated and effective actions even in a simple air, background, and jamming situation

Training and methodological capabilities

A. Possibility to conduct sessions and special trainings both indoor and in the field
B. Complete combat performance cycle of each anti-aircraft gunner (carrying out full volume of the mission, initial and immediate preparation for firing, launch of the missile, observation of the fire results)
C. Section fire control from a portable tablet
D. Possibility to generate an air and jamming environment of high complexity
E. Continuous control of anti-aircraft gunners' actions and recording errors made with a possibility of consecutive evaluation of actions of each gunner
F. Possibility to conduct tactical field exercises with the change of firing positions
G. Decrease of the conventionality of the sessions, making the training conditions to be realistic ones

The simulator enables to achieve the MANPADS gunners' training objectives - to train military personnel in operating MANPADS and shape sustainable skills in performing the whole range of actions for initial and immediate preparation for firing under various conditions, namly:

For section commanders

1. Be able to analyze the air, noise, and background situation within the assigned sector of the anti-aircraft section
2. Be able to assess the capabilities of the anti-aircraft section in engaging air targets
3. Be able to assign fire tasks to anti-aircraft gunners by target indication from the reference points or azimuth and range
4. Be able to determine the MANPADS section firing mode - single missiles or by salvo firing

For anti-aircraft gunners

1. Be able to detect and identify the air targets (the type, speed, altitude and target parameters)
2. To correctly evaluate dimensions of the launch area against specific target
3. To determine the triggering mechanism mode (manual/automatic)
4. To determine the type of fire (in the operating mode of air-borne equipment - incoming/outgoing, automatic/manual, with/without selector, with/without IFF)
5. To make a correct decision and to timely switch on the power supply unit, to quickly acquire the target
6. To correctly chose the moment of launch
7. To assess the fire results (watch the flight of the missile, destruct while hitting the target/self-destruction if missed), to replace the ground power unit in case of exhaustion of the resource of the first one.

The composition and structure

Anti-aircraft gunner work station No.1

1. VR helmet.
2. MANPADS “Igla” mock-up
3. Backpack (system unit, battery, GPS module, wireless channel)
4. Radio.

Section leader work station

1. VR helmet.
2. Air situation tab.
3. MANPADS “Igla” mock-up.
4. Backpack (system unit, battery, GPS module, wireless channel)
5. Radio.

Up to 250 m

Anti-aircraft gunner work station No.2

1. VR helmet.
2. MANPADS “Igla” mock-up.
3. Backpack (system unit, battery, GPS module, wireless channel).
4. Radio.

Wireless data communication link

Instructor’s workstation

1. Standardized desk, 4 video displays, LSD
2. Software-hardware suite.
3. Wireless data link.
4. Radio.
5. Chargers, set

The structure

Wireless local area network

Symbol :
PC – personal computer

Instructor's workstation

Wi-Fi Equipment

PC

Video display

Collective use screen

Section leader workstation

Backpack with PC, power supply, GPS module

Trigger mecanism with power supply and attitude sensors

Virtual Reality helmet

Portable electronic tab

Launch tube mock-op

Anti-aircraft gunner workstation

Backpack with PC, power supply, GPS module

Trigger mecanism with power supply and attitude sensors

Virtual Reality helmet

Launch tube mock-op

Virtual reality helmet

Acoustic system

Virtual reality goggles

Spatial orientation device

Video signal

PC of anti-aircraft gunner (in the backpack)

Technology and software solutions, implemented in the training system

No.	Technology/software solution	Achieved performances of the simulator
1	Using wireless data link channel between the instructor's work station and workstations of MANPADS gunners	A. Possibilities of combat work of the anti-aircraft gunners in full scope without cable connection (tetherless mode) to the instructor's workstation both indoor and in the field (250 meters away from the instructor's workstation) B. Possibility of individual and collective training both indoor and fin the field
2	Using a portable computer with a battery in the anti-aircraft gunner's backpack	
3	Use of the GPS module in the anti-aircraft gunner's backpack	C. Possibility of determination of the coordinates of each gunner in the terrain D. The real terrain visual image generation in the VR goggles of each gunner from his position E. Possibility to change the section positions in the course of training
4	Development of detail 3D model of real shooting range where field trainings are held	F. Possibility of display of the real terrain in VR goggles with concrete landscape, vegetation, textures, infrastructure and reference points G. Generating the air situation based on the real terrain landscape pattern
5	Development of portable electronic tablet of the section leader	H. Possibility of the current air situation display and target designation to the section I. Fire control of the section in the course of tactical exercise
6	Using radio by each anti-aircraft gunner	
7	Calculation of the launch and kill zone for each gunner	J. Display of 3D launch and kill zone for each air target under fire at the instructor's work station K. Increase of the quality level of trained anti-aircraft gunners by understanding the changes in the launch and kill zones depending on the shooting conditions
8	Use of the wireless data link of the launch tube positioning system and the electronic interface unit of each triggering mechanism	L. Possibility of enabling the gunners to act in the same way as with real MANPADS (without cable connection of the launching tubes and triggering mechanisms to the PC)

Instructor’s workstation

Capabilities to prepare the classes

- Switching the simulator on/off
- Registration of trainees
- Selection of training conditions
- Display of the terrain plan (mapping basis of the training area), designation of the terrain reference points
- Selection of the exercise from the library
- Generation of the enemy air strike; storage of the previously generated strikes
- Diagnostics of the simulator state

Responsive assistance to the Instructor

Printing out the training results

Instructor’s workstation

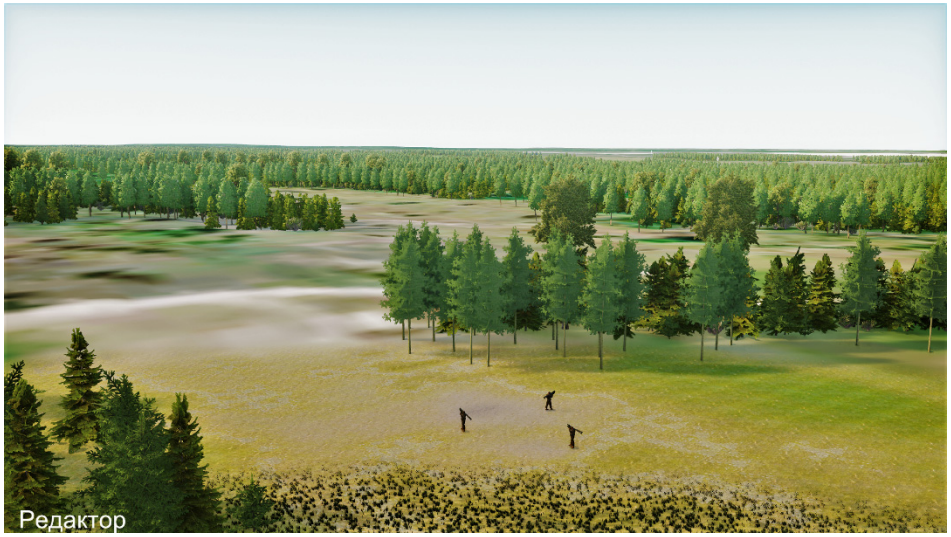
Generating the evaluation mark

Possibilities of the instructor in course of training

- Entering the faults and failures of the simulated MANPADS
- Control of trainees’ actions in course of training
- Display of the firing and damage areas of engaged air targets , fields of view of the gunners and current state of the MANPADS controls

Making the data basis of the results for the training period

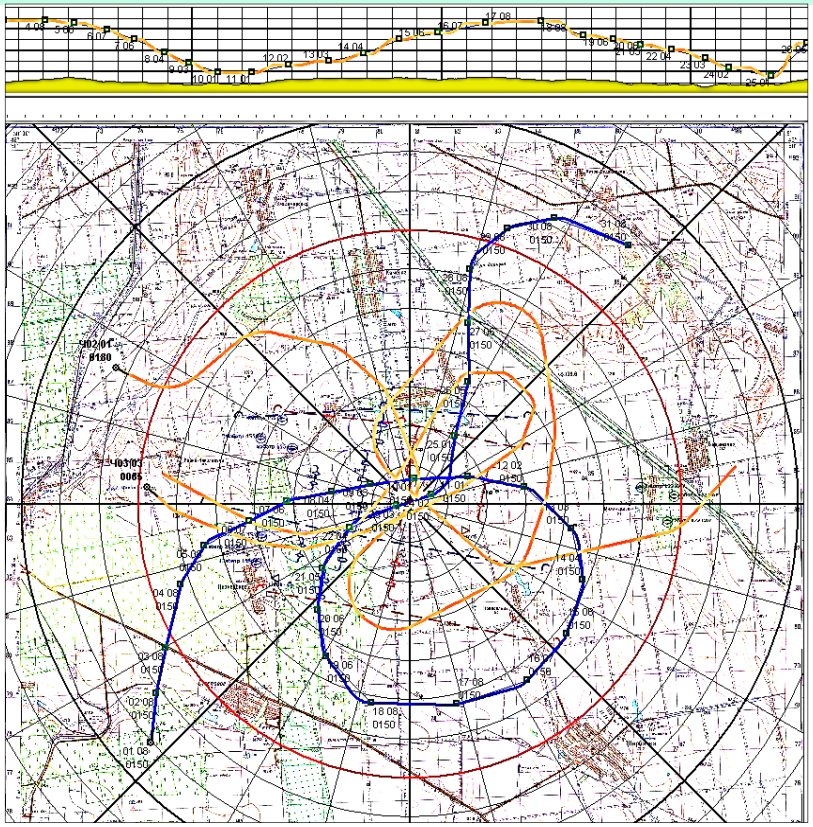
View from the external camera of the section positioning in the "Ground System Editor" mode

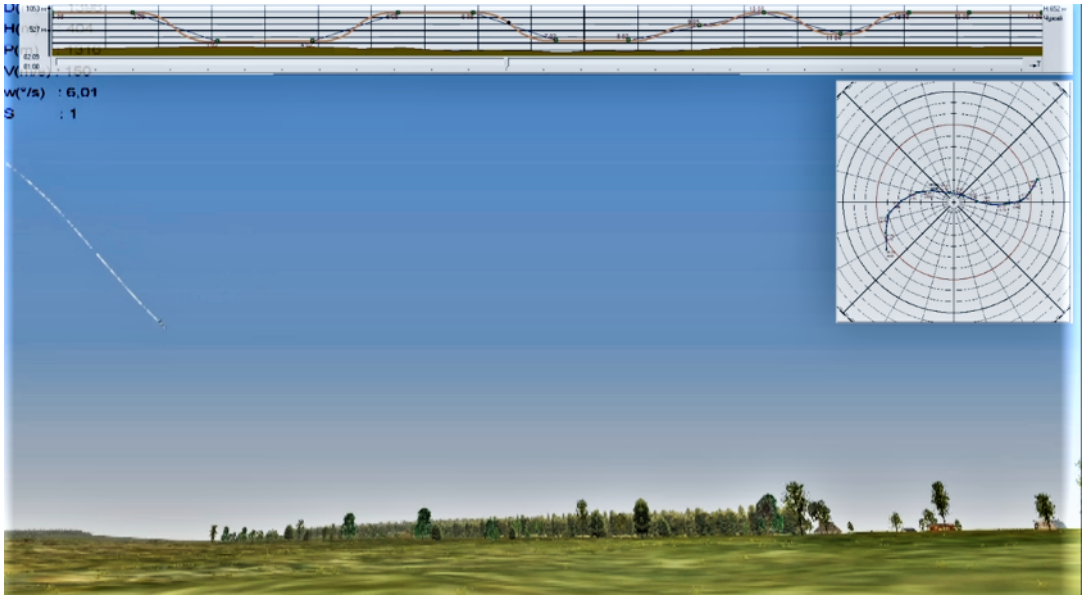


Current fields of view of the anti-aircraft section gunners

Instructor’s workstation/ Air situation editor

View of the air targets itineraries in the Air Situation Editor at the instructor’s workstation

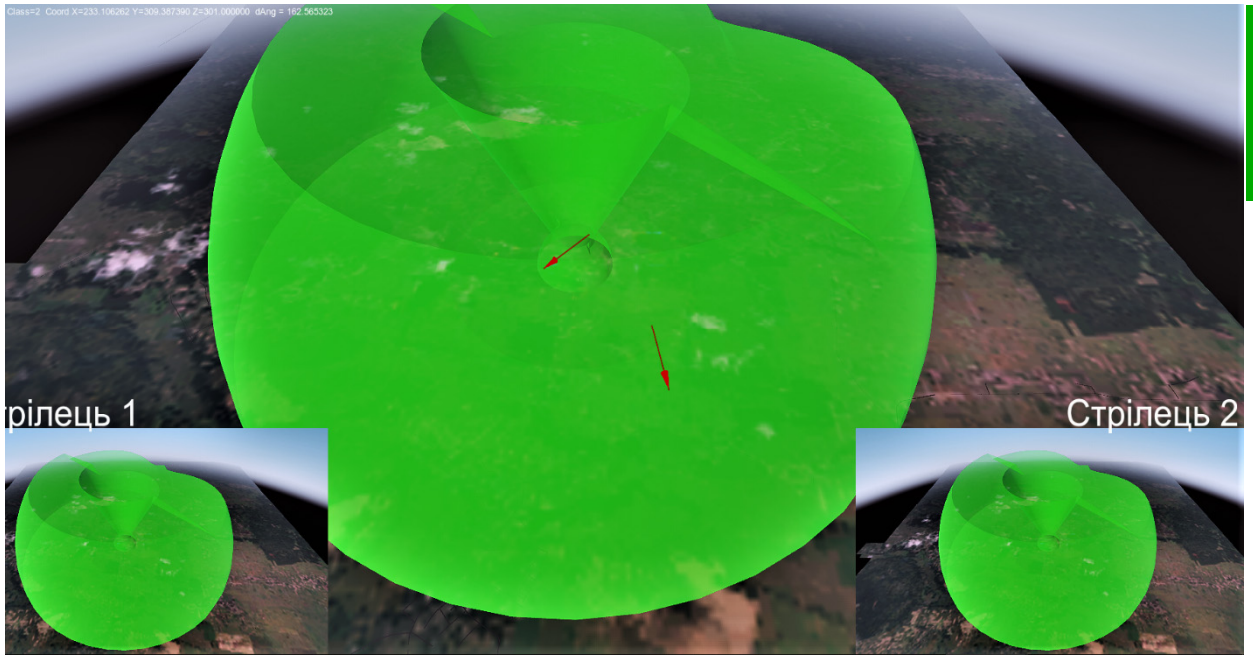




Possibilities of the instructor’s workstation in generating the air and jamming environment

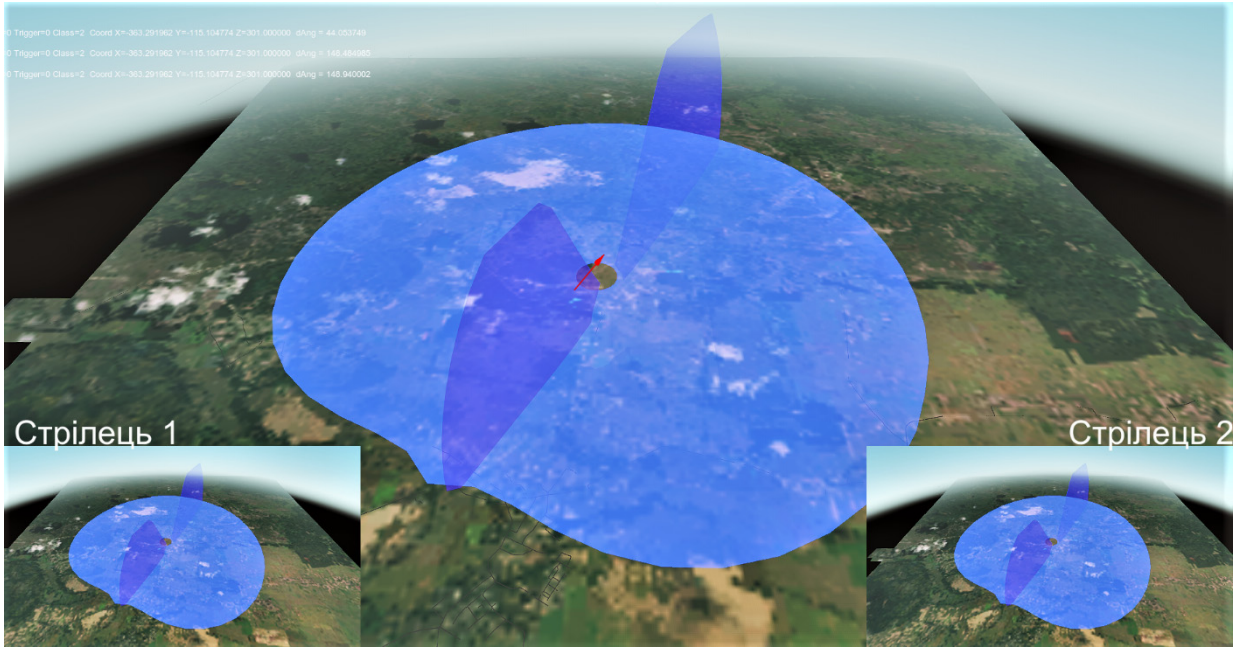
- Display of the air and ground situation at the maps S:50 000
- Drawing the itinerary and profile of the air targets flight (number of the targets simultaneously displayed – up to 16)
- Shaping (setting) the background and jamming (decoys, the Sun, clouds, optronic interference) situation
- Selection of air target type: Helicopters (AH-64, Mi-8, Mi-24), strike fighters (A-10, Su-25, JH-7A) drones аппарат (RQ-7B, MQ-1C, Wing Loonge), cruise missile (of ALCM type), tactic fighters (MiG-29, Su-27, F-16, J-10, J-11), transport aircraft (AN-26, «Hercules», Y-8)
- Time of a day selection– daytime, twilight, night
- The weather conditions selection– sunny, cloudy, wind of different direction and speed
- Season selection – summer, winter (upon a demand of a Customer in accordance with condition of geographic area of the session and training)

Instructor’s workstation. Launch and kill zone



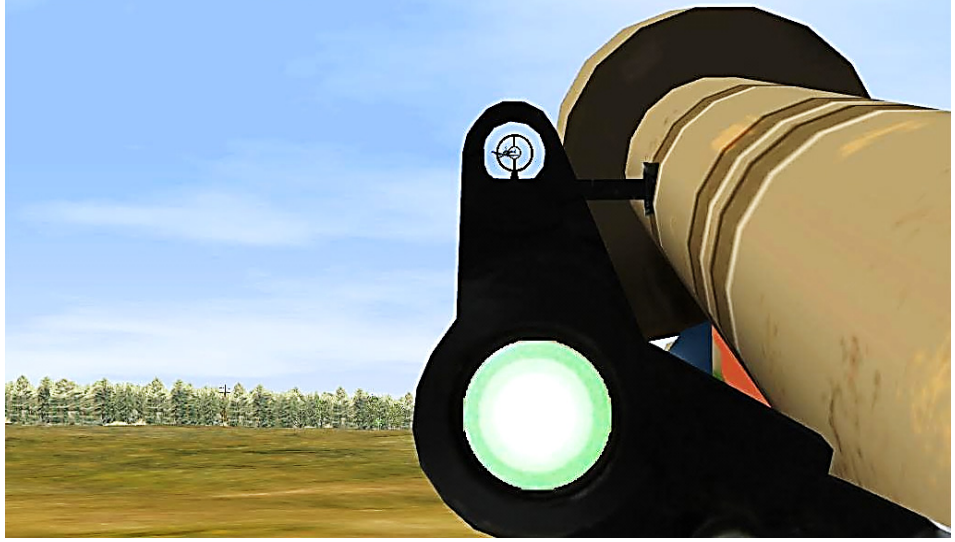
Display of current 3D launch (and kill) zones of the gunners while engaging air targets

Display of current 2D launch (and kill) zones of the gunners while engaging air targets



Quality of visualization of the background environment

1.Field of view of the anti-aircraft gunner while acquiring the target by the homing head



2. Field of view of the gunner after the launch and activation of the ejecting engine

3. The cruise engine, operation, flight of the missile to the target

4. Visual assessment of the firing results

Performance characteristics

Adequacy → Training system enables to accomplish not less than 90% actions of the section leader and gunners

Based on the solutions

- inclusion in the system of proved single gunner's simulators having a high degree of the design and functional adequacy
- a possibility of conducting collective training of the section leader and anti-aircraft gunners on the same terrain area within one environment
- real radio communication system in the section
- a possibility to conduct the visual reconnaissance of the air enemy from any starting position of the gunners
- displaying the air situation on the portable electronic commander's tablet in real-time mode
- enabling the section leader to control gunners' actions
- unbiased evaluation of he leader and gunners' actions in the course of collective training
- possibility of operational coordination of the section in conditions of complex air situation

Trained anti-aircraft gunners

The portable MANPADS gunner set

Performance characteristics

Reliability

The system works reliably for the entire operation life

Based on the solutions

- The use of proved and reliable components in the manufacture process and its incoming control
- Development of the software excluding any conflicts between the general and special software, as well as with the hardware
- Multiple check of developed design solutions
- The use of design solutions enabling lasting work of the mechanic units
- Phased quality control of mechanic and electric assemblies of the simulators
- The use solely contact-free sensors in the simulator parts
- The use of protection means for printed circuit boards of electronic devices and plug contacts against excessive humidity
- The use of industrialized computers
- The use of uninterrupted power supplies for computers
- Provision of necessary thermal modes for simulator equipment
- Provision of power supply reserves

Warranty and service life

- Warranty operational period makes 2 years subject to compliance with the operation and maintenance rules as per the operational documentation.
- The operation life makes not less than 10 years subject to compliance with the operation and maintenance rules as per the operational documentation.

® The system is able to continuously work within 12 hours a day

® Mean time between failures makes not less than 1000 hours

Operational characteristics

The training system has been developed for operation by the military and simple in operation and in maintenance

No	Description		Unit	Value
1	Area for deployment		m^2	40
2	Type of premises		---	Class room
3	Ready to use after switching on		min	Up to 15
4	Duration of continuous work	Mains supply	hrs.	Not less 12
		Autonomously		Not less 6
5	Power: voltage		V	220±10%
	frequency частота		Hz	50±1
6	Consumed power		kW	2,5
7	Running operation and top temperature		°C	Up to +45
	Decreased running temperature			Up to +5
8	Relative humidity at +35°C		%	Up to 80
9	Diagnostics system		---	Embedded semi automatic
10	Mean-time between failure		hrs.	Not less 1000
11	Switch on/off control		---	Remote from the instructor's work station
12	Electrical safety of the trainees and the maintenance personnel		---	Exclusion of hazardous voltage at the anti-aircraft gunners; work stations. Protection of the instructor's work station against short circuit faults
13	Counting operation time		---	Software hour counter
14	Weight, assembled		kg	1220
15	Operation documentation		---	Logbook, operation manual, software installation manual, SPTA List

Effectiveness of the Simulator use in combat training

The training system enables to achieve MANPADS "Igla" units' training objectives:

- To generate trainings conditions close to real combat
- Provide the methodological link of simulated training events with the field training
- Train section leaders in correct and timely fulfillment of all actions in fire control
- To shape and maintain the gunners' skills in combat performance in a complex air environment
- To shape combat coordination of anti-aircraft sections in course of countering airstrikes in conditions close to real
- To control the level of skills of section leaders, gunners in course of the training period
- To control the coordination level of the section in course of entire training period of any duration

Section training capabilities

- Radio training of section fire control
- Selection of the starting position; making the firing card by the leader and issuing the card to the gunners
- Designation of the main and reserve firing positions to the gunners, assign fire responsibility and reconnaissance areas; conduct the air reconnaissance and firing by assigned gunner
- The transition in the readiness 1; setting the fire missions, detection of targets and firing
- The use by the section leader of portable electronic tab
- Simulated shooting against air targets of different types in different jamming and background conditions
- Evaluation of firing results and making a decision for re-firing or firing against another target
- Change of positions from the starting one to the reserved
- Ambush actions
- Coordination of the section and team-working among the anti-aircraft gunners
- Objective evaluation the training level of each gunner and of the section as a whole, determination of the dynamics of acquiring combat skills in all aspects of air and jamming environment

Comparative analysis of simulator building options

Currently, three options of anti-aircraft section simulators are known:

1. Based on «Konus» anti-aircraft gunner simulator (RF).
2. Based on sectoral scanning and UAV («Training systems», JSC , RF).
3. Based on VR goggles («Research and Production Company «Energy 2000» LTD).

Based on «Konus» simulator	Based on sectoral scanning and UAV	Based on VR goggles
Advantages		
◙ High illustrative purpose for trainees, watching the training	◙ Mobility of the simulator ◙ Possibility of indoor training sessions and training in the field ◙ No limits in combat training in all air environment conditions, including firing by all azimuths (360°)	◙ Mobility of the simulator ◙ Realism in the environment and in actions of the section leader and anti-aircraft gunners ◙ No limits in combat training in all air environment conditions, including firing by all azimuths (360°) ◙ High illustrative purpose of initial and direct training, firing for the trainees and for the instructor who observes the combat training from his work station
Disadvantages		
◙ limited possibilities in shaping the air and jamming situation ◙ Impossibility to fire against passing targets in pursuit, at the crossing point, and on big elevation angles ◙ Impossibility to fire against the targets being on more ±90° from the main firing line ◙ Manufacture stationary and needs a considerable space for placement	◙ no possibility for gunners to conduct visual reconnaissance of air targets ◙ law illustrative purpose for trainees, watching the training ◙ no possibility to create a complex air environment for the section during the field training ◙ high degree of conventionality of gunners' actions due to non-compliance of size and speed of the UAV air target mock-up with real air targets ◙ Limited possibilities in conducting classes in rainy, snowy and foggy weather	◙ Limited possibilities in conducting training in rainy and snowy weather

Designer and manufacturer of the simulator:
«Research and Production Company «Energy 2000» LTD
Vozdukhoflotskiy ave. 94-A, Kiev, Ukraine
www.simulator.ua

The Manufacturer provides:

- The simulator manufacturing and deliver it to the place of use
- Assembly, commissioning, and acceptance testing of the simulator at the place of use
- Training the Customer's personnel
- Warranty service of the simulator for 2 years
- Post-warranty maintenance is carried out under a separate agreement