

# **APC BTR-80 Integrated crew simulator**



# PURPOSE, EDUCATIONAL AND METHODOLOGICAL CAPABILITIES OF THE SIMULATOR

Integrated crew simulator is designed to achieve unit's, equipped with APC BTR-80, training objectives and provides:

- individual training of crew members: familiarization with the structure of BTR-80 and weapon and equipment preparation procedures for application, shaping of skills in surveillance, APC weapon systems firing, day and night, under various conditions and on the various terrain;
- training in the driving in full range of Driving Course;
- crew collective training in the full range of firing exercises as per Gunnery Course, tactical training and teamwork building under conditions close to real combat, including force-on-force training exercises
- pre-exercise and field training of mechanized units with use of 3D terrain sectors where exercises are planned to be conducted
- increase of intensiveness and effectiveness of combat training
- maintaining of high level of mechanized units combat efficiency during training period



# STRUCTURE OF SIMULATOR

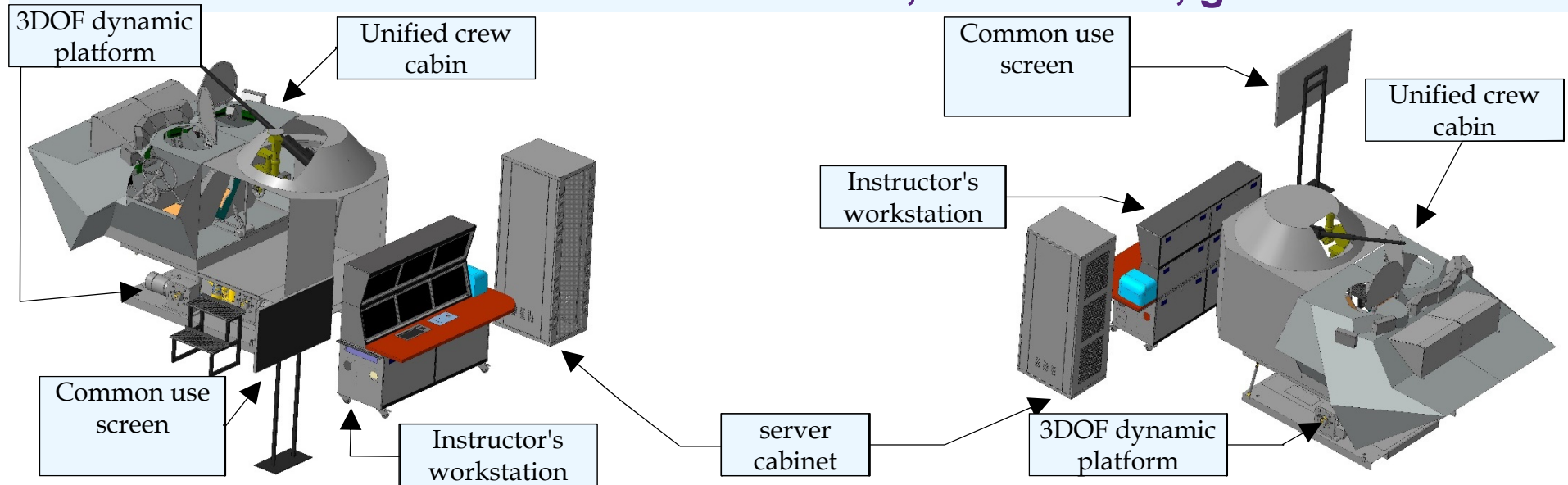
Simulator consists of:

- ❑ driver-mechanic's and commander's cabin mock-up mounted on the dynamic platform
- ❑ BPU-1 turret machine gun mount mock-up mounted on dynamic platform
- ❑ instructor's work station

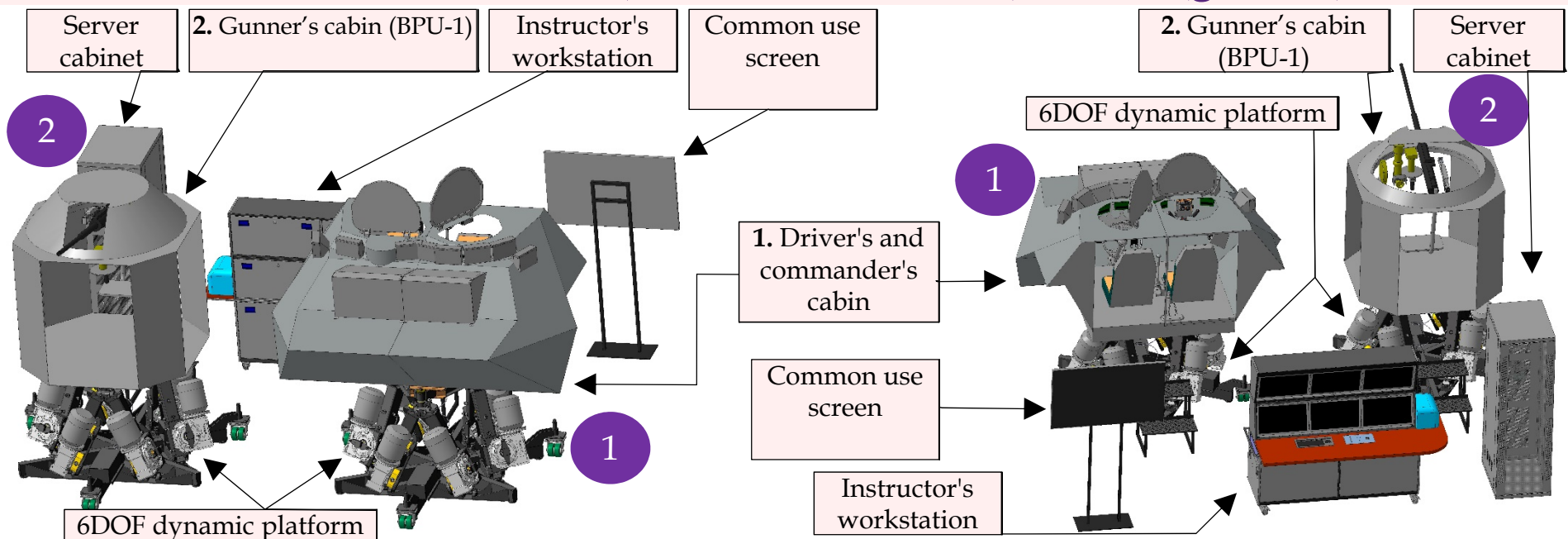


# Simulator's cabin options

## A. Unified crew cabin: driver, commander, gunner

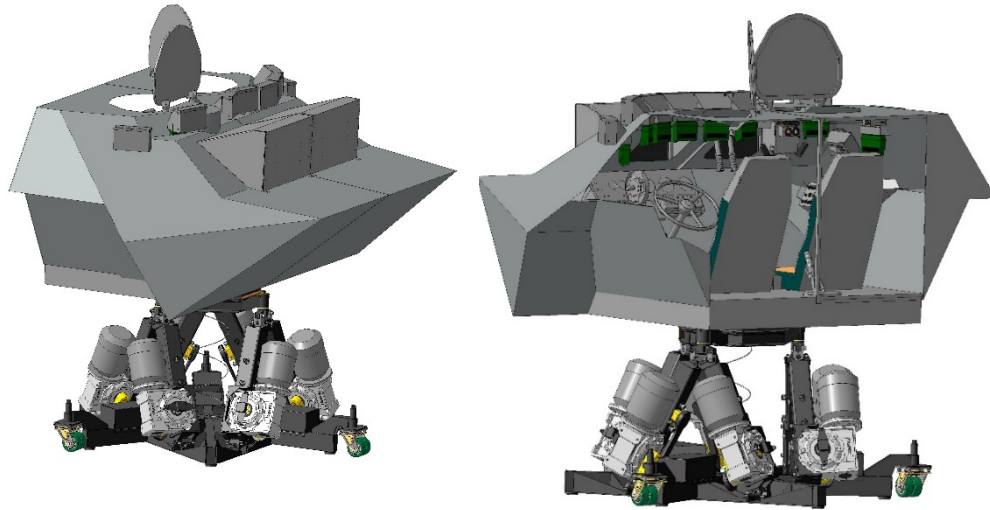


## B. Two cabins: 1-st (driver, commander) + 2-nd (gunner)



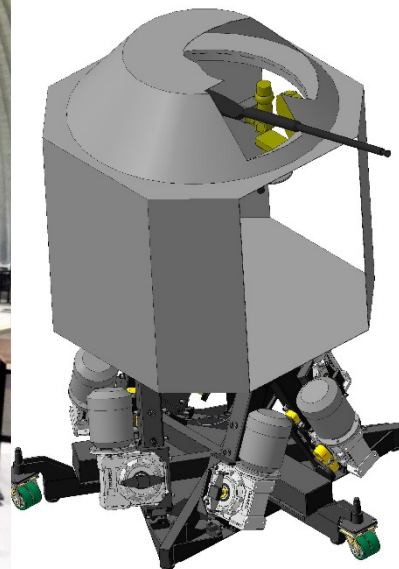


# Driver's and commander's compartment



No serial	Designation, title	Quantity, pcs.
1	<b>Instruments and equipment mock-ups</b>	
1.1	<i>Instructor's work station, set, including:</i>	1
	TNP-B observation devices	4
	driver's lookout hatch	1
	driver's lookout hatch lever	1
	Instruments panel	1
	air-reducer	1
	Tire tabs block	1
	driver's TVN-2V night observation device	1
	steering wheel with signal knob	1
	transmission shift lever	1
	front axle engagement lever	1
	transfer unit gear-change lever	1
	hoisting gear actuation lever (full-scale mock-up)	1
	parking brake system lever	1
	fuel supply pedal	1
	manual fuel feed lever	1
	service brake system pedal	1
	clutch pedal	1
	wave-deflector actuator	1
	hydro-jet doors control cock handle	1
1.2	<i>Commander's workplace, kit, including:</i>	1
	commander's lookout hatch	1
	commander's lookout hatch lever	1
	TPKU-2B observation device (TKN-1C night vision device)	1
	TNP-B periscope observation devices	3
2	<b>Equipment</b>	
	Summer headset	2
	Driver's seat	1
	Commander's seat	1
	dome light	2
	fan	2
	R-123 (full-scale mock-up) radio-station, audio system	1
	A-2 Intercommunication device	1
	A-3 Intercommunication device	1

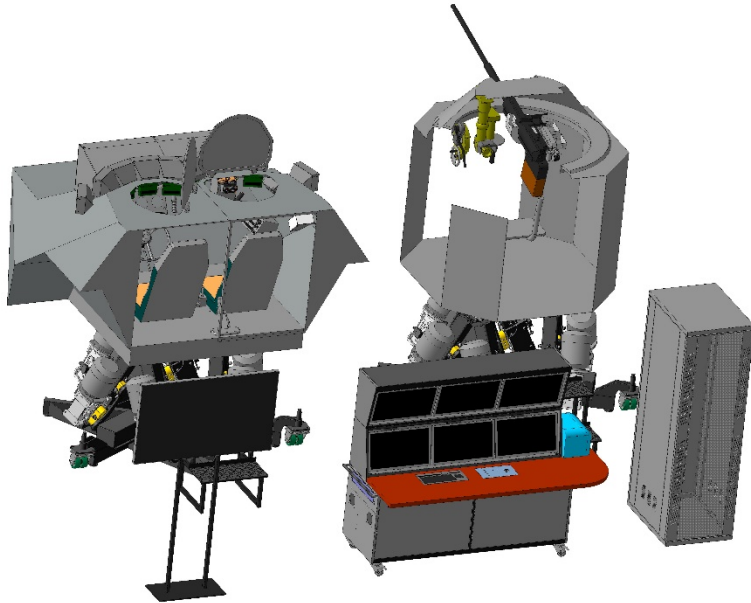
# BPU-1 Turret machine gun mount



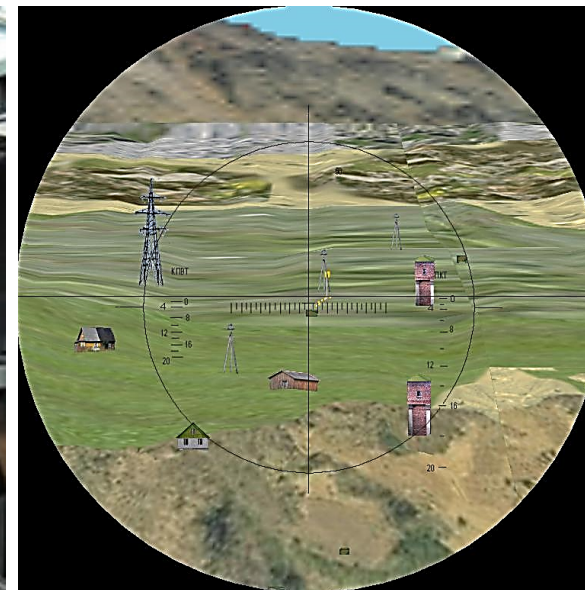
No	Designation, title	Q-ty, pcs.
1	<b>Instruments and equipment mock-ups</b>	
	PP-61AM Sighting device	1
	turret traversing handle with KPVT and PKT electrical firing knobs	1
	coaxial MG lifting handle	1
	cradle locker (lifting mechanism)	1
	turret stopper	1
	Turret brake lever	
	lifting mechanism brake handle	
	KPVT reloading mechanism handle	1
	PKT reloading mechanism handle	1
2	<b>Equipment</b>	
	Summer headset	1
	gunner's seat	1
	dome light	2
	fan	2
	A-2 Intercommunication device, audio system	1

Gunner during sighting and firing

Field of view of PP-61AM sighting device mock-up

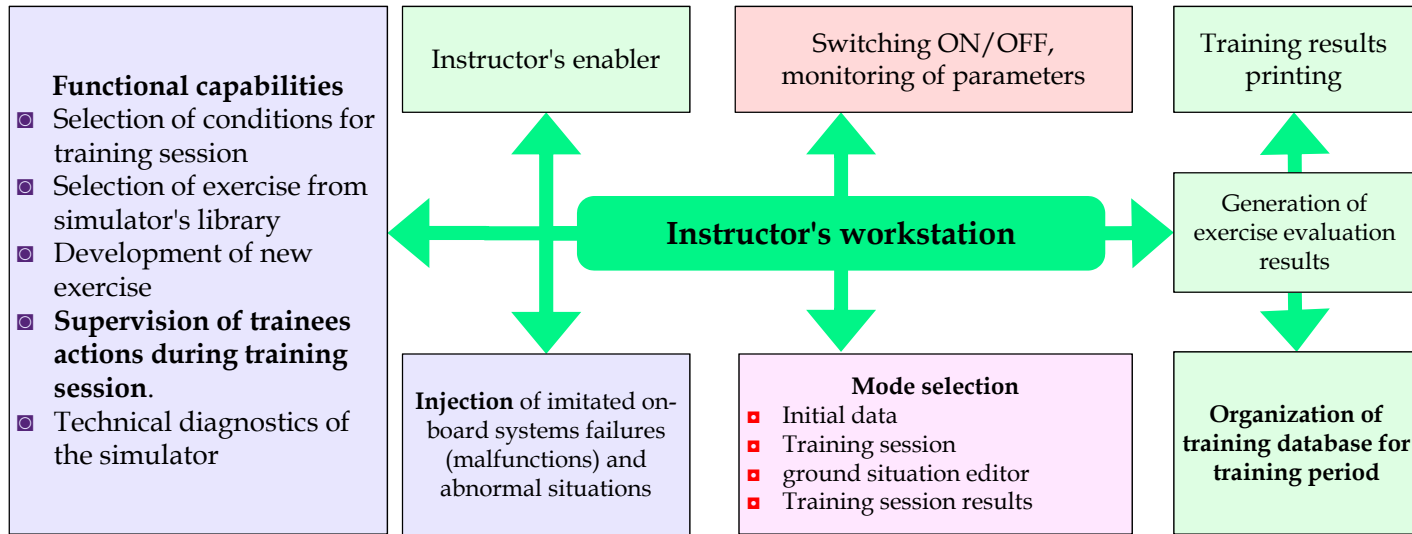


Integrated simulator view with BPU-1 Turret machine gun mount





# Instructor's workstation



Simulator's computing system program operates under «Windows» OS and has simple graphic interface

## Instructor's workstation provides

- determination of exercise sequence and selection of training conditions and modes
- registration of trainees
- monitoring of trainees activities and control of training progress (amendments, reiterative sessions, change of exercise sequence)
- generation of driving and firing exercise evaluation results
- trainees' actions analysis, correctness of their actions and decisions made in the course of session
- analysis of the trainee's level of skills dynamics
- development of individual training programs and sessions
- impartial evaluation of trainee's proficiency level



# SIMULATOR TECHNICAL CHARACTERISTICS

## Adequacy

Simulator ensures extent of functions of APC crew at least 80%.  
Those adequacy features are:

- ▶ correspondence of geometric dimensions of simulator's cabins and equipment mock ups and components locations to real BTR-80
- ▶ full range of reproducible functions of observation and sighting devices, controls and indications
- ▶ correspondence of travel ranges, forces and responses of steering wheel, levers, pedals, and hand wheels of simulator to characteristics of real BTR-80 (correspondence of ergonomic characteristics and sensory-motor field of simulator's workplaces to real BTR-80 crew work places)
- ▶ correspondence of instruments' and equipment's functional algorithms in all modes and reactions of controls and indication means on controlling actions of trainees
- ▶ calculation of bullet trajectories based on ballistic characteristics of KPVT, PKT machine guns and ammunition used
- ▶ accounting of the ability to defeat of ground targets in the simulation of shooting at them from the BTR-80 weapons
- ▶ target visibility calculation based on optical characteristics of observation and aiming devices
- ▶ accounting of all the main characteristics of the BTR-80 (engine power on different gears, transmission characteristics, weight, etc.) in the model of movement, as well as terrain features (topography, soil type, road surface condition)
- ▶ compliance of the operation of a running engine and weapon firing to the real sound effects
- ▶ reproduction of the inclination angles of the APC hull while driving and acceleration effects when speeding up, braking and turnings

BTR-80 driving compartment interior  
correspondence



BTR-80 driving compartment interior  
correspondence





## Background environment visualization quality

The simulator provides the ability to conduct surveillance and weapon firing with regard to optical visibility, distance, meteorological conditions and types of targets

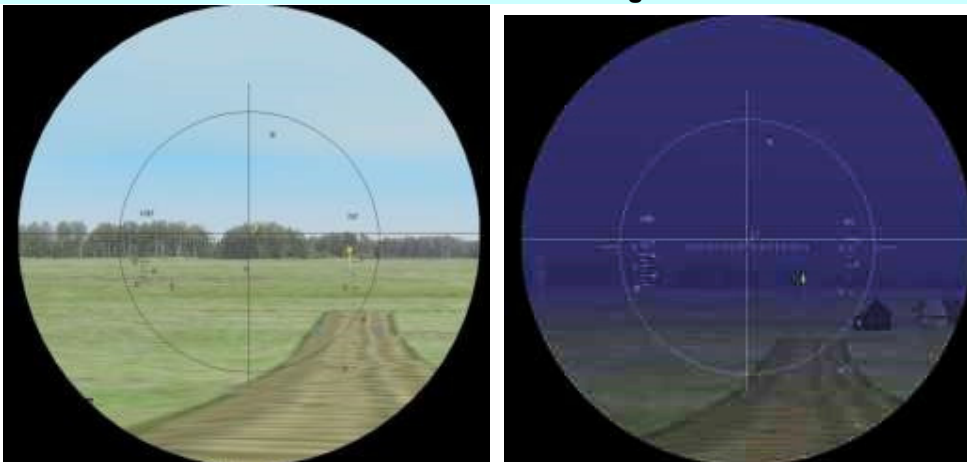
High-quality visualization of the background environment is achieved due to:

- ▶ use of liquid crystal monitors and high-resolution matrices in simulator's optical aiming devices
- ▶ detailing and drawing of terrain textures
- ▶ correspondence of terrain textures color range and objects with real colors and contrasts
- ▶ compliance of angular size, shape, color, contrast of local objects, vegetations, ground target with real objects within field of vision of optical observation and sighting devices

APC view from the external controllable camera



The field of view of 1PZ-2 aiming device





## Visualization samples





# Reliability

Simulator ensures reliable operating of simulator during whole exploitation period (warranted and post-warranted)

Reliability-assurance program is based on the following principles:

- use of proven by exploitation, the best quality and reliable components together with their incoming control
- program solutions development that exclude conflicts between specific and general software, as well as conflicts between software and hardware elements
- multiple repeated check of design solutions that provide long-term lifecycle of mechanical nodes
- application of design solutions, ensuring protracted work of mechanical nodes
- functional and phased check of quality of mechanical and electrical simulator assembly
- use of non contacting angle of rotation sensors (based on magneto sensitive microchips)
- use of protective means of print boards of electronic devices and connectors from environmental affects
- use of industrial computers
- use of uninterrupted power supply units
- ensuring of required simulator hardware thermal conditions
- providing power margin of power supply equipment

## Service life and warranty period

- ▶ Service life of Simulator (the life cycle of Simulator) is 1 years, under condition of strict adherence of Operational Rules, and proper maintenance and repair in accordance with Operational Documentation.
- ▶ Service life of Simulator is 8 years, under condition of strict adherence of Operational Requirements, proper maintenance and repair in accordance with Operational Manual.

® Simulator ensures continuous operations for 12 hours a day

® Error-free running time is 1000 hours

## Operating characteristics

**Simulator is designed for use in the units, it is reliable, simple in exploitation and maintenance**

No	Parameter name	Measurement unit	Parameter value
1	Minimal required area for setting	m <sup>2</sup>	30
2	Premises type	---	Classroom
3	Warm-up time upon actuation	min	up to 5
4	Duration of continuous work,	hours	at least 12
5	Electric power supply voltage	V.	220±10%
	Frequency	Hz	50±1
6	Maximum consumed power	kW	8
7	Average consumed power	kW	4
8	Increased operating and limiting temperature	°C	Up to +35
	reduced operating temperature		Up to +5
9	relative humidity at + 25°C.	%	Up to 80
10	Diagnostic system	---	In-build semiautomatic
11	Error-free running time	hours	at least 1000
12	ON/OFF Control	---	From instructor's workstation
13	SPTA	---	Individual and group (per each 10 simulators)
14	Maintenance	---	Checkup, daily maintenance, maintenance -1 (once per 6 months), maintenance - 2 (once per year)
15	Operating liquids	---	Synthetic oil in dynamic platform motor-reducers
16	Trainees and operating personnel electric safety	---	Dangerous voltage is excluded (DC +24 V is used) Short-circuit relay protection
17	Simulator's operating records		Motor-hour meter
18	Assembled weight	kg	1,900
19	Operating documentation	---	Logbook; Operating manual; On-site Assembly and Adjustment Manual, SPTA List



## Ability to be integrated into tactical platoon simulator

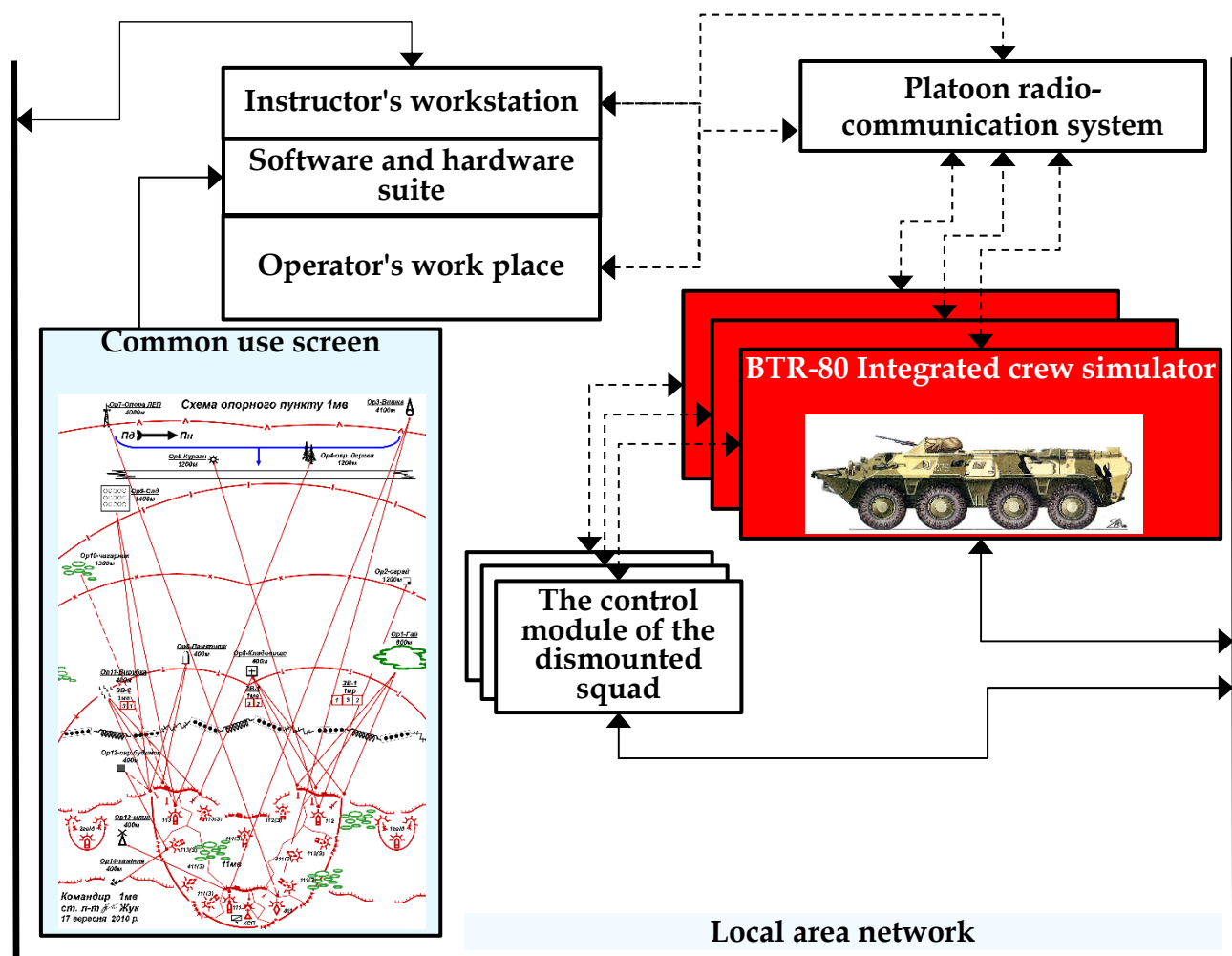
## The simulator provides the ability to conduct a force-on-force training

### The simulator software provides:

- merging of APC BTR-80 Integrated crew simulator into unified coordinated space with two crew simulators of APC BTR-80
- simultaneous functioning of integrated platoon simulators in a single simulated tactical environment in real-time in accordance with the location of each APC in the battle order and combat mission;
- displaying the location of the friendly and enemy forces on the ground with the required degree of details
- conducting fighting as part of a platoon, including force-on-force battle

### Tactical simulators capabilities

- ◆ a wide range of tactical scenarios and battlefield conditions
- ◆ control of training progress
- ◆ documenting the training process results for any period of training
- ◆ providing BTR-80 commanders and platoon leaders with the ability to control the crew and unit in the dynamics of the battle under difficult conditions
- ◆ practicing of effective methods and techniques of tactical actions due to the reiteration of tactical situations, comparative assessment of decisions of commanders and platoon actions during the battle
- ◆ the development of crews' and platoons teamwork, the shaping of platoon leaders' stable skills to control the platoon and fire during the battle
- ◆ practicing of the whole range of issues of organization and execution of combat actions



# EDUCATIONAL AND METHODOLOGICAL CAPABILITIES OF THE SIMULATOR

## Education and training capabilities of the simulator:

- individual training of APC drivers
- individual training of APC gunners
- collective firing and tactical training of crews
- tactical training of mechanized platoons (including force-on-force training exercises)

## The simulator's capabilities to develop conditions for training:

- dimensions of 3D terrain models - 4x4 km
- terrain types - moderately rugged terrain, mountainous, desert
- road types - unpaved, hard surface pavement, off-roads
- time of a day - daylight, twilight, night
- meteorological conditions - sunny, cloudiness, rain, snow, wind of various directions and speed
- season - summer, winter

## Education and training capabilities of the simulator to train drivers:

- execution of the full list of the Driving Course (KVBM) exercises with the automated assessment of trainees' actions
- driving under difficult road and off-road conditions in the course of gunfire and execution of tactical tasks

## Education and training capabilities of the simulator to train gunners:

- execution of the full list of the Gunnery Course (KVBM) exercises with the automated assessment of trainees' actions
- KPVT/PKT machine-guns firing under various conditions during the execution of the crew's fire and tactical tasks

## Supervision capability:

- ⊗ by the current state of the controls and indication means of the driver and the gunner
- ⊗ by the duplicated field of view of driver's observation devices and the 1PZ-2 sight
- ⊗ by the position of the APC on the tank driving range route and the status of the APC
- ⊗ by driving and fire training exercises protocol
- ⊗ by the reports of the trainees via communication means

- ⊗ training results e-documenting (printing if required)
- ⊗ training results archiving for a day or training period



# **The effectiveness of the use of simulator in the mechanized units training process**

The introduction of simulators in combat training allows:

## **1. Implementation of the basic principles of combat training**

- ☐ to make technical, reconnaissance, fire and tactical training of BTR-80 crews a real basis for the activities of mechanized units, to ensure the controllability of the learning and training process
- ☐ to exclude simplifications during lessons and exercises
- ☐ creation of training conditions close to combat
- ☐ provision of intensive training of all personnel of units
- ☐ provision of organizational and methodical connection of training with the use of simulators with the field training, including with live firing
- ☐ provision of objective control of the training level and crews' teamwork
- ☐ support of training methods "crawl, walk, run", individual approach to trainees, continuity of training.

## **2. Achievement of training objectives**

- ☐ provide a real opportunity to shape and maintain the required level of skills and combat coherence of APC crews
- ☐ to teach crews the effective use of APC weapons under difficult combat conditions, day and night
- ☐ develop the commander's skills to continuously control the crew's actions and fires during a battle
- ☐ effectively prepare the crews for exercises with live firing, to conduct tactical drills and training sessions
- ☐ provide the required level of crews' training during the entire training period
- ☐ prepare units to conduct effective actions in modern combat

## **3. Reduction expenses for combat training by 70-80% under the condition of achievement of the required training level and crew teamwork**