

APC BTR-3E1 platoon simulator



The main characteristics

- ✦ Design and functional adequacy of integrated APC BTR-3E1 crew simulators
- ✦ Organic communication system
- ✦ High quality of visualization
- ✦ 3D models of 5x5 km terrain sectors
- ✦ Inbuilt editor of tactical scenarios
- ✦ Simulation of virtual weapon systems playing
- ✦ Wide spectrum of scenarios for exercises and training events
- ✦ Electronic map of terrain sector with a current tactical situation
- ✦ 3D visualization of area of operations
- ✦ After-action-review, and results documentation

The main disadvantage of currently existing combat training facilities

Achieving and maintaining of high level of Army units combat effectiveness is extremely difficult task, which can be solved by means of intensiveness of combat training under complex conditions, typical for contemporary battlefield. Particularly, under conditions of confrontation with well prepared and trained enemy.

THE ESSENCE OF COMBAT TRAINING PHYSICAL INFRASTRUCTURE (FACILITIES) DISADVANTAGES -

Inconsistency of units combat efficiency requirements and characteristics of existing training facilities (infrastructure)

IMPLICATIONS

- 1** It is very difficult to conduct realistic force-on-force training of units acting with use of organic equipment and weapon systems
- 2** It is impossible to conduct leaders training to shape and maintain skills to effectively exercise command and control over subordinate units under conditions of active confrontation with well trained enemy
- 3** Absence of real capabilities to conduct collective training of combat vehicle's crews and acquiring by them of steady skills in operating weapon systems and equipment under conditions of close battle
- 4** Combat training with use of existing training facilities and traditional training methods (regardless of intensiveness of training and methodical support) leads not to be trained to fight with likely enemy but to conduct qualification exercises and various inspections under conditions of well known training areas
- 5** Unit commanders lack in acquiring skills in planning and execution of battles, command and control skills, as well as crews lack opportunity to acquire steady skills in operating organic weapon systems under complex conditions of modern combat
- 6** Military leadership does not possess the tool to objectively assess the level of units cohesion and leaders/commanders abilities in preparation of battle with well trained enemy

The ways to solve the main contradictions in combat training

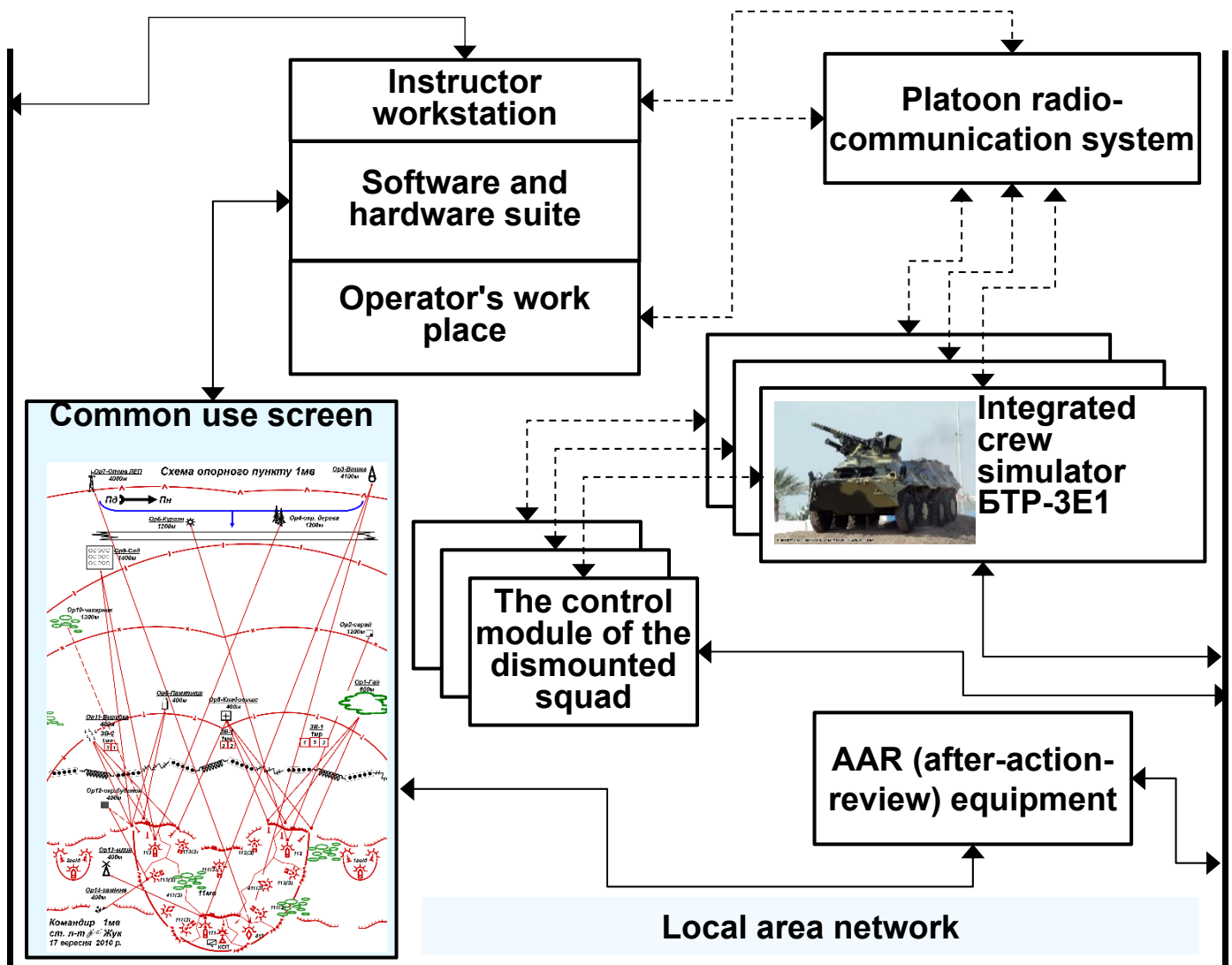
- 1** Building of simulation force-on-force capabilities (systems) and its introduction into combat training system
- 2** Approaching of characteristics of virtual battle space of force-on-force simulators to real conditions of modern combat

The purpose of the platoon simulator

The simulator of infantry platoon equipped with APC BTR-3E1 (index TV-BTR-3E1) is designed to conduct force-on-force exercises in class-room to create training conditions close to modern combat and to solve the following issues:

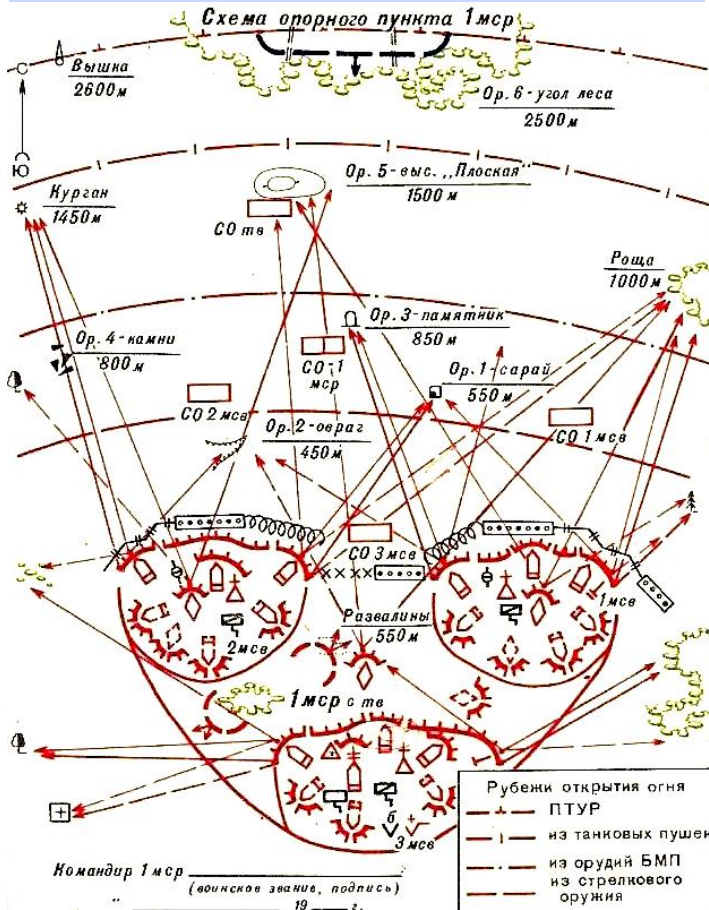
- educate and practice of platoon leaders to plan and execute a battle plan, to control crews and fires during a battle;
- promote cohesion of crews in the course of simulated and simulators-based battle actions;
- educate and conduct collective training of APC BTR-3E1 personnel to shape steady skills in operating equipment and weapon, search techniques, and firing of carrier weapon complex in different ways, under various weather conditions, in summer and winter, at various terrain, day and night

Structure



The components of platoon simulator

Development of the training scenario for the exercise with use of tactical situations editor



Instructor's workstation with software and hardware suite and operator's workplace

General view of the platoon simulator



Local area network and voice communication system support platoon actions within virtual battle space and coordination with supporting and supported units



Integrated BTR-3E1 crew simulators



General view of integrated BTR-3E1 crew simulator



Technical characteristics of the Integrated BTR-3E1 crew simulator

- high level of design and functional adequacy
- both networked (to participate in combined training events), and autonomous (to educate and train crewmembers) capabilities
- Inter-communication system operating adequacy
- Wide spectrum of scenarios for exercises and training events
- Capability to select required terrain (moderately rugged, desert, mountainous) for exercise
- Automated evaluation and assessment of standard driving and firing exercises performance
- Exercise results documentation
- Long duration of continuous work (12 hours without stop)

The control module of the dismounted squad

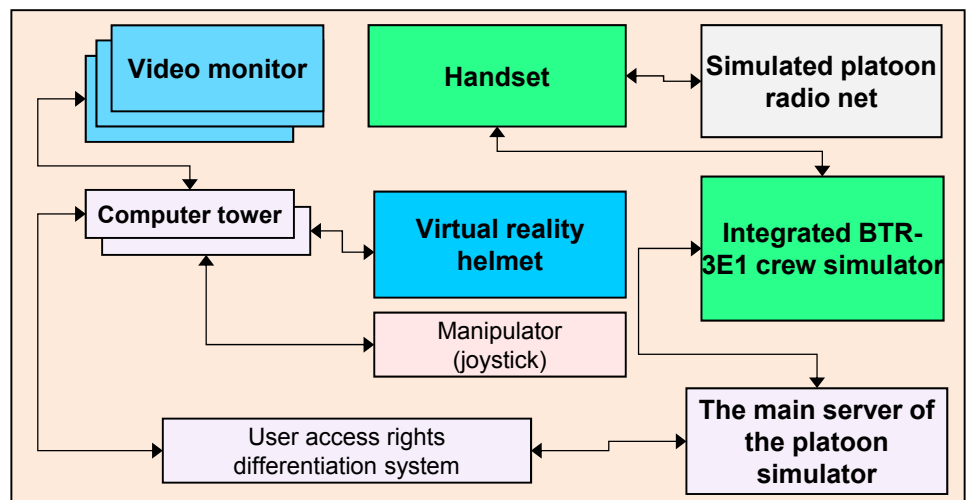
The dismounted mechanized squad control module is the BTR-3E1 (squad commander) commander computer workstation supporting observation the terrain from the point of dismounting, as well as the observation of dismounted virtual soldiers actions of a squad consisting of a machine gunner, a grenadier, a sniper and 4-5 infantrymen.

A virtual reality helmet or a projection screen provides a squad leader a battlefield observation.

Virtual soldiers are controlled using a joystick, which allows each soldier to specify his place in the battle formation, the direction and order of movement, as well as targets to engage. Each virtual soldier has digital intelligence allowing not only to execute the commands of the squad leader, but also to independently perform a number of actions (detect visible targets and engage them, bypass obstacles, stop functioning if defeated or exploded on a mine).

After dismounting, a squad leader maintains voice communication with the platoon leader, other squad leaders, and the APC crew keeping control over its maneuvering and firing.

The control module of the dismounted squad



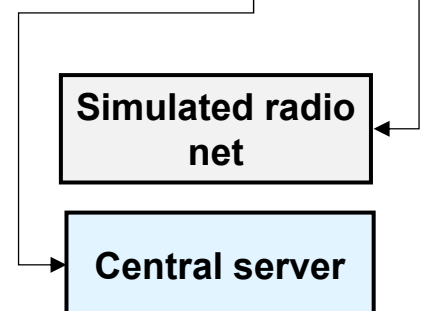
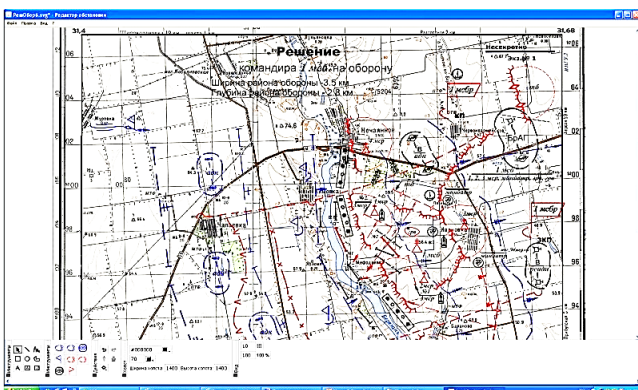
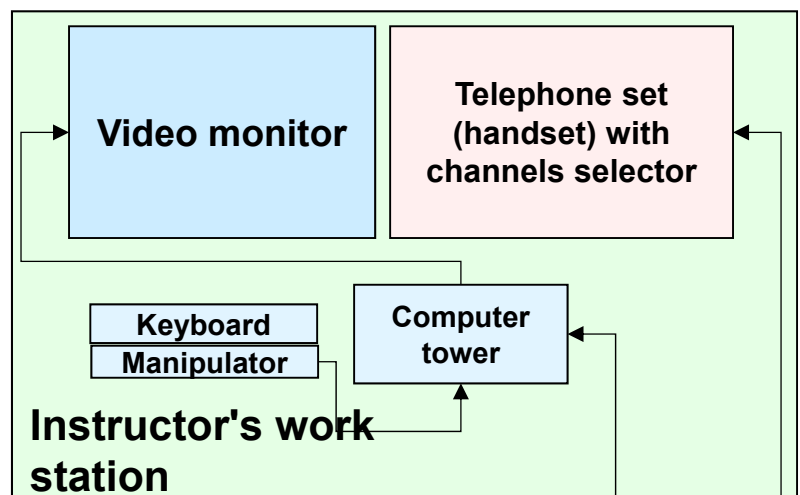
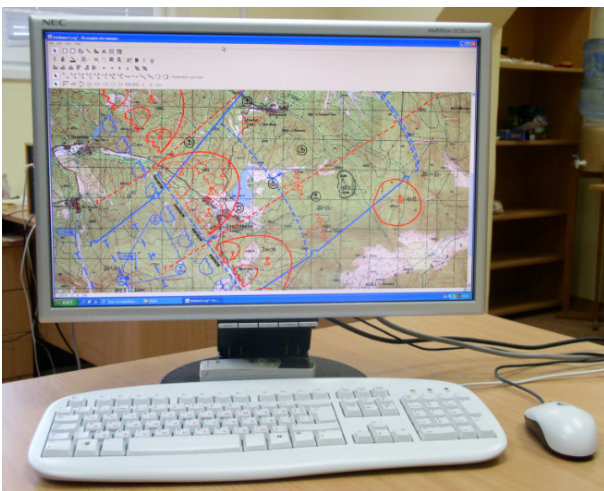
Squad leader controls soldiers (virtual reality helmet is used for observation)



Exercise management

Instructor's capabilities

- Assignment of training objectives
- Selection of required terrain
- Development of exercise design
- E-Mapping of tactical situation with use of tactical situation editor
- Assignment of mission to platoon leader, preparation of e-maps set (if required)
- Arrangement of terrain reconnaissance with use of projection system with cylindric screen and binoculars replicas
- Timing of tactical exercise
- Reproduction of current tactical situation with use of e-map and 3D images (with scaling and detailing capability, up to single platform)
- Display of current actors (belligerents) actions in progression in the forms of tables and graphs (battle losses, ammunition consumption, etc.)
- Supervision of platoon leader's actions and APC crews Radio exchange with trainees and monitoring of radio exchange within net
- Enemy actions play and supporting units activity play (interactive control of imitated units and weapon systems activity)
- Recording of battle drills and exercises progress and AAR Faults analysis and defining of training objectives for the next training events and exercises



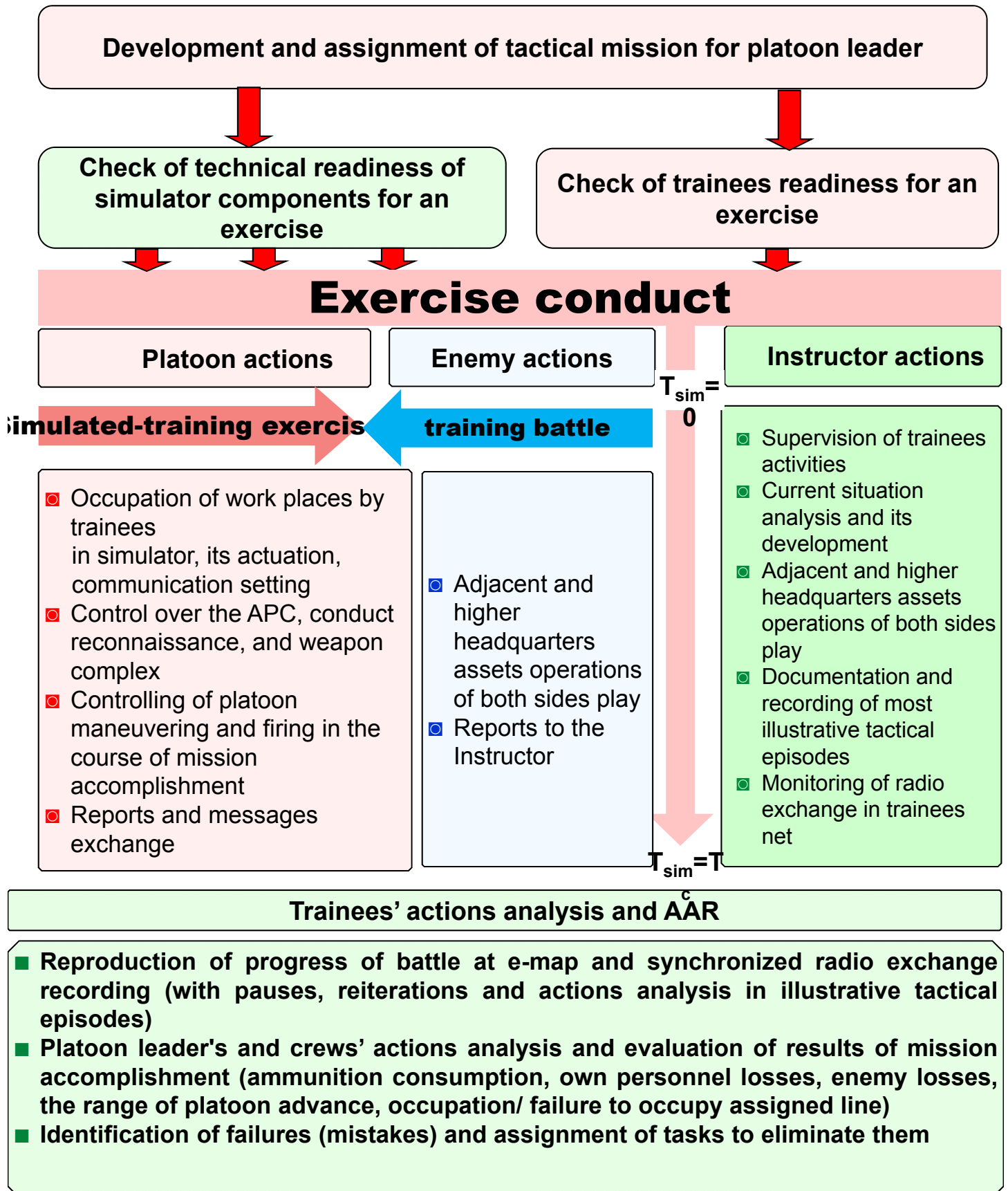
Simulation of activities of virtual units

- ✓ Activities of virtual weapon systems are simulated in the form of 3D “intellectual” models
- ✓ Area of responsibility, area of operations (positions) are assigned for each “intellectual” model automatically with respect to its place in the battle order and mission, as well as control measures
- ✓ “Intellectual” models, within their respective areas, independently detect, identify enemy entities, set target priorities and engage them with specified weapon and ammunition, adjust fires, and assess battle damage;
- ✓ Decision on fact and level of damage of each object (target) from both sides is made at central server of simulator;
- ✓ “Intellectual” models of combat vehicles execute bypass of obstacles and escape from enemy fire within their respective areas of operations

Combined arms battle simulation capabilities

- ✓ Exercise control over virtual units activity with use e-map (tactical symbols)
- ✓ Simulation of combat activity of virtual units (up to single combat vehicle and weapon system platforms);
- ✓ 3D modeling of cross country and urban terrain with different relief, soil, hydrography, vegetation, road net etc.;
- ✓ accounting of influence of firing, maneuvering and reconnaissance capabilities, as well as technical status of organic equipment, allocation of ammunition and fuel, camouflage means, outfit and military personnel of virtual units training level;
- ✓ Considering of influence of terrain relief, radio-electronic, thermal and optical interference, as well as smokes and fires, time of a day, seasons, and meteorological conditions;
- ✓ Interacting virtual units play (adjacent, artillery, missile, air-defense, aviation, reconnaissance, electronic warfare, maintenance and logistic support);
- ✓ reproduction of force-on-force simulated or simulator-based battle on e-map and within a virtual battle space, as well as in the form of tables and graphs

Training event recommended sequence with use of platoon simulator



3D terrain model

There are 3 types of 3D terrain models in simulator's library, ensuring exercise conduct - moderately rugged, desert, mountainous. Development of similar terrain sector is considered.

Visualization system characteristics

- High level of specification and drawing of terrain relief, correspondence of image color scale to real background
- compliance of angular size, shape, color, contrast of local vegetations and object, ground and aerial targets to real objects within field of view of APC BTR-3E1 observing devices
- Adequacy of dynamic characteristics of moving objects (targets) and simulated weapon system

External controllable camera view of tactical field at instructor's work station



Adequacy of simulated model of APC personnel and virtual assets of friendly and enemy forces

Simulated APC model provides

- ❑ adequacy of functional algorithms of simulator's instruments and equipment in operating in standard and emergency modes and simulator response on trainees controlling actions; the simulator ensures coverage of combat work operations at least 90%
- ❑ adequacy of APC motion model while swimming following terrain relief, soil type and surface conditions
- ❑ adequacy of visual, sound and dynamic effects of simulator operating and firing of various types of ammunition
- ❑ accurate accounting of ammunition type, speed and direction of wind, atmospheric pressure, air temperature and its influence on shells and bullets flight range
- ❑ conduct of surveillance with use of optical and optoelectronic devices and all kinds of ammunition firing following optical visibility, obscuration of optical observation devices field of vision, the hull carrier during movement
- ❑ adequacy of ground and aerial targets (dimensions, color, character and parameters of movement, fixation the fact of hit or miss) when firing from APC weapon
- ❑ accounting of terrain conditions, time of a day, season, air temperature

Simulated model of virtual weapon systems provides

- ❑ determination of fact and computing of range of platoon detection by virtual enemy's optical and optoelectronic means with respect to range of line of vision from positions of reconnaissance assets
- ❑ decision making to engage the platoon's armored personnel carriers by virtual enemy anti-tank weapons as per the control cycle, the type of projectiles and anti-tank missiles, and the available ammunition
- ❑ correspondence of ranges and armor penetration capabilities of virtual enemy fire assets (tanks Leopard-2, M1A2 Abrams, T-72B, T-80U, T-90, BMP-2, BMP-3 infantry fighting vehicles, BTR-80, BTR-82A, BTR-3E1 armored personnel carriers, artillery batteries in position, groups of infantry in trenches, anti-tank guided missile systems "Jewelin", "Milan-2") to their real characteristics
- ❑ presence of typical features of reconnaissance assets and weapon systems of virtual enemy on positions (fortification, silhouettes and vehicles painting, combat vehicles operating features)
- ❑ allocation of available weapon systems and remaining ammunition to engage detected targets, decision making on bypassing of terrain sectors and minefields overcoming

Simulator's database

- ★ database of characteristics of combat vehicles and weapon systems, missiles and ammunition, organizational structures of units, strength and status of belligerents
- ★ database of terrain sectors
- ★ program suite to generate and visualize terrain and tactical situation
- ★ interface for setting of initial positions and status of belligerents, battle conditions, and training management
- ★ interface of OPFOR and friendly forces play
- ★ modeling block of adaptive actions simulated units and weapon systems
- ★ service modules, required for AAR

New methods of tactical training

Platoon simulator expands tactical training capabilities and objectively stipulates appearance of new training forms, where general features are:

- two-sided character of exercises and training events
- force against force activity within one 3D terrain model under conditions of single tactical situation and unified time scale
- adequacy of platoon's APC simulators and virtual weapons, used for assigned and interacting units, as well as enemy activity playing
- full algorithm of platoon leader's actions to plan and execute a battle and exercise control over platoon maneuvering and firing
- portraying the course of battle and results of opposition forces activities, and their relative firing impact
- reproducing of real structure of command-and-control radio-net
- provision to conduct simulators-based and simulated battle during offense, defense, reconnaissance in force and combat security actions, and pursuit
- Possibility to repeatedly reiterate tactical situations, conduct AAR

Simulated battle types, implemented in simulator

Simulators-based battle - training battle, in which units act against each other with use of integrated crew simulators of combat vehicles (tanks, IFV, APC) and ATGM systems

Simulated battle – training battle, in which units act with use of simulators, and supporting and interacting units are virtual and their operations are simulated by pole players (and OPFOR) with respect to inbuilt artificial intellect of virtual models

New methods of tactical training, implemented in simulator

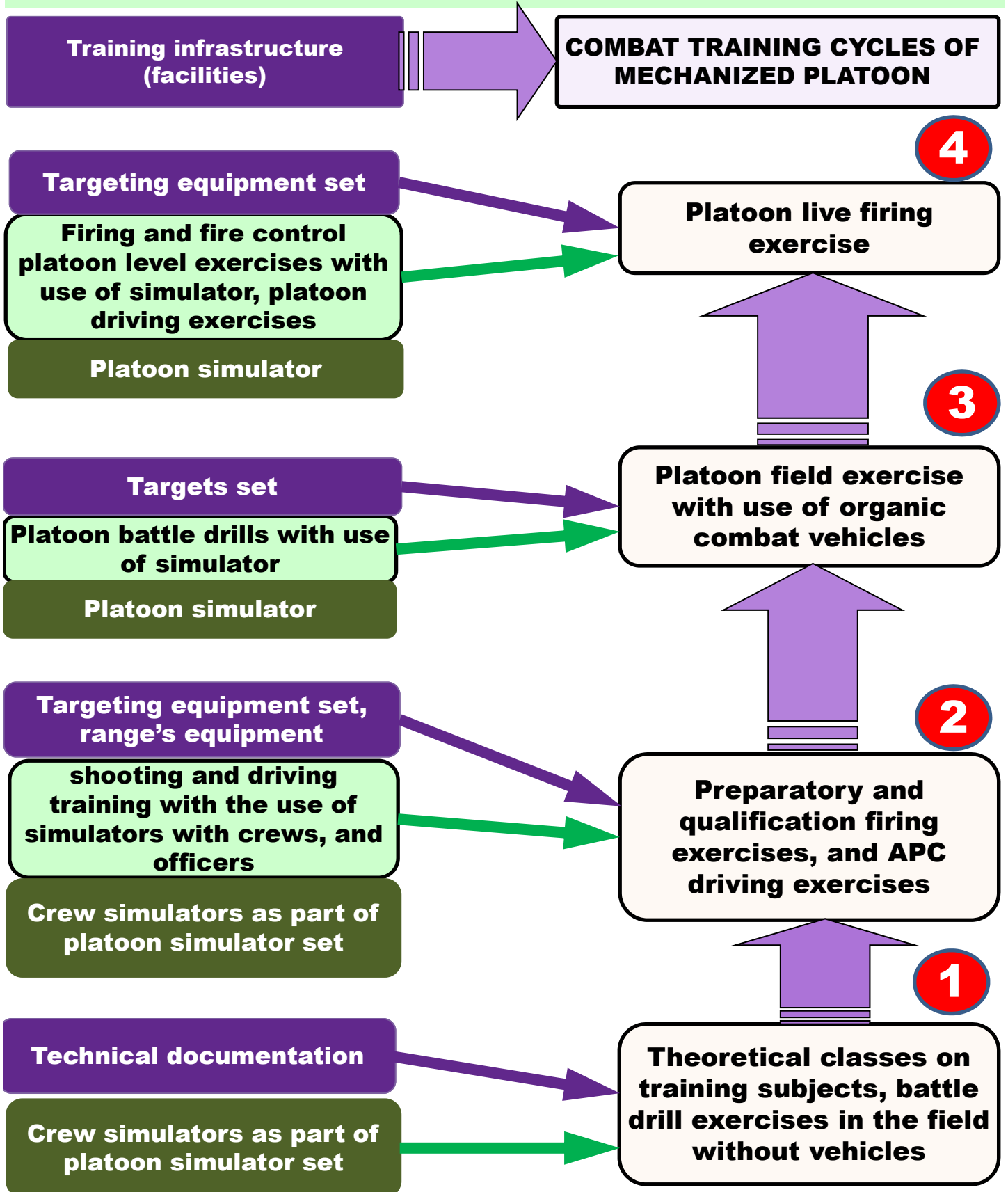
1. Firing and fire control exercises with use of platoon simulator - the form of platoon collective training, education of personnel armored carriers commanders to execute fire control TTPs. Those training events are conducted by practicing of fires planning and fire control in the course of close (force-on-force) simulators-based or simulated battles

2. Tactical exercises with use of platoon simulator – the form of platoon collective training, improvement of skills and proficiency of leaders to plan battle and exercise control over unit during the battle.

Training events are conducted by means of tactical tasks accomplishment by squads and platoons under conditions of force-on-force simulator-based (simulated) battle

The position of simulator in combat training process

Infantry platoon simulator fully ensures preparation of platoon for field exercises



SIMULATOR TECHNICAL CHARACTERISTICS

Serial №	Characteristics	Quantity, pcs.
1	Quantity of simultaneously trained platoons	1
2	Quantity of virtual interacting units	
	Infantry platoon	1
	Artillery battery	1
	Tank platoon	1
3	Quantity of simulated ground targets (including active)	Up to 80
4	The types of virtual (simulated) weapon systems	
	Tanks "Leopard-2", M1A2 "Abrams", T-72B, T-80U	+
	Infantry fighting vehicles BMP-2, BMP-3	+
	Armored personnel carriers BTR-80, BTR-82A, BTR-3E1	+
	Antitank missile complex "Fagot", "Kornet", "Milan"	+
	Artillery battery "Hwozdika", "Akacia" on positions	+
	Combat helicopters AH-64, Mi-24	+
	Assault aircrafts A-10, SU-25, "Alfa-jet"	+
5	Terrain	
	Dimensions of 3D terrain models, km	5x10
	Terrain types - plain, desert, mountainous	+
	Geographically similar terrain (1 sector)	+
	3D terrain models mesh interval, m	1-2
6	Exercise conditions	
	Day, night, twilight	+
	Winter, spring, summer, autumn	+
	Meteorological conditions - fog, cloudiness, precipitation, wind	+
	Smokes and aerosol	+
	Radio-electronic interference	+
7	Simulator's operating modes	
	autonomous BTR-3E1 crews training	+
	tactical training: simulated and simulators-based training battle	+
8	Required space, m²	110
9	Consumed power, kW (mono phase circuit 220V, 50 Hz)	112
10	Actuation time, min	15
11	Duration of continuous work, hours, at least	12
12	Error-free running time, hours, at least	500
13	Specified resource, years	12
14	Warranty period, years	3
15	Integration with simulators of higher level (company)	+

EDUCATIONAL AND METHODOLOGICAL CAPABILITIES OF THE MECHANIZED PLATOON SIMULATOR

Issues solved in the course of tactical training and teaching methods

▣ Platoon firing and fire control:

- ground and air targets reconnaissance, setting of their priorities
- determining the order and means of destruction
- assigning fire tasks
- performing fire tasks
- monitoring and correcting of fire
- monitoring of ammunition consumption

▣ Platoon single or force-on-force training:

- an enemy and an area reconnaissance by observation, ambushes and by combat actions
- platoon in a reconnaissance group during movement to contact
- platoon dismounted or mounted attack, in pursuit and in defense
- platoon actions in reconnaissance-in-force

for platoon leaders - practice in controlling subordinate squads, improving skills in troop leading procedures

- mission analysis, situation assessment, decision making and electronic map keeping
- conducting reconnaissance
- assigning tasks to squads
- organization of control for a battle
- leading squads and fire control during the battle

Instructor supervision capability

- ▣ by the position and status of the platoon's APCs on the tactical field using an electronic map with the current tactical situation displayed, as well as with 3D image of the tactical field from an external controlled camera
- ▣ by training event protocol (armored personnel carriers' and virtual weapons firing, battle losses from both sides)
- ▣ by conversations between platoon leader and crews via communication means

Capability to develop training conditions

- ▣ selection of terrain type (moderately rugged terrain, mountainous, desert), season (winter, summer) and time of a day (day, night, twilight)
- ▣ selection of meteorological conditions (sunny, cloudiness, rain, snow, wind) and ballistic firing conditions
- ▣ determination of structure, strength and initial positions of forces
- ▣ supporting and interacting friendly units play
- ▣ enemy units activity play
- ▣ ensuring realistic platoon command-and-control radio-net operating during tactical events and exercise

EDUCATIONAL AND METHODOLOGICAL CAPABILITIES OF THE MECHANIZED PLATOON SIMULATOR

Platoon leaders' fire control and maneuvering capabilities

Target designation

- from the TRPs (local objects)
- from the axis of attack (tracer bullets, projectiles, signaling means, by pointing weapon at the target)

Controlling platoon in the course of battle

- orally via communication means
- by signaling means
- by personal example

From the platoon command-and-observation post

- in defense - from a battle position
- in offense - from a battle array
- when operating dismounted – behind the platoon in-line-formation from a place where the best observation of an enemy, and actions of subordinates, as well as adjacent units actions and terrain is provided, ensuring continuous control over platoon

Training results processing and storing capability

- ☐ recording of training event progress
- ☐ training results e-documenting
- ☐ training results archiving for a day or training period

Expected tactical training results

- ☐ shaping, consolidation and improvement of platoon leaders practical skills to plan and execute battle plan, to control armored personnel carriers and fires (development of self consistent operational mindset)
- ☐ Collective training of platoons in the course of force-on-force training battles under complex conditions and against tough enemy

Outcome of introduction of simulator into training process

№	Outcome	The ways to achieve
1	Increase of responsiveness and quality of units tactical training	Simulator special program (to conduct computing and development of required graphic and text documents, 3D terrain models)
2	Increase of relevance level during exercise conduct	Capability to develop various tactical situations, selection of terrain and meteorological conditions. Adjacent, supporting and interacting units play. Provision to conduct force-on-force simulated battle
3	Increase of tactical training intensiveness Mastering of effective tactics, techniques and procedures (TTP) under various situations	Capability to reiterate tactical situations to master effective TTPs and ways to solve tactical mission and firing tasks under conditions of specific situation against well trained and equipped enemy
4	Promotion of quality and reduction of time for infantry platoons collective training in full strength	High intensiveness of tactical exercises and training events, comprehensive monitoring of leaders and crews actions
5	Shaping, consolidation and improvement of platoon leaders skills in planning and execution of battle plan, exercising fires control and maneuvering	Conduct of tactical exercises under difficult force-on-force battle conditions, exclusion of simplifications in fire and maneuvering control Capability to conduct detailed analysis of leaders actions, preparation and execution of AAR
6	Increase of responsiveness and quality of teaching instructions and papers for AAR	Capability to record received and given commands, orders and reports, leaders and crews actions to accomplish assigned missions. Recording and reproduction of conducted battles (episodes)
7	Improvement of platoon's preparation quality to conduct field exercises	Ability to conduct preliminary and full-scale practicing of tasks accomplishment with use of simulator, which will be solved during tactical and live firing exercises
8	Increase of safety of tactical exercises with live firing, reduction of traumatic level when operating organic vehicles and weapon systems	Conduct of certification exercises with use of simulators to accomplish tactical and firing tasks, which expected to practiced during tactical exercises with live firing
9	Provision of objectiveness in assessment of tactical training level of platoon leaders and unit cohesion	Capability to comprehensively evaluate leaders' and crews' actions in the course of battle Availability of special program to conduct analysis and evaluate trainees actions

Amendment of time allocation for combat training with use of simulators

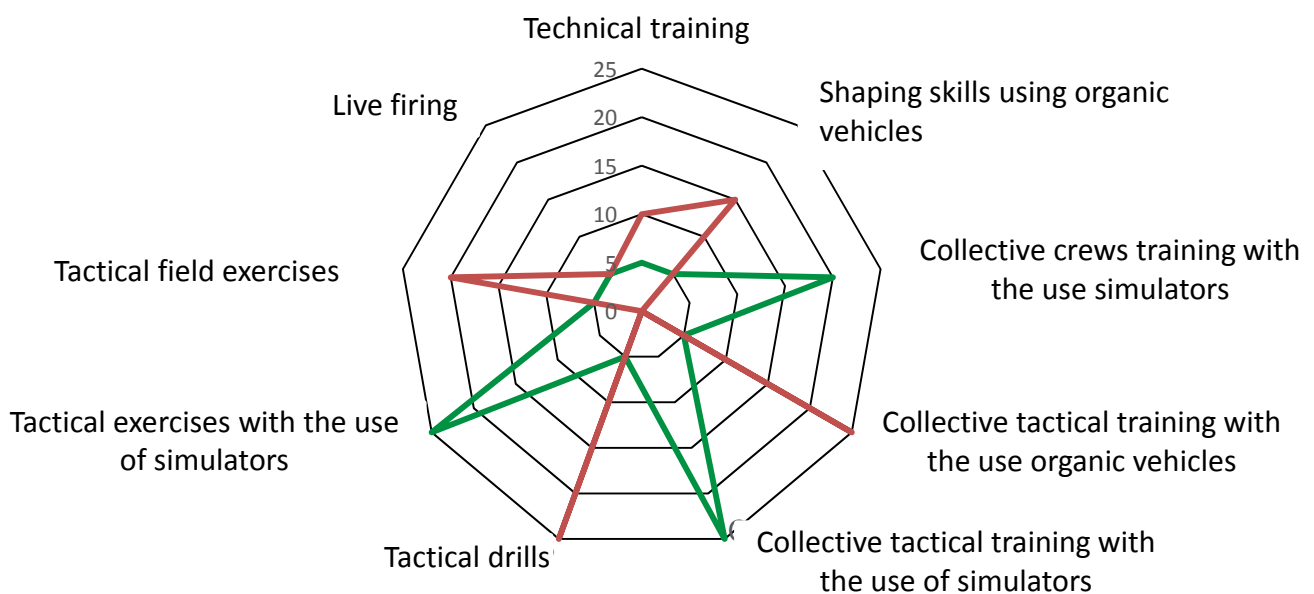
Employment of simulators heavily influence allocating of time for various training events methods:

- 75-80% of time is allocated for shaping and maintaining weapon operating skills at required level with use of simulation systems
- 20-25% of time is allocated for testing of individual skills and collective proficiency during firing exercises, as well as units collective training during tactical exercises.

Combat training time allocation

— Combat training with the use of simulators

— Traditional combat training methods



Achievements from employment of simulators in combat training

- Effective solving of at least 80% of units firing training objectives
- Practicing of firing exercises under various training conditions (cross-country, mountainous, swamp, desert terrain, day and night, in summer and winter, under various meteorological conditions)
- Support of main phases of training periods - individual training, collective crew and platoon training.
- Support of training methods “crawl, walk, run”, individual approach to trainees, continuity of training.
- Organizational and methodical interrelation of training events and exercises with use of simulators with training in the field.
- Objectiveness of training level evaluation of each crew member apart and units as a whole, determination of progress rate in skills level and unit cohesion.
- Manageability education and training process, modification of training process intensiveness.
- Increase of relevance level of training events, approximation of training conditions to combat ones.



**Designer and manufacturer of BTR-3E1 Platoon simulator:
LLC “Research and production company “Energy-2000,
Ukraine, Kiev, Povitrophlotsky avenue, 94-A
www.simulator.ua**

Developer and manufacturer provides:

- fabrication and delivery of simulator to the place of intended use
- assembly, adjusting, commissioning and acceptance testing at the site of intended use
- training of user's technical personnel
- warranty service for 2 years
- post-warranted maintenance (subject to separate contract)
- author's supervision and software modernization during the entire simulator operation period