Dynamic simulator of the BTR-80 armored personnel carrier driver

Purpose of Simulator

Simulator of BTR-80 armored personnel carrier driver is designed for solving tasks of the combat training program of units armed with BTR-80 armored personnel carrier and provides

a) training of driver mechanics of APC driving to the fullest context of Combat vehicle driving course;

b) raising intensity and effectiveness of combat training;

c) maintaining high level of effectiveness of mechanized units within the training period.

Examples of visualization in simulator

Composition of Simulator

The simulator consists of:

- Department of Control BTR-80
- 6-DOF motion platform
- Instructor ’s workplace

Instructor ’s workplace

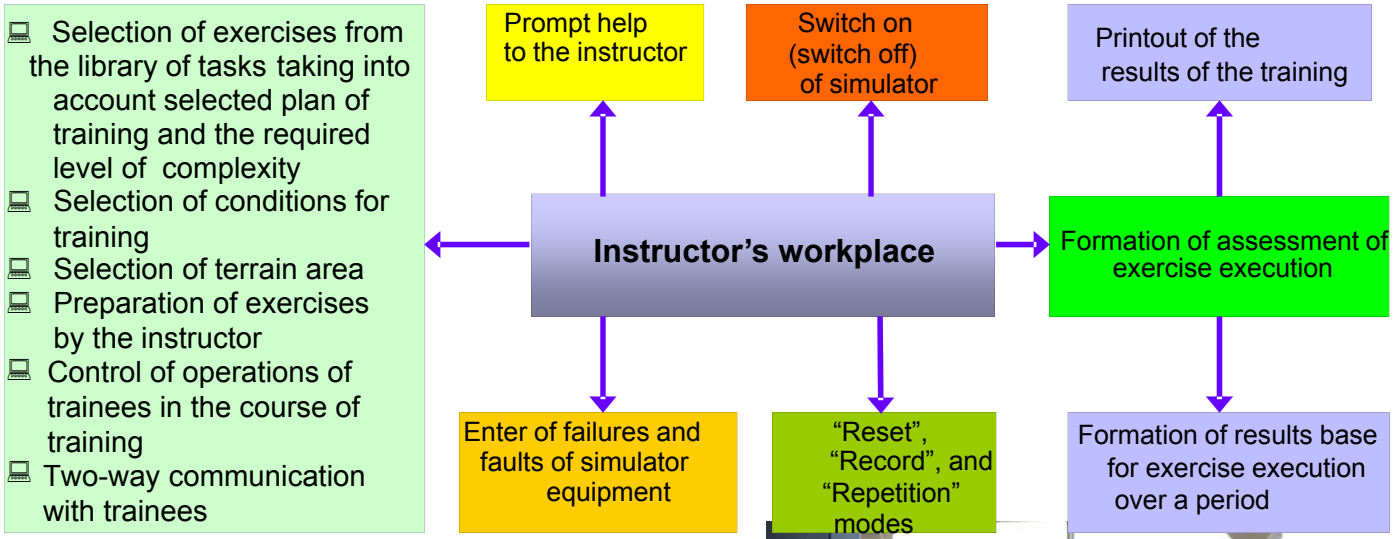
Department of Control BTR-80

6-DOF motion platform

Department of Control BTR-80

No	Name, designation	Number, pcs.
	Simulators of devices and equipment	
1	***Driver's workplace***	
	TNPO-115 vision blocks	3
	driver's lookout	1
	handle of driver's lookout	1
	instrument board	1
	air pressure valve	1
	tire valve unit	1
	washer reservoir (mock-up)	1
	steering wheel with horn button	1
	transmission shift lever	1
	starting lever of front axles and differential block	1
	transfer case gearshift lever	1
	winch release lever (mock-up)	1
	handle of anti-roll-down mechanism	1
	parking brake system lever	1
	accelerator pedal	1
	mechanism of hand-driven fuel feed	1
	service brake system pedal	1
	clutch pedal	1
	washer pump (mock-up)	1
2	**Equipment**	
	summer headset	1
	driver's seat	1
	interior lighting platform	1
	fan	1
	audio system	1

Instructor's Workplace



The program of simulator computer system runs under operating system "Windows" and has a simple graphic interface.

Instructor's workplace ensures:

- determination of procedure and selection of training conditions and modes
- registration of trainees
- control over trainees' operations and training process (introduction of changes in the course of training, repetition of certain elements of exercises and tactical situations, change of training conditions)
- formation of assessment of firing and driving exercise execution
- analysis of trainees' operations in the course of training, efficiency assessment of decisions made by trainees in the course of training
- dynamics analysis of the level of trainees' skills
- formation of individual exercise and training programs
- fair assessment of trainees' training level

Specifications of Simulator

Adequacy

- compliance of geometric dimensions of the simulator cabin and placement of kit simulators and equipment with real BTR-80
- full list of functions of observation and sighting devices, control and indication devices of armored personnel carrier
- compliance of the movement range, forces and response of steering wheel, levers, pedals, hand wheels in the simulator with characteristics of real BTR-80 (compliance of ergonomic characteristics and sensory-motor fields of simulator workplaces with workplaces of APC crew)
- compliance of functioning algorithms of simulator devices and equipment in all modes and responses of simulator control and indication devices to the control effect of trainees
- calculating the visibility of targets subject to optical characteristics of observation devices
- consideration of all main characteristics of BTR-80 (engine power at different transmissions, characteristics of transmission, and BTR weight), as well as terrain features (relief, soil type, condition of the road surface) in movement mode
- compliance of sound effects of operation of the propelling engine and firing with real ones
- simulation of APC body tilt on the move and acceleration effects at acceleration, decelerating and turns

Simulator ensures at least 80% coverage of combat performance of APC (armored personnel carrier) crew

Integrated coefficient of simulator adequacy is ≥0,8

Interior of BTR-80 compartment cabin

Interior of BTR-80 simulator compartment cabin

Visualization Quality of Target Environment

Simulator provides a possibility for conducting visual reconnaissance and firing with account for optical visibility, target range and type, as well as weather conditions

High quality of visualization of target environment is achieved by:

- using LCD high-resolution monitors and matrix in simulators of optical sighting devices (no less than 1280x1024)
- detailing and drawing the terrain texture
- compliance of color range of terrain texture and objects with real colors and contrast
- compliance of angular sizes, shapes, local objects, vegetation, ground targets with real objects within the field of vision of optical observation and sighting devices

View of APC from external controlled camera

Driver lockout view

Reliability

Simulator ensures fall-free operation over the whole operational life (warranty (2 year) and post-warranty (6 years) periods

Liability program of the simulator is based on the following principles:

- use of reliable components proven by operating experience in production, input control
- development of software solutions eliminating conflicts of special software with the general one, as well as with the hardware
- repeated verification of the developed engineering solutions
- use of engineering solutions ensuring continuous work of mechanical assemblies
- step-by-step and stage-by-stage quality control of mechanical and electrical assembly of simulators
- use of only noncontact rate-of-turn and displacement sensors in the assembly structure (on the basis of mangetosensitive microcircuits)
- use of protection means of printed boards of electronic devices and connectors against environmental impact
- use of computers of industrial (armored) version
- use of uninterruptible power supply for computers
- provision of necessary temperature conditions of simulator devices
- provision of power margin of power supply

Warranty and Service Life

- Warranty period of the simulator is 1 year in compliance with the rules of operation and maintenance in accordance with the operational documentation.
- The service life of the simulator is at least 8 years in compliance with the rules of operation and maintenance or repair in accordance with the operational documentation.

® Continuous operation of the simulator is 12 hours a day.

® Mean time between failures of the simulator is minimum 500 hours.

Operating characteristics

Simulator is easy to operate and maintain and is designed for operation by troops

No	Specification	Unit of measurement	Specification value
1	Minimum necessary area for placement	m^2	20
2	Type of room	---	Classroom
3	Operation readiness after turn-on	min	Maximum 5
4	Duration of continuous work	hour	Minimum 12
5	Electric supply: voltage	V	220±10%
	frequency	Hz	50±1
6	Maximum consumed power	kW	18
7	Mean consumed power	kW	9
8	High working and limit temperature	°C	+35
	Low working temperature		+5
9	Relative humidity at +25°c	%	80
10	Diagnostics system	---	Integrated semi-automatic
11	Failure time	hour	Minimum 500
12	On/off control	---	At the instructor's workplace
13	Spare parts, tools and equipment	---	Individual and group (per 10 simulators)
14	Maintenance	---	Walk-around inspection, daily maintenance, 1st maintenance (once every 6 month), 2nd maintenance (once a year)
15	Operational liquid	---	Synthetic oil in gear motors of motion platform
16	Electrical safety of trainees and service personnel	---	Hazardous voltage elimination in the simulator of combat compartment (24V DC). Short circuit protection
17	Recording of simulator time		Software hour meter
18	Assembled simulator weight	kg	1 400
19	Operational documentation	---	Logbook, operational manual, installation, start-up and on site commissioning instruction, SPTE list

Training Capabilities of Simulator

Simulator capabilities for instruction and training :

- individual training of APC drivers
- individual fire training of APC gunners
- joint fire and tactical training of crews
- tactical training of mechanized platoons (including in conditions of two-sided battle)

Capabilities of the simulator to form conditions of instruction and training:

- size of 3-D model of the terrain area – 4x4 km
- types of terrain – median, mountain, desert(under the request of the Customer 3-D model of any area of terrain with size 8x8 km can be created)
- types of roads– dirt road, hard surface, off-the-road
- time of the day – day, twilight, night
- weather conditions – sunny, cloudy, rain, snow, wind of different velocity and direction
- season – summer, winter (under the request of the Customer in accordance with the conditions of the geographical region of instructions and trainings)

Simulator capabilities for instruction and training of drivers:

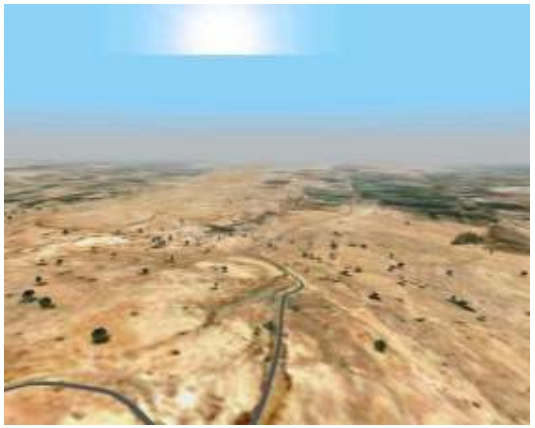
- execution of the full list of exercises of Combat vehicles driving course (CVDC) with computerized assessment of trainees' operations
- driving in different road conditions and off-the-road in the course of execution of fire and tactical tasks by the crew

Examples of landscape synthesized in the simulator:

mountain

plain

mountain and desert



Educational-methodical opportunities of Simulator

Capabilities of control of trainees' operations are based on:

- current status of control and indication devices of the driver and the gunner
- double field of vision of driver's observation devices
- APC condition from observation point of external controlled camera
- APC disposition on the track of tank training area
- protocol of driving and firing exercise execution
- trainees' reports over communication equipment

Video monitor of gunner's control devices (at the instructor's workplace)

Capacities of assessment of trainees' operations:

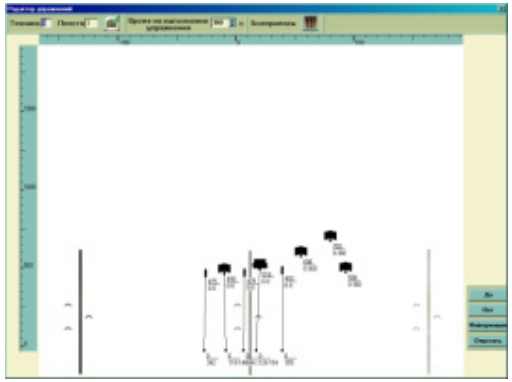
- computerized assessment of trainee drivers at execution of standard exercises in accordance with performance and criteria of Combat vehicle driving course (CVDC)
- fair assessment of trainees' operations based on the results of analysis by all (or selected) control means

Panel for selection of firing conditions

Capacities of creation of training conditions:

- selection of weather conditions for firing
- selection of standard or formation of optional firing or tactical exercise
- selection of the type of terrain, time of the day and year
- selection of enemy's type of operations
- repetition (multiple if necessary) of exercise or situation
- simulation of faults and APC equipment failures

Editor of fire and tactical exercises



- Documentation of results in electronic form (printout if necessary)
- Archiving of results over a day or a period