

A white circular icon containing a stylized human silhouette, representing a user or profile.

## ABOUT US

## ABOUT US

We are company with 5+ years of expertise in the field of software development for computer appliance simulators.

Our mission is to be the company that produces high quality Modelling & Simulation software solutions that maximally satisfy customer's needs.

Having a high qualified team of system architects, developers, analysts, engineers and subject-matter experts we successfully develop Modeling & Simulation software with necessary level of quality.

As we have a development center in Ukraine, we can provide you with cost effective but high-fidelity solutions, as the professional level of ukrainian IT specialists is high.

## RESEARCH & DEVELOPMENT

We have experience in developing software for :

- ▶ MI-8/MI-17 helicopter Full Mission Simulator (FMS)
- ▶ Aero L-39 airplane Full Mission Simulator (FMS)
- ▶ Dispatcher Center Simulator
- ▶ Tactical Simulator for officers' staff

We work as a partner of simulator development companies to provide them with all the necessary software for the simulators they produce.

Having a development center in Ukraine (Eastern Europe) we can leverage all possibilities of its IT market with a lot of high qualified programmers, QA-Engineers and other IT professionals. As Ukraine is an ex-USSR country, we also can leverage experience of many high-qualified experts in military, aerospace, electronics and other applied fields that were prepared by the USSR and post-USSR military-oriented education.

## MAIN REASONS TO WORK WITH US

- ▶ Professional team with **expertise** in area of Modelling & Simulation software development
- ▶ **Cost effective** software development and expertise with our development center in **Ukraine**
- ▶ **Subject-matter experts** in electrotechnic, aerospace and military domains
- ▶ **Turnkey-based approach.** Give us a complex problem and receive the complex problem solution.
- ▶ We can be your **gate to Ukraine employees market.** We have plenty of experienced professionals in the market for low rates

## KEY POINTS OF OUR EXPERTISE

### Software services

- ▶ **Full development cycle** (analysis, implementation, quality assurance, documenting, support) for all types of Modelling & Simulation software development

### Simulators development

- ▶ Development of software for **tactical, dispatcher center, FFS/FMS (Full Flight Simulators / Full Mission Simulators)** simulators
- ▶ Development of **Computer Based Trainers (CBT) & Trainer Procedure Devices**

### Working with hardware and hw simulation

- ▶ Simulation of **on-board systems** based on electrotechnical schemes. Both **interactions with hardware controls and software** interactions
- ▶ Development of software for **in-cockpit realism**: outside world related sounds etc, managing device control force feedback, in-cockpit sounds, device illuminations etc.
- ▶ Integration with different types of **motion platforms**, including **6 degrees of freedom** motion platforms, controlling vibration system
- ▶ Support of different type of **cockpit visualization systems**, like spherical screens, virtual reality helmets etc.

### Network & Interoperability

- ▶ Network interactions with other simulators or simulator parts using **HLA 2010 Evolved** protocol (or another interoperability protocol, like DIS, on customer's request) to train aircrew or for training formation flights and execution of formation combat missions.
- ▶ Support of HLA **integration with dispatcher center simulation** to teach pilots and dispatchers to work together.

### Applied development

- ▶ **Experience in such applied development areas** as: aerodynamic, flight dynamics and air traffic management modelling; airport facilities modelling; physics calculations and mathematical modelling; on-board systems modelling; vector maps and geospatial development; artificial intelligence (AI) and virtual reality modelling; HLA and network related development; 3D visualization; database related development;
- ▶ **Subject-matter expertise** in aerodynamic, radar and airport facilities, air traffic dispatching, artillery and joint tactics, electrotechnics. We can also hire specialists in other applied fields on the market
- ▶ Simulation of **flight dynamics** using physics principles, strong mathematical modelling, including aerodynamic modelling based on aircraft parameters.
- ▶ Modelling of atmospheric effects, weather and time-of-day conditions for training **pilots to operate in different conditions**

### 3D and virtual reality

- ▶ Realistic **modelling of real-world terrain area** with automatic approach, using elevation data, digital vector maps, terrain imagery and 3D models typical for the region or **automatic terrain generation** according to customer's needs
- ▶ Rich **3D visualization** development of **huge terrain areas in hundreds of thousands of square kilometers** with conformance of this area to the real world (same elevation, land types, objects etc.)
- ▶ **Virtual world and AI simulation** development. Distributed algorithm that calculates movements and actions of all units according to mission editor tasks and their parameters. True physics and ballistic principles are used in simulation core.
- ▶ Recording of all activities during simulation time for debriefing and after action review and with the possibility to replay the simulation from any point. Action controls for starting, pausing or stopping the simulations. **nVidia PhysX** is used for high-performance of physics-related operations

### Geospatial development

- ▶ **Geospatial** related development: using digital vector maps for dynamic air and ground environment visualization, for editing environment etc. Geospatial anchoring of all virtual world objects

### Air traffic related simulation

- ▶ **Virtual air traffic modelling and airport facilities modelling** using flight dynamic principles and with terrain following. **Modelling of airport facilities and environment** to teach pilots to operate with them
- ▶ Development of software for studying of **mutual communications of dispatchers and aircrews**.

### Instructor operating development

- ▶ **Instructor operating stations** development where an instructor can monitor flight and mission tasks operating, state of on-board devices, environment in 3D and on the maps, introduce device malfunctions etc.
- ▶ **Media classroom** development showing current training in different views with instruments for after-action review
- ▶ Development of **mission and environment editors** for preparation of different trainings

## OUR TEAM

Our professional team consists of experts in different areas of simulator software development.

Lots of our specialists have master degrees from Technical Universities of Ukraine. The founders of this company also have master degrees from National Technical University of Ukraine in system design speciality (<http://cad.kpi.ua/en>). Our basic hiring principle is to hire only the professionals that like simulation development field, that like to work and investigate new technologies. We enjoy our work and like to work a lot, because S&M modelling development is our life. That's why we have a professional team that can bring to our customers high quality solutions that meet all customers' needs. Having high qualified team of system architects, developers, analysts, engineers and subject-matter experts we successfully develop software for different simulators with necessary level of quality.

## Subject-matter experts

### Aerodynamics modelling experts

We have experts in helicopter and airplane dynamics modelling that are professors in this area and have 20+ years experience of modelling simulators and real aircrafts. They have developed a library of aerodynamic modelling of aircraft flight that takes into account parameters of propellers, wing airfoils, fuselage, etc., for calculating ascensional force and other aerodynamical parameters. Source data packages for this model are received from test operations of real aircrafts and from the airflow inside an air tunnel. Testing of the model is performed by the airflow in the air tunnel too.

### Radar expert

We have a world-class expert in radar technologies. He has tens of years of expertise in radar-related mathematics and technologies. With his expertise we can solve such tasks as modeling of radar detection zone depending on the radar type and characteristics, current terrain elevation and types, location of radar station etc.

### Airfield equipment and traffic expert

We have an airfield equipment and traffic expert with 15+ years of experience in this area. So, we can model airfield equipment behaviour, objects and their parameters and locations, we can model airfield traffic patterns, communication with dispatch centers, model work of dispatchers and processes in dispatcher centers etc.

### Flight modelling expert

We have an expert in dynamics of aircraft flight. He has an expertise in calculating trajectories of flight depending on different parameters of aircraft and terrain elevation. One of the important things he can do is to model behaviour of AI controlled aircrafts that are described in mission editor. Operator can describe the points which the aircraft should pass through and AI, the logic of which is described by this expert, will model the flight of this aircraft with passing all the mission points with terrain following.

### Infantry and artillery tactic specialists

We have specialists in infantry and artillery tactics. They are both colonels of infantry and artillery accordingly. So, their expertise in tactics could be used for modelling of forces or AI behaviour, for creating missions, testing adequateness of combat etc.

## Engineering staff

### Programmers staff

We have experienced Java and C++ programmers that can develop highly technological software for simulators, as they have experience in development of simulators that we have already developed.

They are not just programmers, but also applied specialists that understand physics, mathematics, aerodynamics, artificial intelligence, cartography etc.

### Electro-technical engineering staff

We have electro-technical engineering staff with proper university master education. So we can read, for example, electro-technical schemes and implement them to simulator software code with proper behaviour

### 2D and 3D Designers

Our team has 2D and 3D designers that can develop interface design or 3D models for 3D visualization.

### 3D Visualization developers

Our team contains ex GSC Game World specialists that have created S.T.A.L.K.E.R game series and other GSC Game World games. We use their experience for creating realistic 3D visualization for simulators.

For example, for a helicopter simulator we have created 3D visualization of a virtual world with the size of almost 200 000 sq. kms). Despite of the size, this is high performance visualization because of our dynamic loading technology that supports huge areas for visualization. As they came from the game world where requirements to visualization quality are high, our 3D visualization is nice-looking and with high quality.



# PARTNERSHIP PROPOSAL

## PARTNERSHIP PROPOSAL

We are open for partnership with companies that produce modelling & simulation (M&S) solutions.

In this case we are glad to propose you to subcontract your projects or a part of them to us. You can leverage our experience and expertise to develop M&S solutions successfully that meets international standards as well as customers' needs and requirements.

Despite of our expertise in producing military simulators, our company can consider offers for producing other types of Simulation & Modelling software for other industrial branches. So, we are open for any propositions and offers that are related to applied software development.

We are also ready to communicate about investments into our company.

### Working with us has the following advantages



#### Cost effective solutions

We can provide you with our cost effective software development and expertise with our development center in Ukraine



#### Military domain professionals

Ukraine has lots of highly skilled technical specialists: programmers, engineers, subject matter experts in the field of aviation and army. This is a result of our history: Ukraine was a part of the USSR and the second USSR republic by army power. The USSR had the development of a powerful army as one of the priority tasks, that's why education in the USSR was military oriented. As a result there are many experts in the military sphere that work in Ukraine. Besides, there were a lot of technical universities in the Ukrainian Republic of the USSR, and they still train a lot of good technicians. Furthermore, this company has been founded by two Masters of Science graduating from System Design Department of National Technical University of Ukraine "KPI". So, working with us means that you will get both highly qualified programmers and engineers in military/aerospace domain for low rate.



#### Experience and Expertise

You do not have to hire common programmers and engineers and train them in the military and simulators knowledge domain. We have 5+ years of expertise in military simulators software domain and can solve your tasks with minimal efforts and man-days. We have programmers, electrotechnical engineers and subject matter experts. Working with us you will get not only programmers. You will get our experience and expertise.



#### Turnkey solutions

You can outsource to us some task or project, and you will get a result on turnkey basis. You do not have to waste your resources for managing a team and solving operational tasks within your operational structure. You will get a solution for your problem by outsourcing the whole task to us, and we will manage it for you



#### Gate to Ukraine's outsourcing market

Ukraine's software outsourcing market is one of the best in the world. Low rates and at the same time highly skilled professionals can make high quality software for low price. Our company can be your gate to the Ukrainian Software outsourcing market

If some part of your projects can not be subcontracted to non-residents of your country due to government security rules, we can make other parts of your projects that are safe for outsourcing according to your government law.

So, as you can see, to work with us is a good case for you, as you can reach your development goals with good economical and technical results.





**PORTFOLIO**

## PORTFOLIO



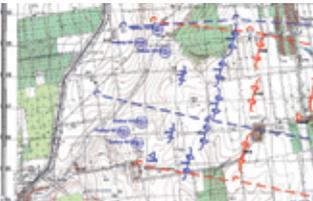
### [Mi-8/Mi-17 helicopter Full Mission Simulator \(FMS\)](#)

This simulator is a HLA-based computer appliance Full Mission Simulator (FMS) with 6 degrees of freedom motion platform, hardware copy of cockpit with realistic copies of all devices, sound effects and cockpit device illumination system, instructor operating stations, media classroom and spherical display for Outside World visualization. This simulator is network-based and can act in a shared virtual environment with each other, dispatcher center simulator workplaces and other simulators using HLA protocol.



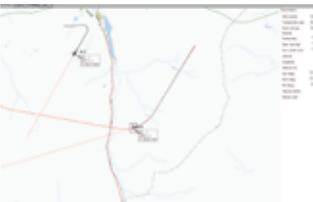
### [Aero L-39 aircraft Full Mission Simulator \(FMS\)](#)

This is a HLA-based computer appliance Full Mission Simulator (FMS) with 6 degrees of freedom motion platform, hardware copy of cockpit with realistic copies of all devices, sound effects and cockpit device illumination system, instructor operating stations, media classroom and spherical display for Outside World visualization. This simulator is network-based and can act in a shared virtual environment with each other, dispatcher center simulator workplaces and other simulators using HLA protocol.



### [Tactical Simulator for officer's staff](#)

Tactical simulator allows officers to train and improve their tactical skills of commanding formations in combat conditions. This is a collective training where a team of officers from both sides takes part in simulator training using a computer network. Officers study to plan and fight a battle, with possibilities of what-if tactical analysis and after-action review.



### [Dispatcher Center simulator](#)

This simulator have set of workplaces for dispatchers or air control officers where each of them can train to control the air traffic and solve different air traffic problems. Also this simulator have powerful Instructor Operating Station for exercises preparations, controlling and after action reviewing. This simulator is network-based and trainees at workplaces can act in a shared virtual environment with each other, man-in-the loop aircraft simulators and instructors using voice hardware and HLA protocol.



### [Computer Based Trainings](#)

As part of FMS and Dispatcher Center simulators development, we developed Computer Based Trainings (CBT) for cost effective trainings.

Due to our architectural principles, same software is used both for Full Mission Simulators and Computer Based Trainings. So, we made less expensive training solutions based on low-fidelity hardware but still with high-fidelity software.





## Tactical Simulator for officer's staff

We took part as team members in developing a tactical simulator for military officers' tactics trainings and mission rehearsals.

This simulator was developed with the principles of maximum correspondence to the real world and to tactical actions of military officers.

## Key features of our developed simulator software

### Tactical simulation features

- ▶ Planning and fighting simulation modes
- ▶ Possibilities for what-if analysis: fast forward to see the result of current officers' decisions
- ▶ Support of units from different military branches taking part in simulation
- ▶ Map visualization with displaying a big picture of battlefield using formation signs
- ▶ On-map drawing mode for drawing the assumed enemy forces and other signs for decision making

### 3D, terrain, AI and virtual reality world

- ▶ Real-time simulation of battlefield with huge amounts of units and formations
- ▶ True mathematical modelling of physics processes, like weapon ballistics depending on weaponry and ammunition properties. Each unit movement and action, weapon shot etc. is modelled individually using a strong mathematical model. nVidia PhysX is used for high performance of physics related calculations
- ▶ Modelling of real world area terrain using geospatial information and elevation data
- ▶ Strong AI for simulating movements and actions of virtual units, with line-of-sight checks, collision detections, path findings, damage logic etc.
- ▶ 3D visualization for modelling field officers' viewpoints and 3D free-fly mode for instructor situational awareness

### Instructor operating development

- ▶ Instructor operating station for monitoring and controlling the simulation, the computer simulated forces are used for playing up via introducing battle events etc.
- ▶ Distributed events recordings for debriefing and after-action review
- ▶ Network simulator with supporting of plenty of workplaces for collaborative training of officers staff
- ▶ Strong unit, formation and mission editors for defining unit, weaponry and ammunition properties, formations structure, source geospatial data and map imagery, graphical setting of forces positions and their tasks etc

### Geospatial development

- ▶ Geospatial based, geodesy and cartography are widely used in calculations, e.g. distances, coordinates etc

## Dispatcher Center simulator

We develop software of Dispatcher Center Simulator as the main subcontractor of a company that develops computer appliance simulators.

This simulator have set of workplaces for dispatchers or air control officers where each of them can train to control the air traffic and solve different air traffic problems. Also this simulator have powerful Instructor Operating Station for exercises preparations, controlling and after action reviewing.

Real world areas and are precisely modelled, with relief correspondence. Also civil air traffic and related objects of real area is modelled to train dispatchers and air control officers be ready to work in concrete real world environment.

This simulator is network-based and trainees at workplaces can act in a shared virtual environment with each other, man-in-the loop aircraft simulators and instructors using voice hardware and HLA protocol.

## Key features of our developed simulator software

### Air traffic related simulation

- ▶ Real-time air traffic modelling and management
- ▶ Man-in-the-loop and computer-in-the-loop simulated aircrafts support
- ▶ Modelling of airport-related environment
- ▶ Radar work simulation with visibility zone calculation, azimuth grid and radar scan sweeps
- ▶ Realistic modelling of flight dynamics and trajectories, with correct turn radiuses calculations depending on aircraft properties

### Network & Interoperability

- ▶ HLA based network simulator with lots of workplaces of dispatchers or air control officers who share the same virtual environment

### Instructor operating development

- ▶ Instructor Operating Station for controlling traffic, setting meteorological conditions, time of day etc, for aircrew answers voice accompanying for training dispatchers, accompanying computer-in-the-loop aircrafts behaviour according to a dispatcher's orders
- ▶ On-map for a "big picture" and 3D views for situational awareness are available
- ▶ Editors for configuration of airport-related environment
- ▶ Distributed simulation recording for debriefing and after-action review

### Geospatial development

- ▶ Geospatial based, geodesy and cartography are widely used in calculations, e.g. distances, coordinates etc

## Computer Based Trainings

As part of FMS and Dispatcher Center simulators development, we developed Computer Based Trainings (CBT). Due to our architectural principles, same software is used both for Full Mission Simulators and Computer Based Trainings. Software modules can be configured to work with hardware, with network over HLA or just simulate hardware and visualize it on computer display.

Computer Based Trainings are used for members of instructors' team can play up to trainees as wingmans or some own or alien units. They can be used also as cost-effective training solutions. As same to Full Mission Simulators high fidelity codebase is used for Computer Based Trainings, our customers can hold high quality exercises using same aerodynamics and on-board systems modelling as in Full Mission Simulators.

Our tactical simulator for officers' staff in fact is a network based Computer Based Training simulator with addition of some radio emulated voice hardware.

### Key features of our developed simulator software

#### Advanced simulation

- ▶ Real-time simulation for complex trainings of operating different machines or processes
- ▶ Development of driving and military ground machines simulators

#### Network & Interoperability

- ▶ Network interactions with other simulators or simulator parts using HLA 2010 Evolved protocol to train aircrew or for training of formation flights and execution of formation combat missions. Support of integration with other simulators for performing military cross-branches trainings with different types of simulators.
- ▶ Support of HLA integration with dispatcher center simulation to teach pilots and dispatchers (or air control officers) to work together.

#### Instructor operating development

- ▶ Instructor operating stations development where an instructor can monitor flight and mission tasks operating, state of on-board devices, environment in 3D and on the maps, introduce device malfunctions, etc. Also monitoring soft for a media classroom showing the current training in different views. Multi monitor workstations are used for providing such information.
- ▶ Recording of all distributed activities during simulation for debriefing and after-action review across distributed environment with the possibility to replay the simulation from any point. Action controls for starting, pausing or stopping the simulations.
- ▶ Development of mission and environment editors for the preparation of different training. Modelling of airport facilities and environment to teach pilots to operate with them

#### Tactical simulation for officer's staff development

- ▶ Development of tactical simulators: planning mode, what-if analysis of tactical decisions, on-map drawings, support of different military branches etc

#### Geospatial development

- ▶ Geospatial related development: using a map for dynamic air and ground environment visualization, for editing environment etc

#### Air traffic related simulation

- ▶ Virtual air traffic modelling using flight dynamic principles and with terrain following
- ▶ Modelling of airport related environment
- ▶ Radar work simulation with visibility zone calculation, azimuth grid and radar scan sweeps

#### Advanced flight simulation development

- ▶ Development of flight simulator software for teaching procedural and flight operations (turning on, driving, takeoff, landing, flight operating, manoeuvring, technical failures operating, firing, bombing, etc)
- ▶ Simulation of flight dynamics using physics principles, strong mathematical modelling, including aerodynamic modelling based on aircraft parameters. We have subject-matter experts for projecting and implementing such tasks.
- ▶ Modelling of atmospheric effects, weather, time-of-day and season conditions to train pilots to operate in different conditions (for example, such parameters as wind, temperature, turbulence, density, humidity, flying on low altitudes affect the aerodynamics of a flight; rain, snow, fog, clouds, sun shine, time-of-day light visual effects are modeled to train crew to operate in different visual conditions)

#### Hardware simulation

- ▶ Simulation of on-board systems based on electrotechnical schemes. Our electro-technical engineers can describe an on-board devices model, and implement it with our developers. We can implement inner logic, interactions with hardware devices, visualization of devices on Instructor Operating Stations we can implement for a trainee to be able to study working with on-board systems effectively

#### 3D, terrain, AI and virtual reality world

- ▶ Realistic modelling of a real-world terrain area with automatic approach, using elevation data, digital vector maps, terrain imagery and 3D models typical for region or automatic terrain generation according to the customer's needs
- ▶ Rich 3D visualization development of huge terrain areas in hundreds of thousands of square kilometers with correspondence of this area to the real world (same elevation, land types, objects etc)
- ▶ Virtual world and AI simulation development. Distributed algorithm that calculates movements and actions of all the units according to the tasks of mission editor and their parameters. AI simulates complex patterns like decision making, aim selection, shooting etc. We take into account lots of parameters when developing a virtual world: parameters of each ground or air units (configurable into editors), relief, land types, movement capabilities etc. True physics and ballistic principles are used in the simulation core. nVidia PhysX is used for high-performance of physics-related operations



## SERVICES

## Overview

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We have an expertise in development of software for military simulators.  
We have 5+ years of experience in developing software for:

- ▶ Full Mission Simulators (FMS);
- ▶ Dispatcher Center Simulators;
- ▶ Tactical Simulators for Officer's Staff;

and can develop other military and civil simulators according to customer's needs. We work as a subcontractor of simulator development companies to provide them with all the necessary software for the simulators they produce.

We develop our software with the principles of maximal realism for effective teaching of military personnel to work with vehicles, understand tactics or follow military procedures. All processes in our simulators are processed with strong mathematics background and with observing the principles of physics. Aerodynamics is calculated based on aircraft parameters for flight simulators and meteorological conditions, ballistics of ammunition depends on weather conditions and parameters of ammunition and weapons, etc.

Our mission is to be the company that produces high quality Modelling & Simulation (M&S) software solutions that maximally satisfy customer's needs. So we are ready to develop not only software for air, ground or marine simulators, but also other types of Modelling & Simulation software.

Our simulators are network-based using HLA 2010 Evolved protocol and can be used for teaching cooperation of the whole crew, dispatcher team or division command simultaneously. Note that HLA is not a limitation for us and we can use other interoperability technologies (like DIS) in our simulator development.

All that we develop allows teaching a trainee effectively to complete specific mission tasks by introducing virtual environment that has dynamics similar to a virtual world: flying of aircrafts, battle of different types of military units, etc. For example, with such an approach a helicopter simulator trainee can not only study to operate the helicopter flight, but also to complete mission tasks like performing a battle against enemy or operating a helicopter in aggressive battlefield environment.

We model terrain to maximally conform some real world area. Elevation, land types, water areas and ground objects maximally correspond to some real world area. So, for example, a trainee can be maximally prepared with the simulator before real-life exercises.

Our simulators support different types of hardware: cockpits, display systems, on-board devices etc.  
All sound and illumination effects hardware for in-cockpit realism is managed by our software.

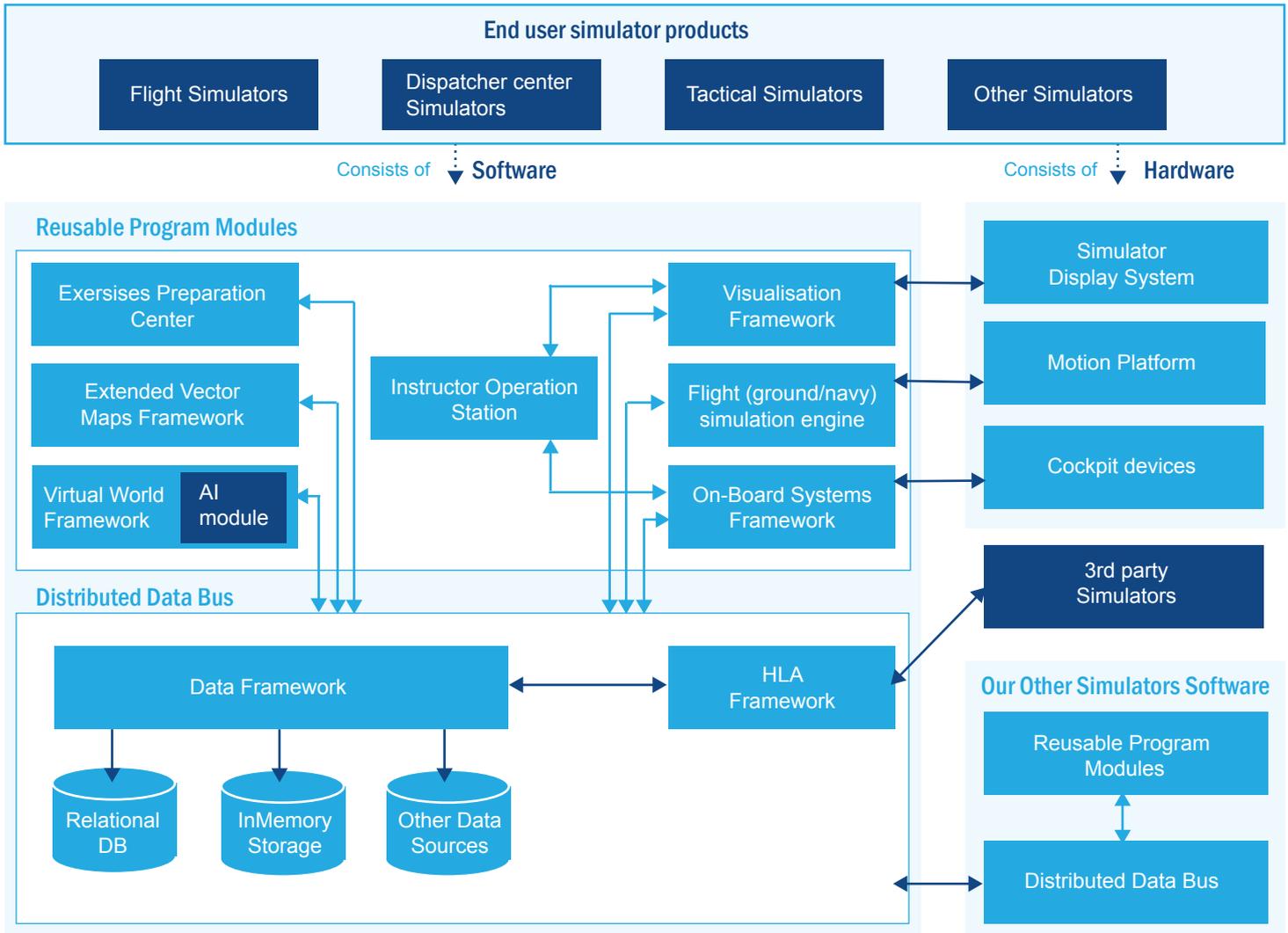
We develop our simulators based on architecture approach. We extract everything that can be reused in other simulators or in the same simulator as a reusable module. Owing to this our approach allows us to develop a new simulator or extend the existing one rapidly, with minimal efforts, costs and terms. You can read precisely about our approach in subsection of this section.

You can read precise subsections of this section for getting more details about our services.

## Solution Architecture

We develop our simulators based on architecture modular approach. We extract everything that can be reused in other simulators or in the same simulator as a reusable module. Owing to this our approach allows us to develop a new simulator or extend the existing one rapidly, with minimal efforts, costs and terms.

Using this approach with each new simulator developed our architecture became more robust and reusable, owing to the minimization of new projects costs and terms.



You can see our approach to the simulation development from our architecture diagram. Each of the simulators contains architecture blocks that can be reused in new simulators. Such approach as described in the architecture diagram leads to drastic minimization of development efforts and costs. As all synchronization and data-related codes have been written before and located in Distributed Data Bus, all other reusable codes are located in the simulator modules developed before, simulator developers have to write only a code of specific simulator logic. So, a smaller amount of simulator developers and less time are required for developing software for a new simulator.

## FFS (Full Flight Simulators) / FMS (Full Mission Simulators) //

We develop software for FFS/FMS computer appliance simulators for crew trainings.

We model all necessary aspects of simulators:

- ▶ aerodynamic modelling with taking into account external factors;
- ▶ interactions with motion platform;
- ▶ cockpit devices and visualization systems;
- ▶ replicating of real world areas in Outside World with different environment conditions;
- ▶ high quality visualization of Outside World;
- ▶ modelling of all on-board systems;
- ▶ interaction with crew by controls and gauges

## Key points of our FFS/FMS software services //

### Advanced flight simulation development

- ▶ Simulation for complex training both procedural and flight operations (turning on, driving, takeoff, landing, flight operating, manoeuvring, technical failures operating, firing, bombing, etc.)
- ▶ Simulation of flight dynamics using physics principles, strong mathematical modelling, including aerodynamic modelling based on aircraft parameters. We have subject-matter experts for projecting and implementing such tasks.
- ▶ Modelling of atmospheric effects, weather, time-of-day and season conditions for training pilots to operate in different conditions (for example, such parameters as wind, temperature, turbulence, density, humidity, flying on low altitudes affect the aerodynamics of a flight; rain, snow, fog, clouds, sun shine, time-of-day light visual effects are modelled for teaching a crew to operate in different visual conditions)

### Network & Interoperability

- ▶ Network interactions with other simulators or simulator parts using HLA 2010 Evolved protocol (or another interoperability protocol, like DIS, on customer's request) to train aircrew or for training formation flights and execution of formation combat missions.
- ▶ Support of HLA integration with dispatcher center simulation to teach pilots and dispatchers to work together.

### Instructor operating development

- ▶ Instructor operating stations development where an instructor can monitor flight and mission tasks operating, state of on-board devices, environment in 3D and on the maps, introduce device malfunctions etc. Also monitoring of soft for a media classroom showing the current training in different views. Multi monitor workstations are used for providing such information.
- ▶ Recording of all distributed activities during simulation for debriefing and after-action review across distributed environment with the possibility to replay the simulation from any point. Action controls for starting, pausing or stopping the simulations.
- ▶ Development of mission and environment editors for the preparation of different trainings. Modelling of airport facilities and environment to teach pilots to operate with them

### Geospatial development

- ▶ Geospatial related development: using a map for dynamic air and ground environment visualization, for editing environment etc.

### Working with hardware and hw simulation

- ▶ Simulation of on-board systems based on electrotechnical schemes. Our electrotechnical engineers can describe on-board devices model and implement it with our developers. Inner logic, interactions with hardware devices, visualization of devices on Instructor Operating Stations we can implement for a trainee to be able to study working with on-board systems effectively
- ▶ Integration with different types of motion platforms (including 6 degrees of freedom platforms), controlling vibration system
- ▶ Support of different types of cockpit visualization systems (for example, a spherical screen with a set of stuck together images from different projectors)
- ▶ In-cockpit realism development: software for controlling devices illuminations, in-cockpit sounds, outside world related sounds, managing device controls force feedbacks etc.

### 3D, terrain, AI and virtual reality world

- ▶ Realistic modelling of a real-world terrain area with automatic approach, using elevation data, digital vector maps, terrain imagery and 3D models typical for the region or automatic terrain generation according to the customer's needs
- ▶ Rich 3D visualization development of huge terrain areas in hundreds of thousands of square kilometers with correspondence of this area to the real world (same elevation, land types, objects etc.)
- ▶ Virtual world and AI simulation development. Distributed algorithm that calculates movements and actions of all the units according to mission editor tasks and their parameters. AI simulates complex patterns like decision making, aim selection, shooting etc. We take into account lots of parameters when developing a virtual world: parameters of each ground or air unit (configurable into editors), relief, land types, movement capabilities etc. True physics and ballistic principles are used in the simulation core. nVidia PhysX is used for high-performance of physics-related operations

### Air traffic related simulation

- ▶ Virtual air traffic modelling using flight dynamic principles and with terrain following

## Virtual Reality Worlds

We can create virtual reality worlds with terrain, cultural objects, ground and atmospheric environment and different types of units controlled by AI that are used in different simulators, such as Full Mission Simulators (FMS) or Tactical Simulators.

Such a virtual world is simulated in real-time mode by a virtual world engine. All the missions that are created in mission editors are calculated and modelled by AI engine. In this virtual world different types of ground / aerial / marine units are moving, taking part in combats, attacking, marching, flying etc. according to their missions and led by AI according to the actual environment and combat conditions.

So, we can create a world that simulates some real combat or other military or civil actions. This virtual world can be used for example:

- ▶ for teaching army staff to command their formations in combat conditions in tactical simulator and to understand how to make correct tactical decisions in different situations
- ▶ for teaching pilots and other machine staff to operate their machine and combat with their machine in real combat conditions
- ▶ for displaying current combat to training instructors

## Core features of the worlds that we can simulate:

- ▶ Real-time simulation of the real world, including moving and combat actions of different unit types
- ▶ Correspondence of a virtual world to some real world area. Elevation map, terrain imagery, digital vector maps and 3D models typical for region are used to perform it. Random terrain generation abilities
- ▶ Thousands of simulated units in one virtual world
- ▶ Distributed synchronized world that allows different users to work with the same world simultaneously
- ▶ Integrated physics, including collision and damage processing. nVidia PhysX is used for high performance of such calculations
- ▶ Support of any amounts of viewpoints, including different 2D (paper scan-based map, digital vector map etc) or 3D views
- ▶ Rich logic of a simulated world, including bullet and shell ballistics depending on weather conditions same to ammunition and weapon characteristics, different parameters of unit that are taken into account during simulation process, trafficability etc. Each unit acts according to its characteristics using physics principles. All characteristics can be changed through characteristics editors and behaviour will change based on the new characteristics.
- ▶ Graphical editor of starting positions and mission tasks for unit and formation during simulation process
- ▶ Rich AI (Artificial Intelligence) that makes decision for each simulated unit (AI features are described precisely below)

## AI features of a simulated world:

- ▶ On each simulation step AI takes decision concerning the movement or action that should be made at the current step
- ▶ Complex behaviour patterns are taken into account (like march of different combat arm formations from point A to point B with boarding of infantry into vehicles and overrunning a position)
- ▶ Fire behavior modelling of each unit depending on a set of parameters, including line-of-sights checks to enemy units and types of weapons/ammunition and enemy units
- ▶ Entrenching of units. If units are entrenched, their damaging calculations are operated as for entrenched units.
- ▶ Path finding for unit movements. Plenty of parameters are taken into account: trafficability, bypassing obstacles, shortest distance to target, march rules etc.
- ▶ Damage calculations. All bullets and shells are flown by their ballistics, calculation of which depends on lots of properties of weapon and ammunition. Damage depends on collision detection for a bullet or distance to target to shell. Depending on damage type calculation, elimination or immobilization of a unit can take place.

## Tactical Simulators for officer's staff

We are experienced in creating tactical simulators for officer personnel.

Tactical simulator allows officers to train and improve their tactical skills of commanding formations in combat conditions. This is a collective training where a team of officers from both sides takes part in simulator training using a computer network. Officers study to plan and fight a battle, with possibilities of what-if tactical analysis and after-action review.

### Key points of our development:

#### Tactical simulation features

- ▶ Planning and fighting simulation modes
- ▶ Possibilities for what-if analysis: fast forward to see the result of current officers' decisions
- ▶ Support of units from different military branches taking part in simulation
- ▶ Map visualization with displaying a big picture of battlefield using formation signs
- ▶ On-map drawing mode for drawing the assumed enemy forces and other signs for decision making

#### 3D, terrain, AI and virtual reality world

- ▶ Real-time simulation of battlefield with huge amounts of units and formations
- ▶ True mathematical modelling of physics processes, like weapon ballistics depending on weaponry and ammunition properties. Each unit movement and action, weapon shot etc. is modelled individually using a strong mathematical model. nVidia PhysX is used for high performance of physics related calculations
- ▶ Modelling of real world area terrain using geospatial information and elevation data
- ▶ Strong AI for simulating movements and actions of virtual units, with line-of-sight checks, collision detections, path findings, damage logic etc.
- ▶ 3D visualization for modelling field officers' viewpoints and 3D free-fly mode for instructor situational awareness

#### Instructor operating development

- ▶ Instructor operating station for monitoring and controlling the simulation, the computer simulated forces are used for playing up via introducing battle events etc.
- ▶ Distributed events recordings for debriefing and after-action review
- ▶ Network simulator with supporting of plenty of workplaces for collaborative training of officers staff
- ▶ Strong unit, formation and mission editors for defining unit, weaponry and ammunition properties, formations structure, source geospatial data and map imagery, graphical setting of forces positions and their tasks etc

#### Geospatial development

- ▶ Geospatial based, geodesy and cartography are widely used in calculations, e.g. distances, coordinates etc

## Terrain Generation and Modelling

We have expertise in real world terrain modelling. So, we can recreate real world areas in our virtual world with maximum level of similarity. In this case maximum realism of training can be reached because trainees can be most prepared for further training in the same place in the real world, and the most important properties of the real world have already been taken into account in the simulation process.

We develop software for automatization of terrain modelling. Using an elevation map (in SRTM or other format), terrain imagery, digital vector maps and 3D models typical for the region our terrain generation module can create simulation and 3D models of the real-world area for their further use in simulation. Models are created both at simulation (for simulation algorithms) and 3D scene levels.

Obviously, military training in some real world area is the most much effective if trainees have experienced training in such a place with a simulator before.

### We simulate a real world area with the greatest level of similarity:

- ▶ Automatic modelling of a real world area terrain using an elevation map, terrain imagery, digital vector maps and 3D models typical for the region. Random terrain generation abilities
- ▶ Recreation of the real world relief (using SRTM or customer terrain elevation database) and its use in our simulation model. The relief is taken into account for aerodynamics modelling, calculating of radar zones, information purposes, possibility to move ground machines etc.
- ▶ Modelling of real world terrain types, for example lakes, forests, bogs etc. These types of terrain are take into account in the model and affect the movements of ground machines and soldiers. Basic information about the terrain types is got from digital vector maps in automatic mode
- ▶ Modelling of real world natural or cultural objects. For example, some single rock, tree or building, or a village or city. All these objects are taken into account in a simulation model, for example it affects moving or positioning of ground machines.
- ▶ Weather, lighting and atmospheric effects according to the real world area. All these effects are taken into account when modelling aerodynamic of flight.
- ▶ High realistic 3D visualization of a real world area. So, a pilot can train to fly with a helicopter simulator on some simulated area of the real world with the same relief, aerodynamics, same objects like cities, temples, towers etc. After such a simulation he can train with a real helicopter and know this area because he has flown there many times before with the simulator. Pilots reported about realism of visualization because they recognized the area in the simulator.
- ▶ Development of 3D models similar to a modelled region. These models are used on terrain creating algorithms



## Cartographic based programming

We have expertise in development of cartographic software.

### Examples of our services:

- ▶ Displaying of vector maps. We have even created our own framework for working with digital vector maps. We use vector maps visualization everywhere: in mission editors, for visualizations at dispatcher center or instructor operating stations etc.
- ▶ Geodesic calculations. For example, in our simulators every object or terrain is geodesically anchored according to the real world with the possibility of different geodesic calculations like distance measuring etc.
- ▶ Integration of digital vector maps into applications. For example, we dynamically display current aircraft positions, radar scans, landing beacon visualizations, airfield traffic patterns etc. just over the map in our different simulators. Or we use these maps in mission editors with the customized signs developed in-house for using them on the map
- ▶ Raster maps support. For example, we used raster maps for our tactical simulator (for the maps to look the same as the officers have got accustomed). These raster maps were anchored to geographic coordinates same to the virtual world, so we had military signs on the map to visualize current combat environment. In a similar way we used raster maps for mission editors.

## Computer Based Trainings / Training Procedure Devices

As we have expertise in production of FMS simulators we also can develop Computer Based Trainings or software for Training Procedure Devices for cost effective trainings. Under Training Procedure Devices we mean a simplified (in comparison with FMS) computer appliance with or without cockpits or motion platforms for crew members to practice flight procedures. So, we can make less expensive training solutions based on low-fidelity hardware but still with high-fidelity software.

For flight procedure trainers we can develop, for example, a non-board devices trainer which truly models on-board systems behaviour.

We can also develop a low cost flight trainer with computer display that has an adequate aero-dynamic model. Besides we can use our AI To simulate own and alien units for adjustment of trainee's skills.

You can leverage all high-fidelity software possibilities of Full Mission Simulators in Computer Based Trainings / Training Procedure Devices and we can develop it for our clients.

### Examples of our development possibilities:

#### Advanced simulation

- ▶ Real-time simulation for complex trainings of operating different machines or processes
- ▶ Development of driving and military ground machines simulators

#### Network & Interoperability

- ▶ Network interactions with other simulators or simulator parts using HLA 2010 Evolved protocol to train aircrew or for training of formation flights and execution of formation combat missions. Support of integration with other simulators for performing military cross-branches trainings with different types of simulators.
- ▶ Support of HLA integration with dispatcher center simulation to teach pilots and dispatchers (or air control officers) to work together.

#### Instructor operating development

- ▶ Instructor operating stations development where an instructor can monitor flight and mission tasks operating, state of on-board devices, environment in 3D and on the maps, introduce device malfunctions, etc. Also monitoring soft for a media classroom showing the current training in different views. Multi monitor workstations are used for providing such information.
- ▶ Recording of all distributed activities during simulation for debriefing and after-action review across distributed environment with the possibility to replay the simulation from any point. Action controls for starting, pausing or stopping the simulations.
- ▶ Development of mission and environment editors for the preparation of different training. Modelling of airport facilities and environment to teach pilots to operate with them

#### Tactical simulation for officer's staff development

- ▶ Development of tactical simulators: planning mode, what-if analysis of tactical decisions, on-map drawings, support of different military branches etc

#### Geospatial development

- ▶ Geospatial related development: using a map for dynamic air and ground environment visualization, for editing environment etc

#### Air traffic related simulation

- ▶ Virtual air traffic modelling using flight dynamic principles and with terrain following
- ▶ Modelling of airport related environment
- ▶ Radar work simulation with visibility zone calculation, azimuth grid and radar scan sweeps

#### Advanced flight simulation development

- ▶ Development of flight simulator software for teaching procedural and flight operations (turning on, driving, takeoff, landing, flight operating, manoeuvring, technical failures operating, firing, bombing, etc)
- ▶ Simulation of flight dynamics using physics principles, strong mathematical modelling, including aerodynamic modelling based on aircraft parameters. We have subject-matter experts for projecting and implementing such tasks.
- ▶ Modelling of atmospheric effects, weather, time-of-day and season conditions to train pilots to operate in different conditions (for example, such parameters as wind, temperature, turbulence, density, humidity, flying on low altitudes affect the aerodynamics of a flight; rain, snow, fog, clouds, sun shine, time-of-day light visual effects are modeled to train crew to operate in different visual conditions)

#### Hardware simulation

- ▶ Simulation of on-board systems based on electrotechnical schemes. Our electro-technical engineers can describe an on-board devices model, and implement it with our developers. We can implement inner logic, interactions with hardware devices, visualization of devices on Instructor Operating Stations we can implement for a trainee to be able to study working with on-board systems effectively

#### 3D, terrain, AI and virtual reality world

- ▶ Realistic modelling of a real-world terrain area with automatic approach, using elevation data, digital vector maps, terrain imagery and 3D models typical for region or automatic terrain generation according to the customer's needs
- ▶ Rich 3D visualization development of huge terrain areas in hundreds of thousands of square kilometers with correspondence of this area to the real world (same elevation, land types, objects etc)
- ▶ Virtual world and AI simulation development. Distributed algorithm that calculates movements and actions of all the units according to the tasks of mission editor and their parameters. AI simulates complex patterns like decision making, aim selection, shooting etc. We take into account lots of parameters when developing a virtual world: parameters of each ground or air units (configurable into editors), relief, land types, movement capabilities etc. True physics and ballistic principles are used in the simulation core. nVidia PhysX is used for high-performance of physics-related operations

## 3D Visualization

We can make 3D visualization of any simulator view or simulated environment.  
Examples of our software that can be developed:

- ▶ 3D visualization of virtual worlds on simulator display
- ▶ Free-fly camera for an instructor to see what is happening in any part of the simulated world in real time or on post-action basis
- ▶ Camera that is tied to a helicopter or another machine for an instructor to see the correspondent environment around the helicopter
- ▶ Any other case when 3D visualization is necessary

## Key points of our 3D visualization services:

- ▶ HLA module for attaching to a virtual world as a viewpoint, with support of HLA 2010 Evolved protocol
- ▶ Support of huge territories visualization (hundreds of thousands of square kms)
- ▶ Visualization of a virtual model of a real world area. Maximum similarity to the real world area
- ▶ High Quality realistic rendering. Staff from S.T.A.L.K.E.R computer game series
- ▶ Display of terrain that is taken from real-world elevation matrixes (like SRTM)
- ▶ Atmospheric, daylight, meteorological, lighting and special effects support
- ▶ Infrared and night vision goggles views support
- ▶ Embedded 3D editor for natural and cultural objects creating, deleting and positioning, terrain elevation modifications, forest and grass batch placing, rivers and lakes creation with ripples, waves and water flow defining etc.
- ▶ PhysX-based physics modelling
- ▶ Moving objects animation
- ▶ Rich library of 3D objects such as trees, buildings, culture objects, infantry, ground vehicles, helicopters, aircrafts etc. that are created by our 3D designers
- ▶ 3D sound generation engine





## OUR TECHNOLOGIES

## OUR TECHNOLOGIES

As the founders of MPS company have 12+ years of software development experience, our core principle is to productize everything for reusable modules for maximal reusability of code and extendibility of solution. This allows us to reduce drastically the terms and costs of simulator projects, as many of things are common for different simulators, and we do not have to waste time to develop such things again.



### Reusing the code

New simulators are developed using skeleton and reusing similar functionalities of the previously developed simulators. As all infrastructure code has already been developed, the developers have only to implement the specific logic of an existing simulator for new simulators, without writing an infrastructure code or writing a common simulator code.

Besides, at the same time this is the only way to create a high-quality extendable solution. If requirements has been changed at the time of the development process, we can make necessary changes with minimal efforts.



### Productization Approach

Furthermore, because of the productization approach we can faster develop alpha or beta versions of our software for customers. With this case the risks of requirements misunderstanding are drastically minimized that leads to the minimization of development terms and customer satisfaction. This approach also leads to the early start use of beta versions for integration development with other simulation environment components.



### Rapid prototyping

Another achievement of this approach is rapid prototyping. We can develop a simulator prototype in short time with small amount of human resources. This allows reducing time of the simulation development as the customer can introduce important changes to requirements on early stages.

So, we extract to reusable modules everything that could be reused in other projects. These modules are joined together into frameworks.

So, our core approach is to extract program modules and frameworks from our software to reuse them in different projects for rapid creation of high-quality extendable solutions.

## The list of modules and frameworks we developed:

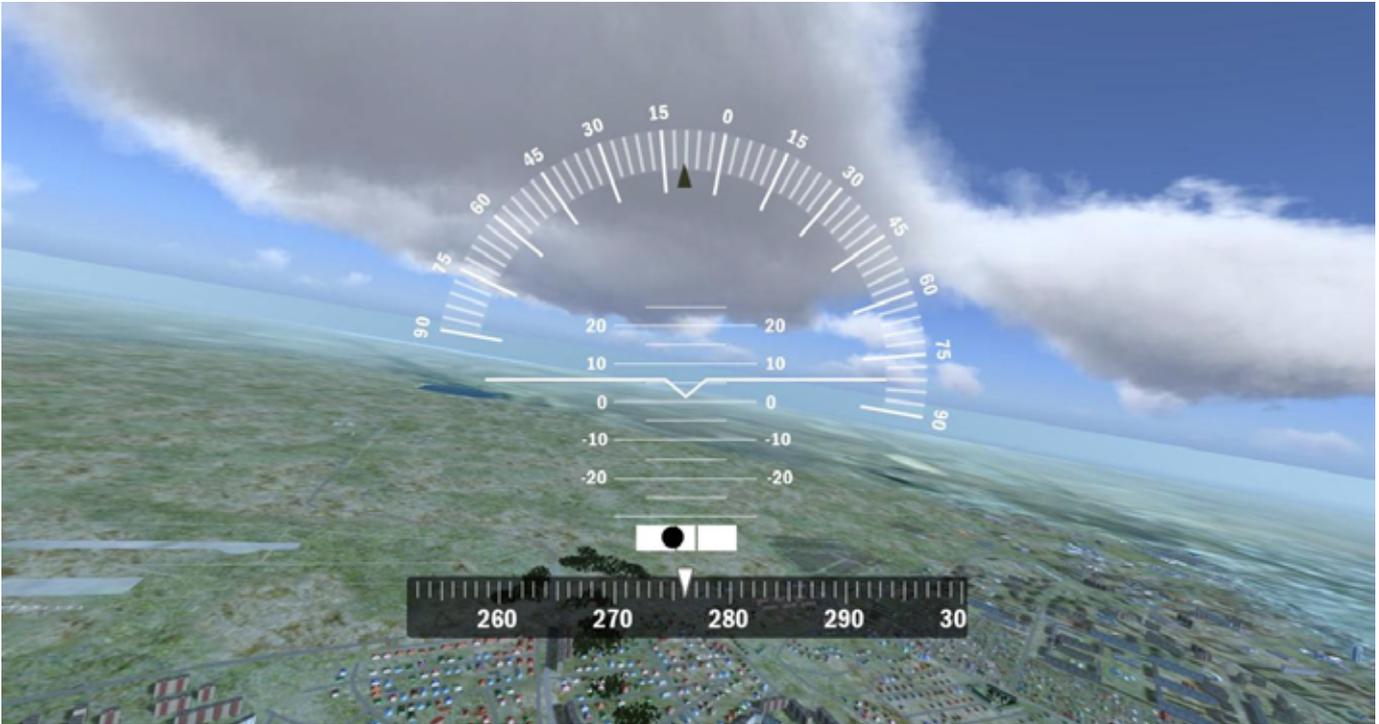
- ▶ [FFS/FMS Simulators Skeleton](#)
- ▶ [Air Traffic Simulation Skeleton](#)
- ▶ [HLA Framework](#)
- ▶ [On-Board Systems Framework](#)
- ▶ [On-Board Systems testing framework](#)
- ▶ [Digital vector maps based world generator](#)
- ▶ [Relief modelling framework](#)
- ▶ [3D Visualization Framework](#)
- ▶ [Virtual Reality Engine](#)
- ▶ [AI \(Artificial Intelligence\) Engine](#)
- ▶ [Extended Digital Vector Maps Framework](#)
- ▶ [Remote Application Launcher Framework](#)
- ▶ [Solution Testing Framework](#)
- ▶ [Self-Made Data Framework \(Plasticine\)](#)
- ▶ [UI Framework](#)
- ▶ [Automatic UI generation module](#)
- ▶ [Responsive Event-Driven User Interface Framework](#)
- ▶ [Exercises preparation center \(Characteristics editor, Environment editor, Mission editor\)](#)



## GRAPHICS AND SCREENSHOTS

## GRAPHICS AND SCREENSHOTS

### Out-of-cockpit view



### 2d visualization of on-board system devices

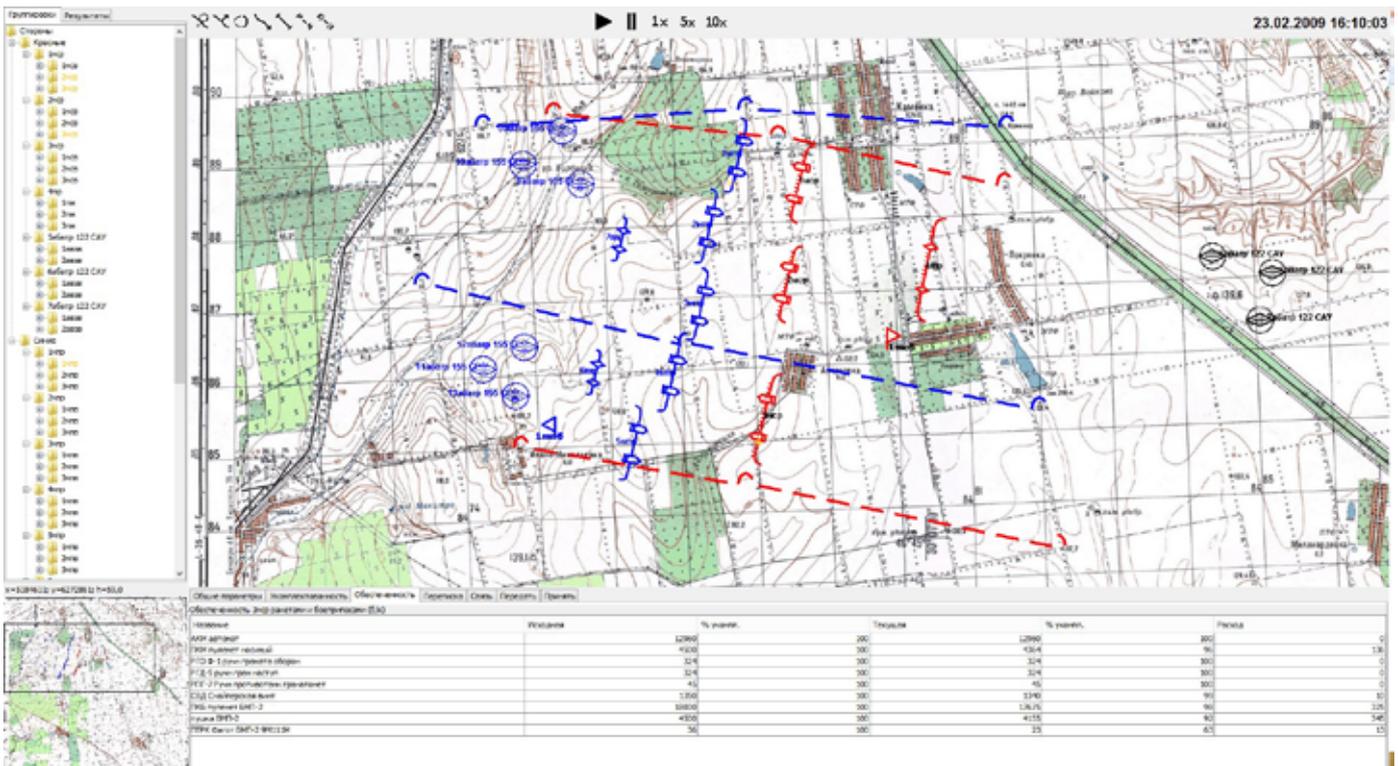


## GRAPHICS AND SCREENSHOTS

### 3d visualization of on-board system devices

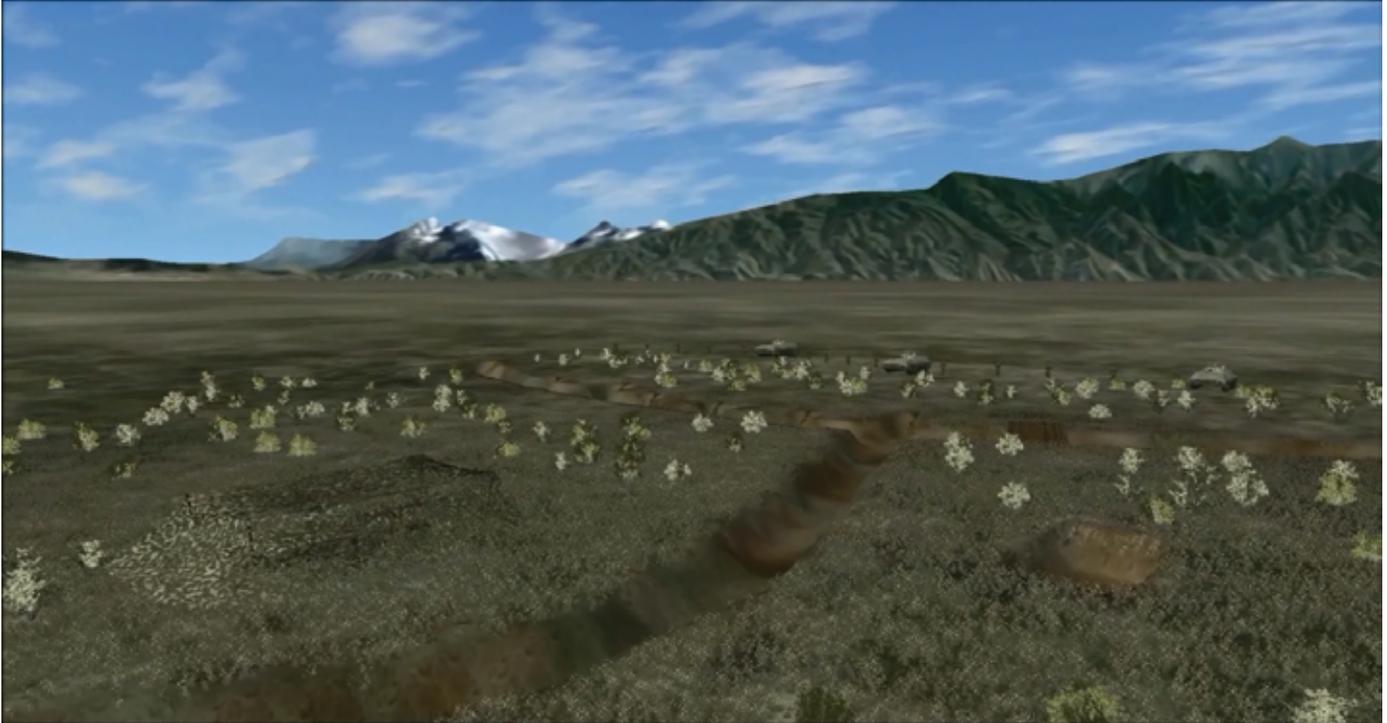


### Tactical simulator. Topographic view

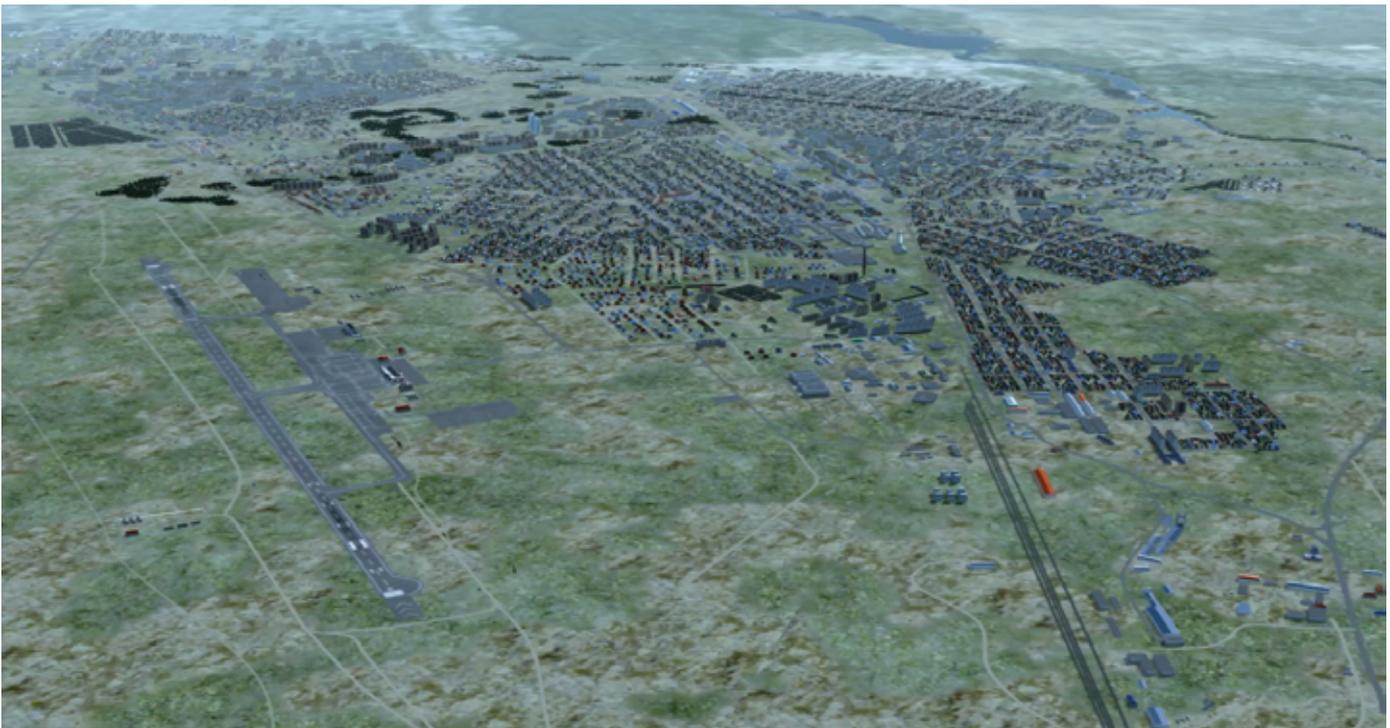


## GRAPHICS AND SCREENSHOTS

Tactical simulator. 3D visualisation of the attack of mechanized infantry

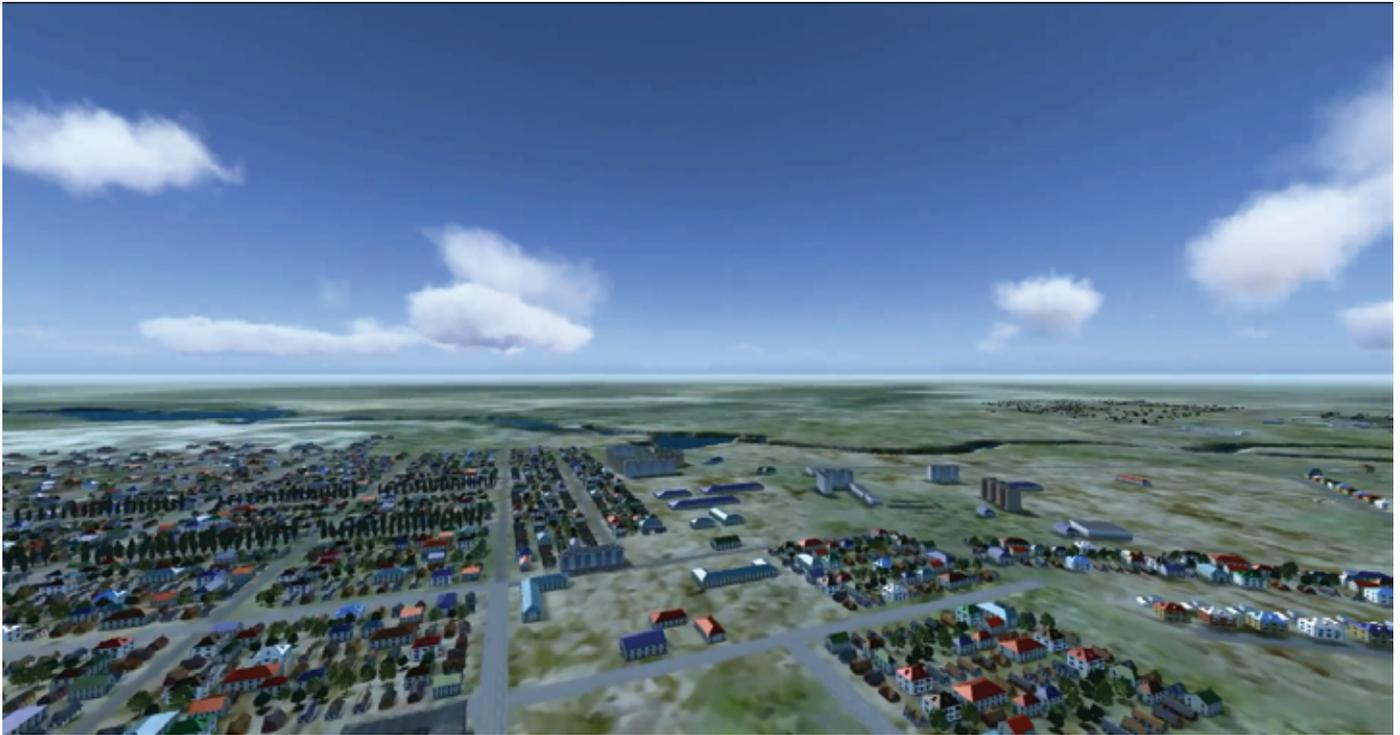


3d restoration of the real-world city



## GRAPHICS AND SCREENSHOTS

### Relief modelling



### Modelling of city blocks typical for a region

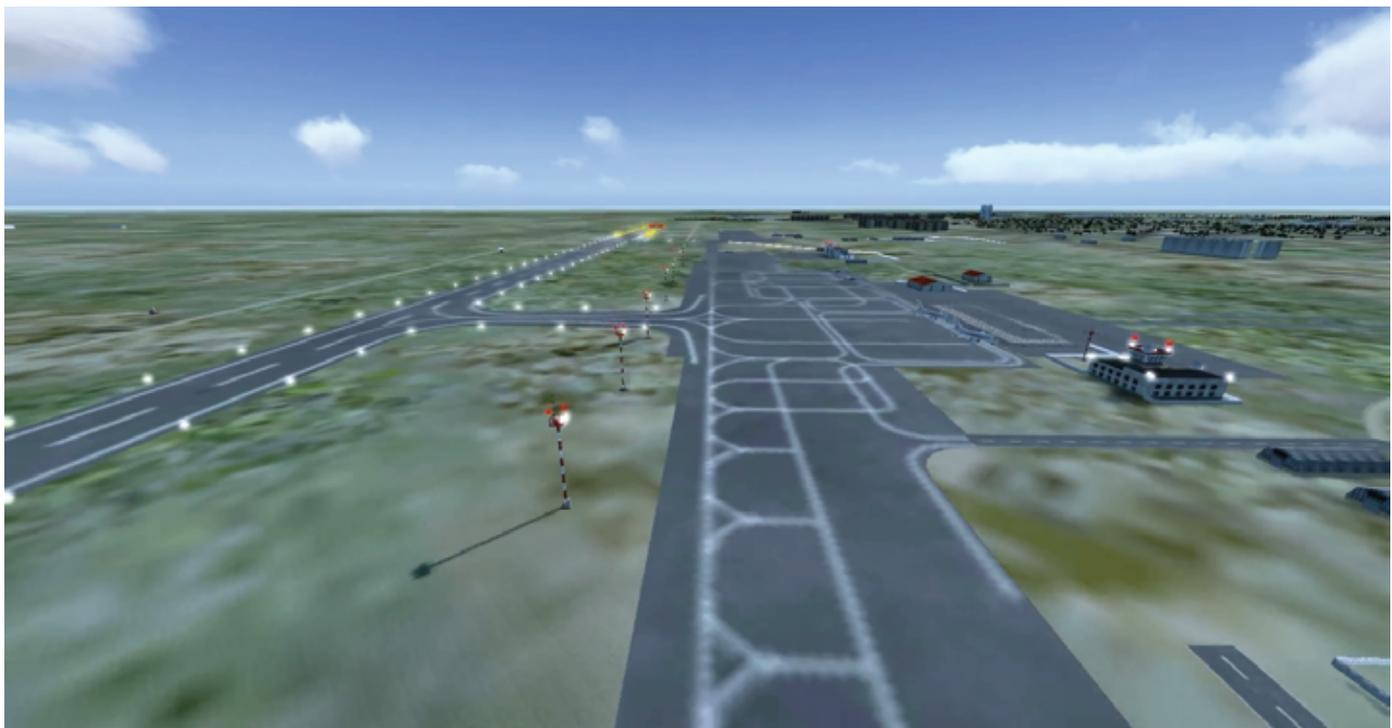


## GRAPHICS AND SCREENSHOTS

### Modelling of cultural objects



### 3d visualization of airdrome environment



## GRAPHICS AND SCREENSHOTS

### 3d visualization of clouds



### Different 3d models

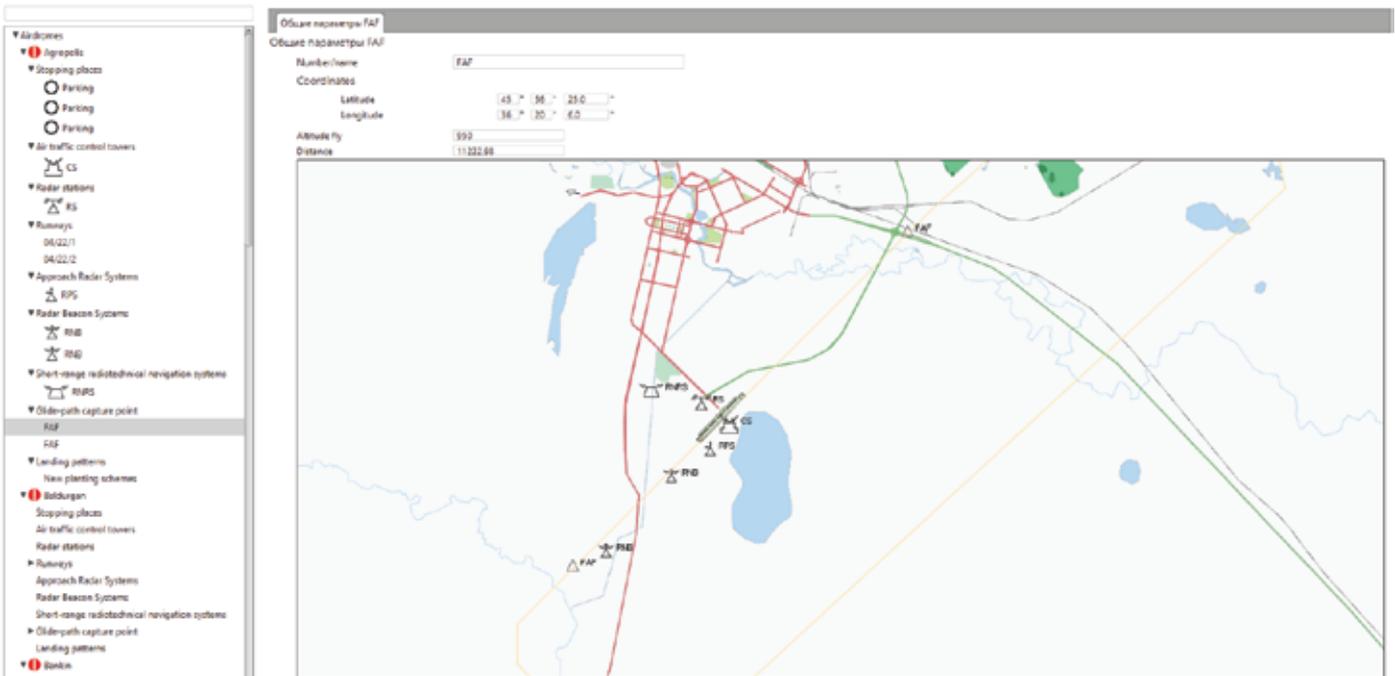


## GRAPHICS AND SCREENSHOTS

### 3d visualization of armed vehicles

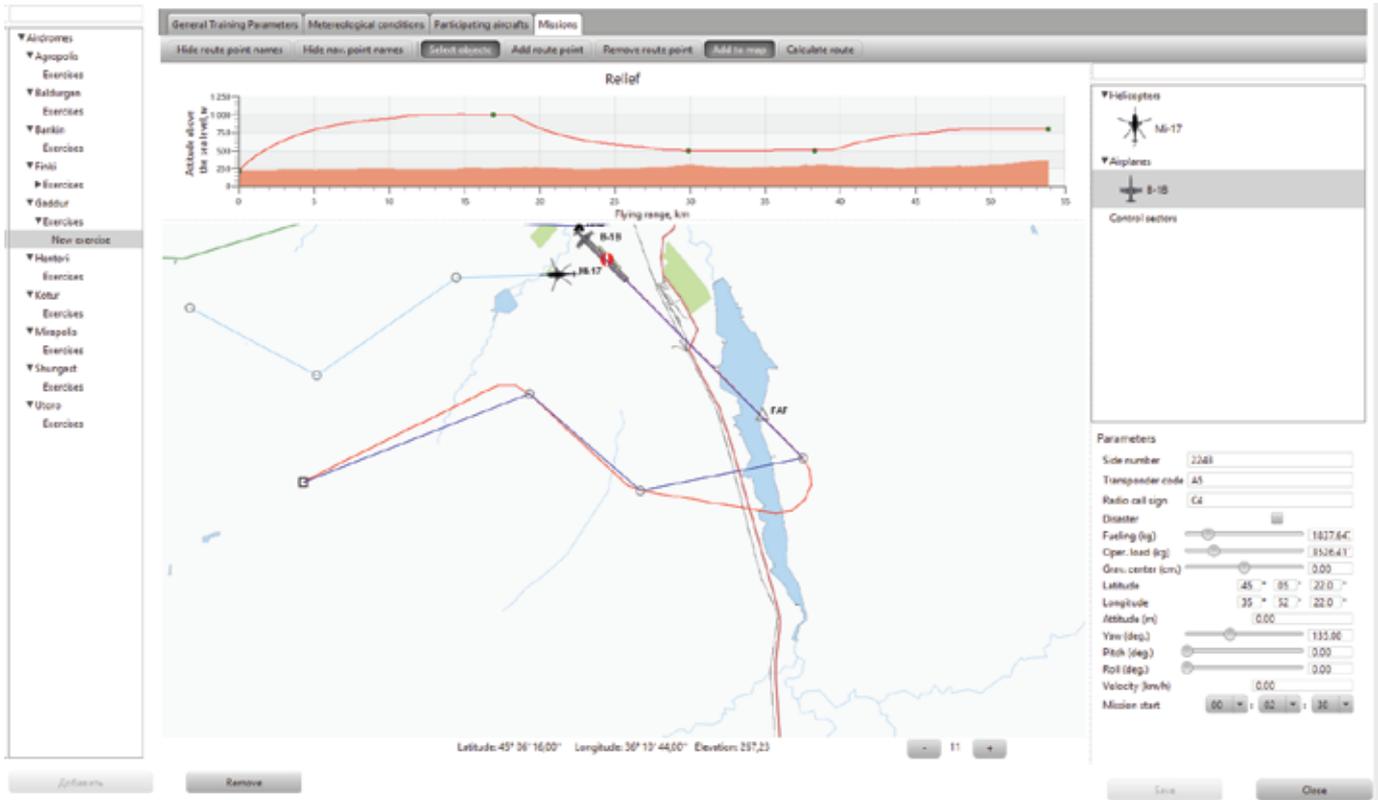


### Environment editor



# GRAPHICS AND SCREENSHOTS

## Trajectories editor



**General Training Parameters** | Meteorological conditions | Participating aircrafts | Missions

Hide route point names | Hide nav. point names | Select objects | Add route point | Remove route point | Add to main | Calculate route

**Relief**

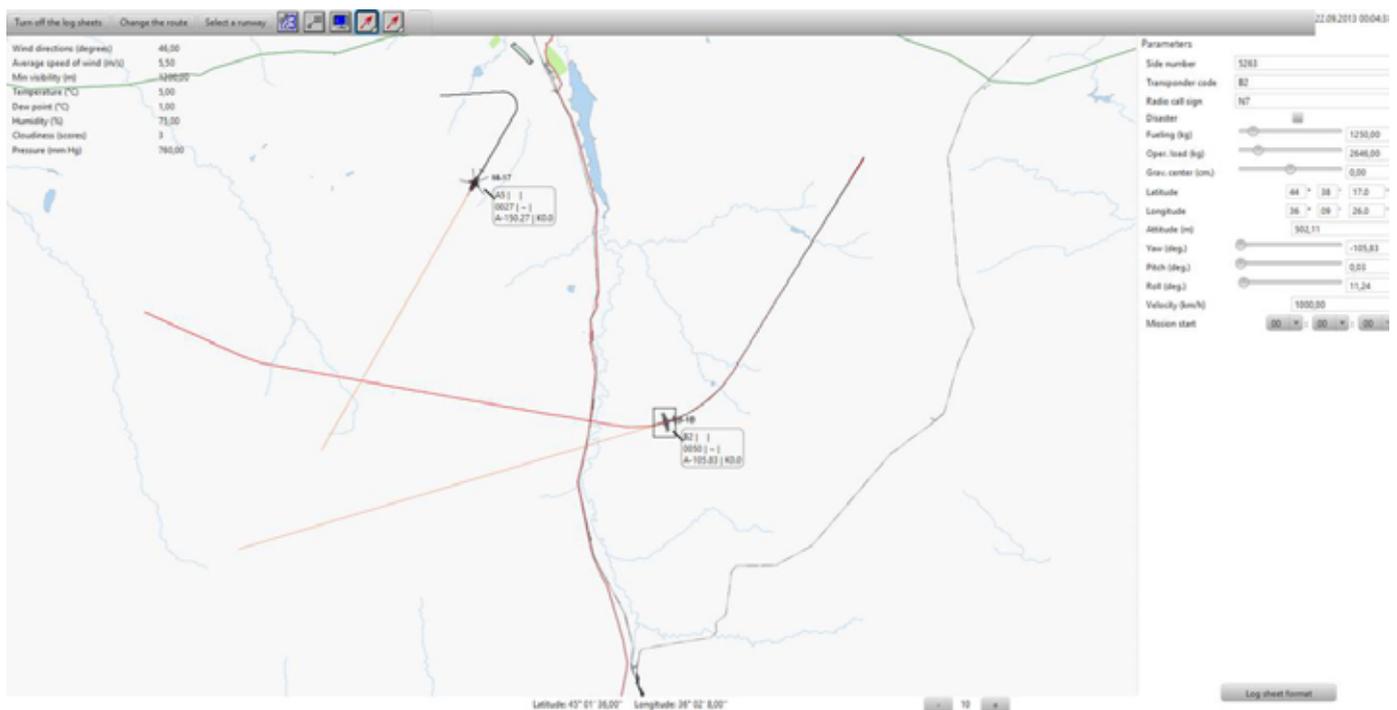
Altitude above the sea level (m)

Flying range, km

Parameters:

- Side number: 2281
- Transponder code: A5
- Radio call sign: C4
- Disaster: [Slider]
- Fueling (kg): 1827.64
- Crew load (kg): 8526.41
- Crew center (cm): 0.00
- Latitude: 45° 05' 20.0"
- Longitude: 35° 52' 22.0"
- Altitude (m): 0.00
- Yaw (deg.): 135.00
- Pitch (deg.): 0.00
- Roll (deg.): 0.00
- Velocity (km/h): 0.00
- Mission start: 00 | 52 | 30

## On-map air situation



Turn off the log sheets | Change the route | Select a runway

22.09.2013 00:04:31

Wind direction (degrees): 45.00  
 Average speed of wind (m/s): 5.50  
 Min visibility (m): 1200.00  
 Temperature (°C): 5.00  
 Dew point (°C): 1.00  
 Humidity (%): 73.00  
 Cloudiness (score): 3  
 Pressure (mm Hg): 760.00

Parameters:

- Side number: 5282
- Transponder code: B2
- Radio call sign: N7
- Disaster: [Slider]
- Fueling (kg): 1250.00
- Crew load (kg): 2640.00
- Crew center (cm): 0.00
- Latitude: 44° 38' 17.0"
- Longitude: 36° 09' 26.0"
- Altitude (m): 502.11
- Yaw (deg.): -105.83
- Pitch (deg.): 0.05
- Roll (deg.): 11.24
- Velocity (km/h): 1500.00
- Mission start: 00 | 00 | 00

Log sheet format