BMP-3 IFV dynamic crew simulator

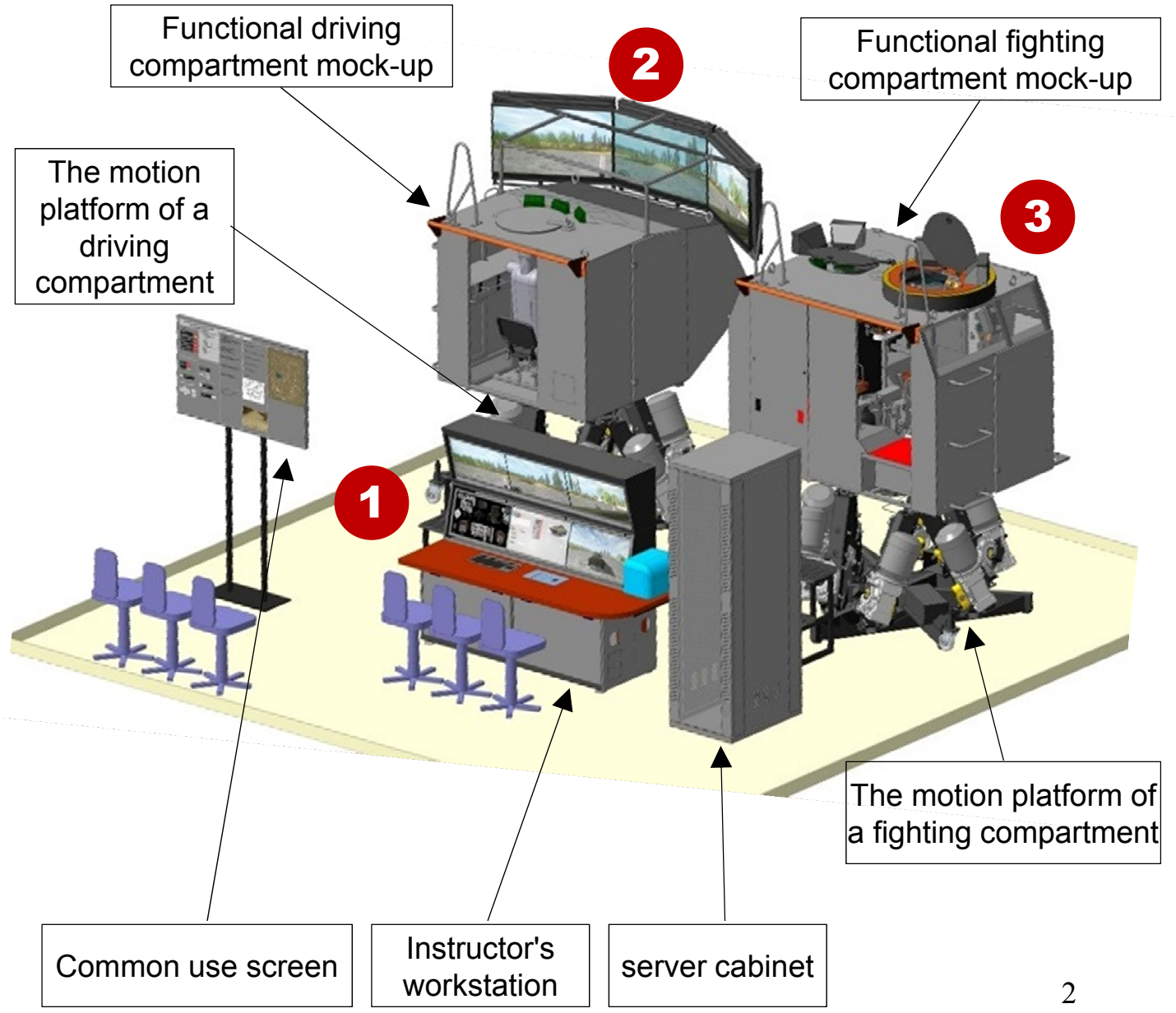
The simulator is intended for collective indoor training of the BMP-3 (BMP-3F) infantry fighting vehicles crews in armament handling, scanning for targets, firing from a weapon complex, performing fire and tactical missions under various conditions.

The simulator basic characteristics

- The design adequacy of the functional driving and fighting compartments' mock-ups
- Functional adequacy of algorithms and operating models of systems and equipment of a combat vehicle
- High-quality visualization of an outer environment
- 3D models of a tank driving range, a shooting range, and a tactical field
- Realistic tilt and acceleration effects
- Full package of the Combat Vehicle Driving Course exercises
- Full package of exercises of the Gunnery Course
- The tactical exercises of a single combat vehicle
- A wide spectrum of scenarios for exercises and training events
- Unbiased evaluation of trainee's actions
- Training results documenting

Structure

1. The instructor’s workstation (including server cabinet, software, and hardware suite, a screen of collective use)
2. BMP-3 driver’s compartment functional mock-up mounted on a 6DOF dynamic platform
3. Functional BMP-3 fighting compartment mock-up mounted on a 6DOF dynamic platform



The exterior of the simulator

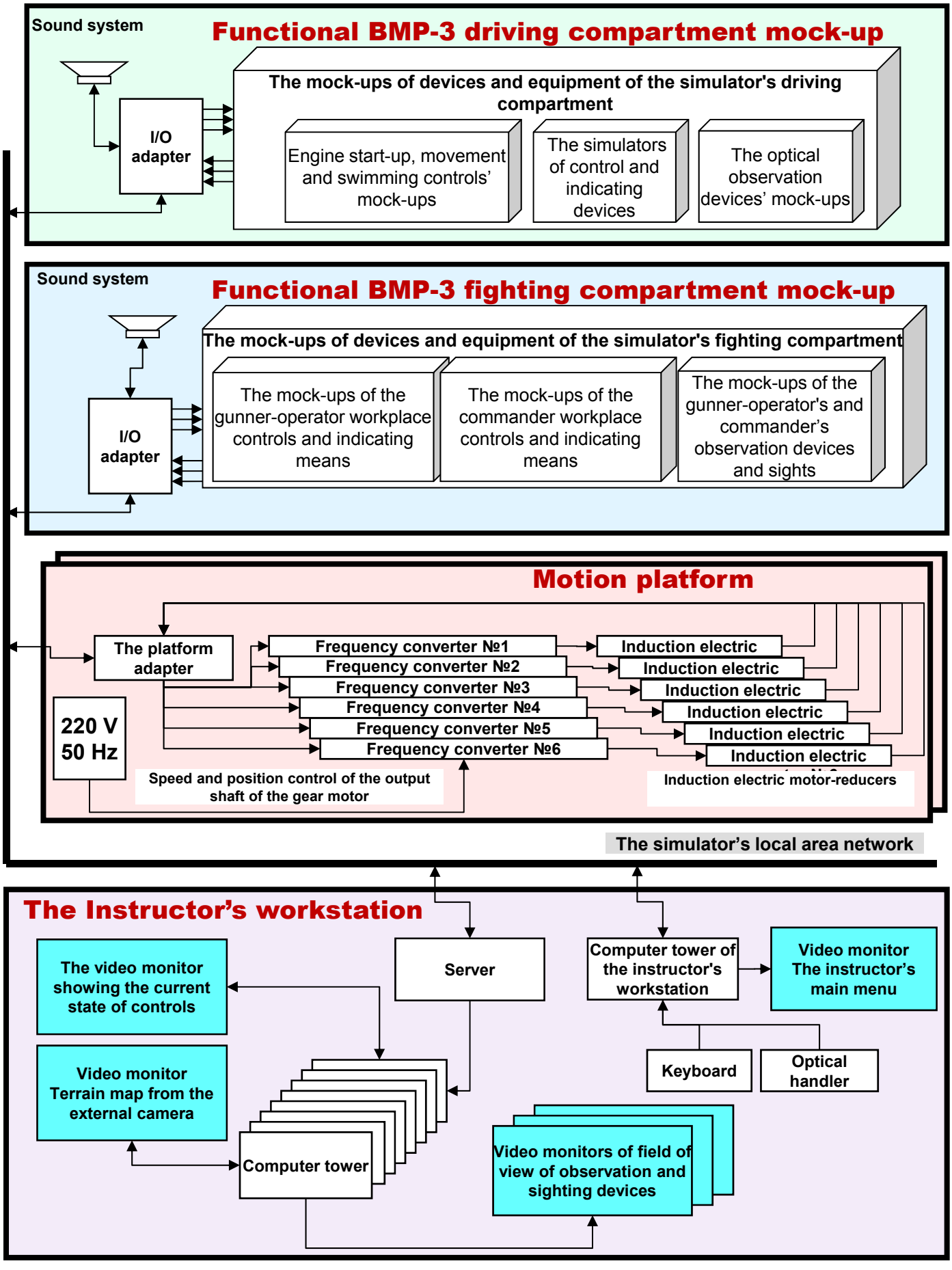
General view of the simulator

The BMP-3 driver's compartment functional mock-up mounted on a 6DOF dynamic platform

Simulator technical characteristics

№ seq.	Characteristics	Unit of measurement	Parameter's value
1	Quantity of simultaneously trained learners	---	3 (driver-mechanic, gunner, commander)
2	The minimum area of a training facility	m^2	40
3	Actuation time Switching ON	min	up to 15
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	27
7	The range of operating temperatures	degrees C	from +5 till +40
8	The type of the diagnostic system	---	In-build semiautomatic
9	3D model of tank driving range	km	2x4
10	3D model of tank firing range	km	4x4
11	Tactical field dimensions	km	8x8
12	The simulator ON/OFF control	---	Remote from the instructor's workstation
13	Training scenarios (terms and conditions)	---	Day, night, winter, summer, dust storm, fog, various optical visibility range, temperature range air from - 20° C up to +50° C
14	The capacity to input the failures and faults of the simulated fighting vehicle	---	Entering the malfunctions and failures is implemented from the Instructor's workstation
15	Maintenance	---	Checkup, daily maintenance, maintenance -1 (once per 6 months), maintenance - 2 (once per year)
16	The electrical safety of technicians and trainees	---	The danger voltage is absent on the trainee's workplaces Protection of the Instructor's workstation against short circuit
17	Error-free running time	hours	at least 1000
18	Specified lifetime	years	at least 10
19	Warranty period	years	3
20	Simulator's operating records	---	Motor-hour meter
21	Assembled weight	kg	2,450
22	Operating documentation	---	Logbook, operating manual, repair manual

Simulator structure



The Instructor’s workstation

Instructor's enabler

Simulator turn on/off
Voice communication check

Training results printing

Instructor’s workstation

Generation of exercise evaluation results

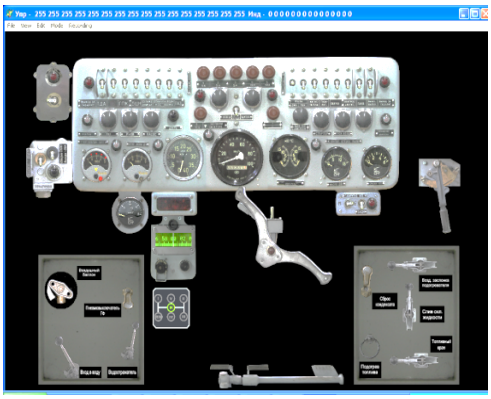
Entering faults and failures of a simulated combat vehicle

Modes selection
- Training conditions
- Training session
- The results of a training session

Development of a training database for a training period

The general view of the Instructor’s workstation

The monitor of the driver workplace's controls



The monitor for supervising the field of view of the SOZH-M sight of the gunner-operator in day mode

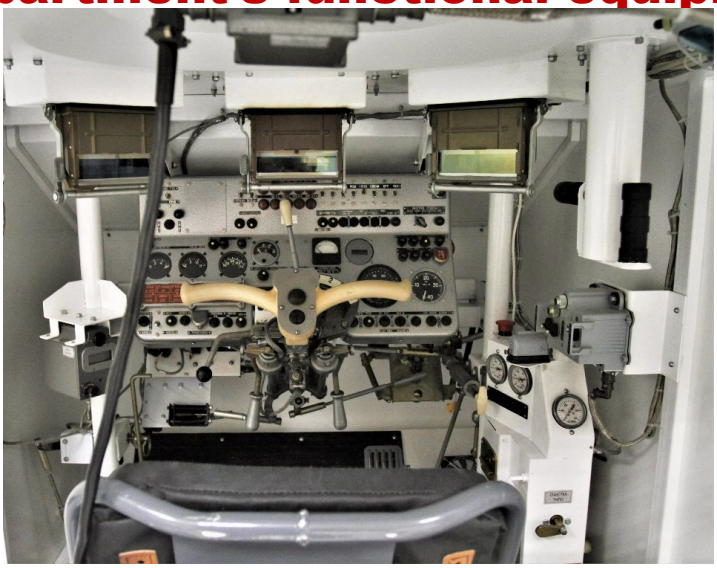
The motion platform

6DOF motion platforms ensure adequate cabins' tilts and acceleration loads on the crew when starting, accelerating, braking, turning, a movement of an infantry fighting vehicle as per a driver's actions, terrain and a state of a route, collisions with obstacles, firing from a 100-mm gun

Characteristics of the 6DOF motion platform

№	Designation		Value
1	The the type of drives of motors		Asynchronous with short-circuited rotor
2	Driving motor Controls		Frequency by speed and position
3	Pitch angle		+/- 20 degree
4	Angle of heel		+/- 20 degree
5	Heave		+/- 100 mm
6	Angle of rotation around vertical axis		+/- 30 degree
7	Surge		+/- 300 mm
8	Sway		+/- 300 mm
9	Angular speed of movement along the axes		0-20 degree/sec
10	Accuracy of control signals processing		< 0,2 degree at the corners
			<10 mm positionally
11	Maximum consumed power, kW	6ПД8М2	9.8
		6PD11M2	11.4

The composition of the BMP-3 driving compartment's functional equipment



№	Designation, title	Quantity, pcs.
1	**Simulator's instruments and equipment mock-ups, set, including**	1
	TNPO-170A observation device	4
	Drive turns, swing drive with steering wheel and gear shift lever, lever of hydro jet on/off and turns, including water gate valve control with electric trigger buttons of directional guns	1
	TVNE-1B (TVN-5) night vision device	1
	Central dashboard of driver	1
	Fuel-feed pedal, handle of manual fuel supply drive	1
	brake pedal	1
	Pneumatic system panel	1
	air cylinder with valve	2
	Fuel distribution cock	1
	Tap valve of heater fuel supply system	1
	Control panel PU-15 of fire suppression system (FSS)	1
	GO-27 device /dimensional mock-up/	1
	traffic signal box KDS1-2C	1
	GPK-59 directional gyro	1
	TNPO-350B observation devices to support in water crossing in swimming mode	1
2	**Equipment kit, including**	1
	A hatch with opening and locking mechanism	1
	Driver's seat	1
	helmet with push-to-talk button	1
	interior dome light	1
	fan	1
	audio system	1
	a panoramic framework of the visualization system	1
	metal stand	1
	detachable hand-holds	1

The composition of the functional mock-up of the BMP-3 fighting compartment

№	Designation, title	Quantity, pcs.
1	**Simulators of controls and instruments, kit, including**	1
1.1	***Commander's workplace, kit, including:***	1
	Tank commander's TKN-3MB observation device	1
	1PZ-10 Sighting device	1
	2E52 Control panel of weapon stabilizer	1
	R-173M radio-station and R-174P receiver	1
	Intercommunication device set BV-34	1
	PP-088 Control panel	1
	Air cylinder of a hydro-pneumatic clearing system	1
	BU-088 Command unit	1
	TNPO-170A observation device	2
	KR-60 command box of heating system	1
	The control console of a fire suppression system	1
1.2	***Gunner-operator workplace***	1
	"SOZH" (PPN "SOZH"-TM) sight-guidance unit	1
	2E52 Control panel of weapon stabilizer	1
	PPB-2 periscope sight-backup	1
	902B Control panel of smoke grenades launch system	1
	Weapon unit lifting gear	1
	A manual turret rotation mechanism	1
	turret stopper	1
	azimuth indicator	1
	Ammunition indication display unit	1
	TNPO-170A observation device	2
	2A70 and 2A72 breech assembly	1
	PKT receiver	1
	1B539 Ballistic calculator	1
	PL-088 Control console	1
	R-174 Intercommunication and commutation apparatus devices	1
2	**Equipment, kit, including**	1
	commander's cupola with a rotation drive and a hatch with a stopper	1
	gunner's hatch with a stopper	1
	commander's seat	1
	gunner's seat	1
	helmet with a push-to-talk button	2
	interior dome light	2
	fan	2
	audio system	1

The simulator technical characteristics

Adequacy

The simulator ensures replication of at least 80% of the driver-mechanic, commander, and gunner-operator actions of the BMP-3 during movement, reconnaissance, target designation, and firing from the weapons complex

- the correspondence of the geometric dimensions of the functional fighting and driving compartments, and the placement of the simulator's equipment mock-ups of the real BMP-3
- the full resemblance of the front panels of devices and equipment mock-ups, compliance of equipment illumination, instrument scales, indication and signaling means of a real BMP-3
- the completeness of reproducible functions of observation devices' mock-ups, controls, and an indication
- the correspondence of ranges of movement, efforts, and the reaction of steering bar, levers, pedals in the simulator to the characteristics of the real BMP-3
- the correspondence of algorithms and mathematical models functioning of the simulator's devices and equipment in all modes of a real BMP-3
- the correspondence of reaction of the controls and indication means, and the simulator's visualization system to the control actions of trainees with the real BMP-3
- calculation of the visibility of ground objects, based on the optical characteristics of observation and aiming devices under the day and night conditions
- accounting of all the main characteristics of the BMP-3 (engine power on different gears, transmission characteristics, weight, etc.), as well as terrain features (topography, soil type, road surface condition)
- accounting the BMP-3 (BMP-3F) principles of movement in the water
- in the swimming model; matching the sound effects of an operation of a traveling motor and units in the simulator to the real one
- the reproduction of tilt angles of the BMP-3 hull during movement and acceleration effects when speeding up, braking, and turning, hull oscillations when overcoming obstacles and colliding with objects
- calculation of bullets and projectiles trajectories based on the ballistic characteristics of the 7.62-mm PKT machine gun and 30-mm 2A72 gun, 100-2A70 gun, and ammunition used
- calculation of a flight path of the 9M117 guided missile based on the characteristics of the semi-automatic guidance contour
- accounting a defeat-ability of ground targets when firing from the BMP-3 weapons

Simulator technical characteristics

Background environment visualization quality

The simulator provides the ability to drive a combat vehicle, conduct visual reconnaissance and firing day and night, with different optical visibility, range, and type of ground and air targets, weather conditions

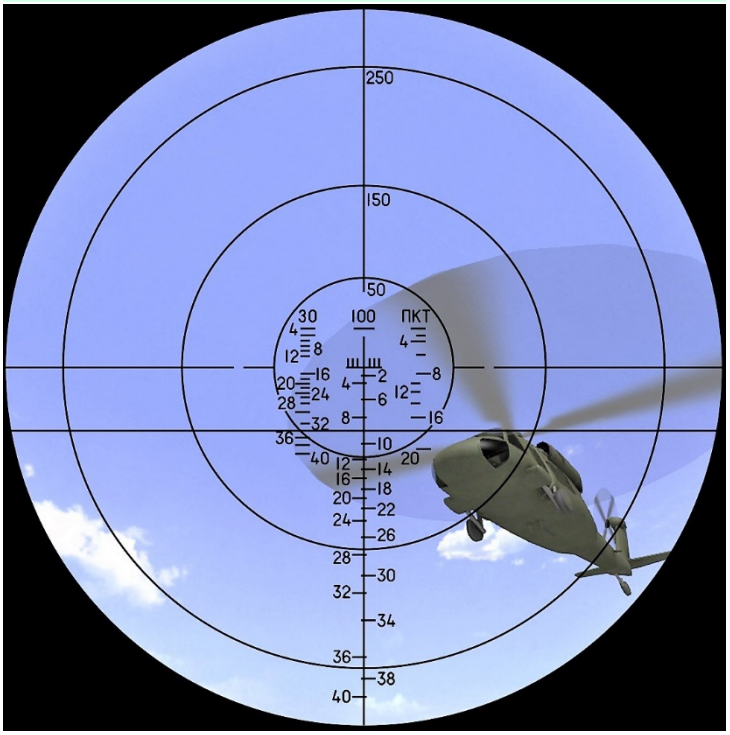
High-quality visualization of the background environment is achieved due to:

- high capabilities of the visualization program for generating dynamic scenes
- use of liquid crystal monitors and high-resolution matrices in the simulator's optical observation and aiming devices
- detailing and drawing terrain textures, matching the color scheme of terrain textures and objects to real colors and contrast
- compliance of angular size, shape, color, the contrast of local objects, vegetations, ground target with real objects within the field of vision of optical observation devices

The fields of view of optical sights

PPB-2 backup sight

1PZ-10 sight



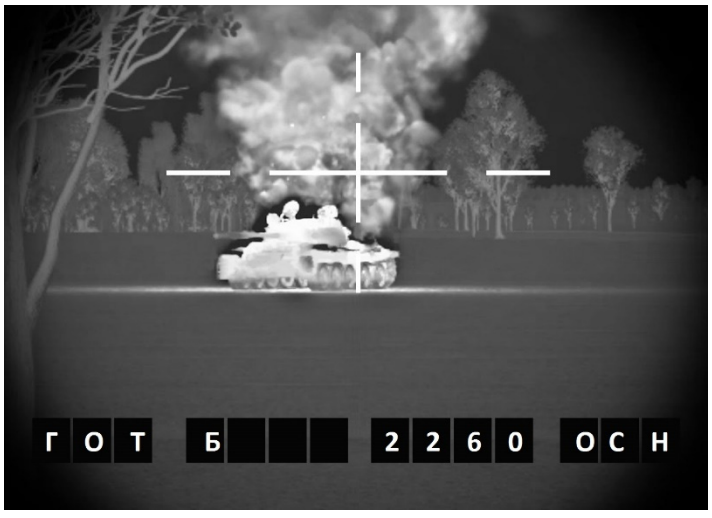
Simulator technical characteristics

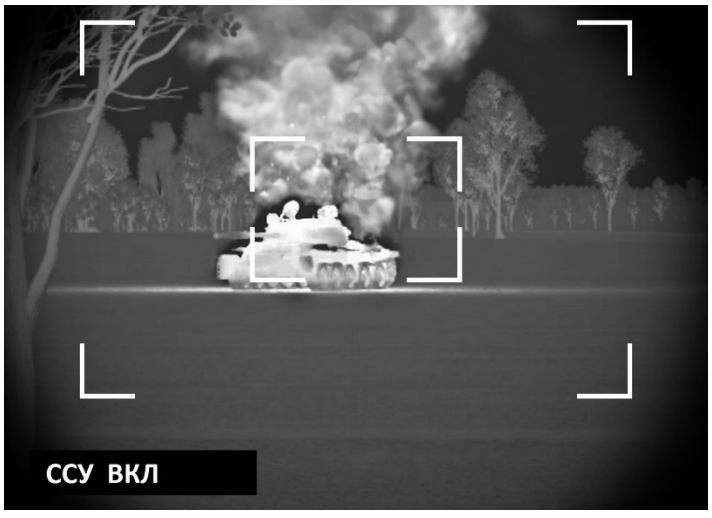
Background environment visualization quality

The fields of view of night sights

SOZH-M night sight channel

(SOZH-TM sight) thermal-vision sight





Simulator technical characteristics

Background environment visualization quality

View of a 3D terrain model from the simulator

Simulator technical characteristics

Reliability

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

The 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 excludes 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 the quality of mechanical and electrical simulator assembly
- use of the 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 effects
- 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

- **The service life of the Simulator (the life cycle of Simulator) is 3 years, under the condition of strict adherence of Operational Rules, and proper maintenance and repair following the Operational Documentation.**
- **The service life of the Simulator is 10 years, under the condition of strict adherence of Operational Requirements, proper maintenance, and repair following the Operational Manual.**

® The simulator ensures continuous operations for 12 hours a day

® Error-free running time is 1000 hours

Education and training capabilities of the BMP-3 crew trainer

Education and training of specialists and crews
- driver-mechanic individual training
- individual training of gunner-operators
- collective firing and tactical training of crews

To develop conditions for exercises and training events, namely
- selection of the terrain sector from the simulator's library
- setting the time of day (day-light, night, twilight);
- selecting meteorological conditions (sunny, cloudiness, fog, a wind of various directions and speed)
- season - summer, winter (according to the conditions of the geographical area of the user and required training scenarios)
- selection of meteorological and ballistic conditions for firing;
- selection of standard or generating of the improvised firing or tactical exercise
- selection of particular enemy activities
- repetition (multiple when required) of exercise (or exercise phase) or event
- entering of the BMP-3 equipment faults and failures during the training

Education and training of driver-mechanics
- performing of the full list of the Driving Course exercises with the automated assessment of trainees' actions
- driving under various road and off-road conditions in the course of gunfire and execution of tactical tasks

Education and training of crews
- execution of the full list of the Gunnery Course (KVBM) exercises with the automated assessment of trainees' actions
- performance of advanced fire and tactical missions within a crew

Supervision of trainees' actions
- the current state of the driver's, commander's and gunner's controls and indication means
- duplicated field of view of the driver observation devices
- by duplicated fields of view of sights SOZH-M (SOZH-TM), PPB-2, TKN-3MB, 1PZ-10
- by a position of a combat vehicle on the driving range, firing range, or tactical field
- driving and fire training exercises protocol
- by the reports of the trainees via communication means

The training results in processing and storing
- training results e-documenting (printing)
- training results archiving for a day or specified training period

Developer and manufacturer:
LCC ‘ Research and Production Company ‘Energy 2000’
Povitrophlotsky, 94-A, Kyiv, Ukraine
www.simulator.ua

Developer and manufacturer provide:

- **manufacturing the simulator**
- **assembly, adjusting, commissioning and acceptance testing at the site of intended use**
- **training of customer’s technicians**
- **warranty service for 3 years**
- **Post-warranted maintenance (subject to separate contract)**