



CLEAN INNOVATIVE TECHNOLOGIES

INTERNATIONAL CONSORTIUM

*“Clean innovative technologies”*

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## ***COMPETENCE***



***Specialization of the International consortium partners:***

- 1) ***development and implementation of innovative environmentally friendly resource-saving breakthrough technologies;***
- 2) ***scientific researches of optimality of technical solutions;***
- 3) ***designing appropriate, primarily modular transportable equipment;***
- 4) ***automation of technological processes;***
- 5) ***IT-technologies;***
- 6) ***certification and standardization of products for various purposes;***
- 7) ***manufacture and supply of engineered equipment;***
- 8) ***designing of objects of any complexity;***
- 9) ***construction, installation, commissioning and other work, allowing to build objects «turnkey»;***
- 10) ***warranty and post-warranty service of equipment;***
- 11) ***development, manufacture and supply of chemical products;***
- 12) ***cleaning of reservoirs and tanks for petroleum products;***
- 13) ***collection, transportation, decontamination and recycling oil-containing waste of III-IV classes of danger;***
- 14) ***other, aimed at supporting domestic innovation activities.***

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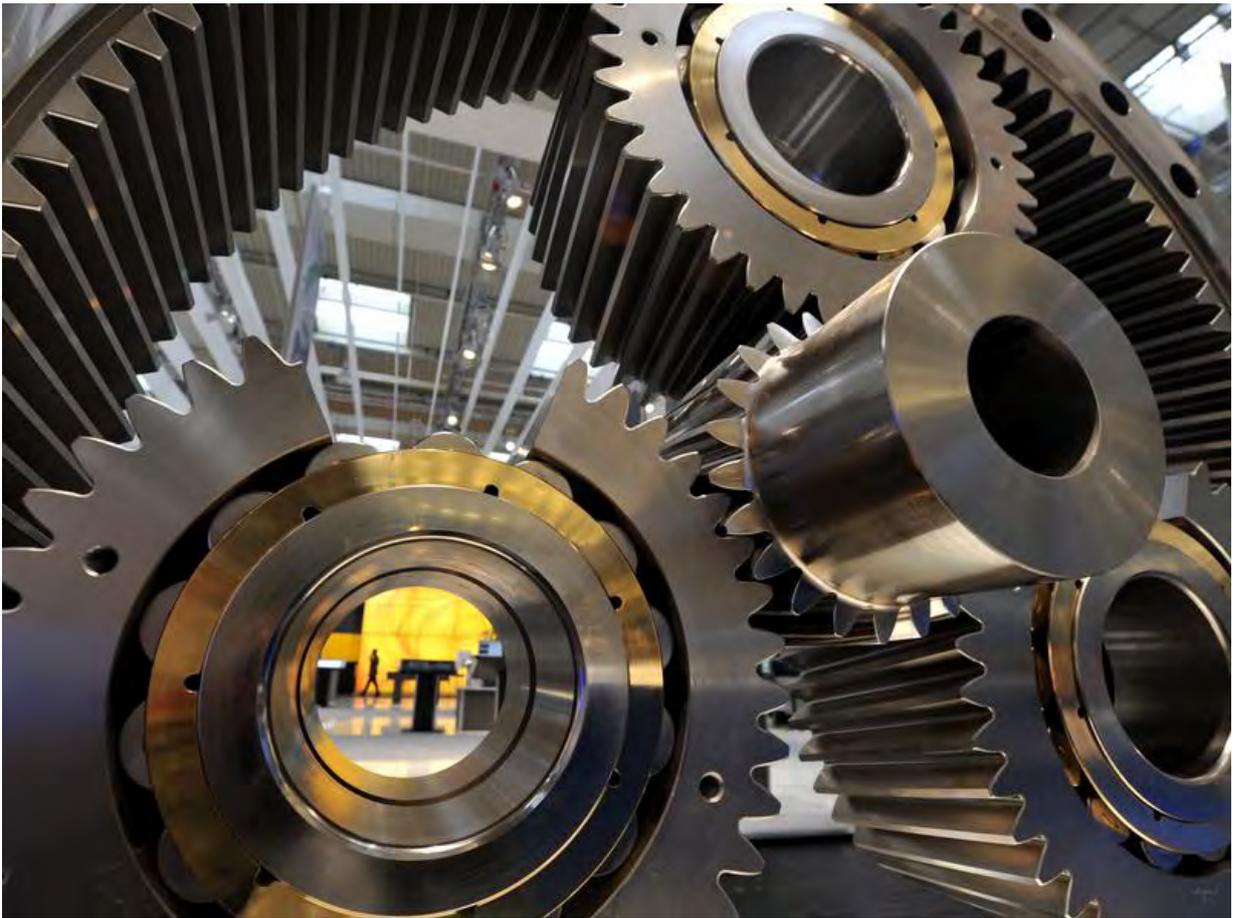
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***MECHANICAL ENGINEERING***  
*and*  
***INSTRUMENT MAKING***



*in the interests of  
military-industrial complex,  
nuclear industry,  
transport industry  
and others*

**1. Robototic systems, exoskeletons etc.  
for  
solutions to various technological problems,  
including on objects with high radiation**

*The proposed technologies and equipment, namely **robotic tools and complexes** for conducting **radiation reconnaissance, inspection, accident response, rescue and technological work**, including at facilities with high radiation.*

*The activities of nuclear power plants (NPPs) are accompanied by potentially dangerous factors for humans (levels of radiation, humidity and heat), so it is necessary to implement systems that can perform labor-intensive tasks for people that threaten their health.*

*With the help of robotics at NPPs, it is possible to **clear territories of infected objects, load nuclear fuel, make maps of radioactive contamination**, etc. Robotic systems can be used in work related to **decommissioning of spent power units and in work with radioactive waste**. Robots can also act as carriers of equipment for the inspection of radiation-hazardous objects. At the same time, the work itself can be performed both outdoors and indoors, in various conditions (frost, precipitation, increased radiation).*

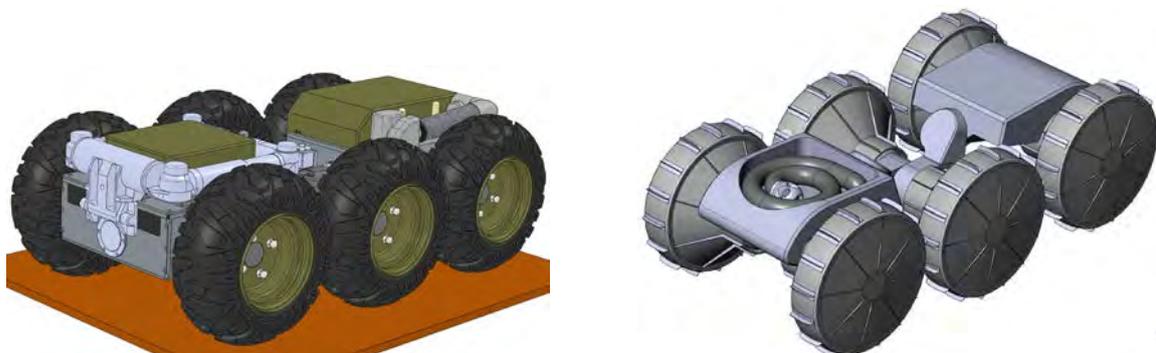
***Robotic systems can be developed and delivered for specific tasks defined in the technical specification.***

*Developed, implemented, or at various stages of implementation, for example:*

**1.1. Mobile robotic complexes**

*are intended for exploration and carrying out primary measures to eliminate the consequences of emergencies, including in the conditions of emergency mining, as well as search and detection of victims in the conduct of mining rescue operations. Mobile robotic complexes (MRCs) equipped with a manipulator can perform the main functions of instrumental influence on machines, mechanisms, communications, etc. (closing-opening of cranes of pipeline communications, etc.).*

*Have been developed two modifications with a total weight of 150 and 400 kg. Is being developed a modification weighing up to 50 kg. MRC can be manufactured in a sealed and explosion-proof version.*



### 1.1.1. Mobile robotic platforms.

The proposed mobile robotic platforms can consist of movement systems (chassis), lower-level control, power supply, external charger, as well as attachments and additional equipment..



Attachments include:

- ✓ radiation, chemical, and visual reconnaissance devices (can be mounted on swivel and / or retractable turrets);
- ✓ manipulators with a load capacity of up to 20 kg;
- ✓ two-handed manipulators with a load capacity of up to 10-20 kg on the arm and up to 40-50 kg on the torso;
- ✓ manipulator masts with 3D video camera;
- ✓ portable x-ray machines;

Additional equipment includes:

- ✓ top-level management systems;
- ✓ radio channel;
- ✓ units additional rechargeable batteries;
- ✓ gas generators with fuel tank;
- ✓ sets of metal wheels;
- ✓ sets of wheels with polyurethane running track.



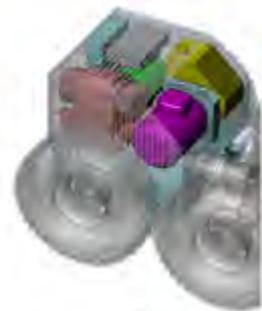
Manipulator



Deployable mast  
with tilt and rotation drives  
TV cameras



Manipulator system  
with two hands  
on the torso



Hybrid  
power plant

### **1.1.2. Base vehicle**

*Based on the created base vehicle, it can be build robotic complexes for use in various purposes and conditions.*

*For example, a basic vehicle (BV) as part of robotic complexes (RC-DP) designed to localize contamination of surfaces of areas of premises or terrain, after various operations are carried out there, for example, to extinguish a fire.*

*The basic vehicle as part of a robotic complex using mounted technological equipment must perform the following technological operations in radioactively contaminated areas:*

- ✓ *independent extension to the work area with a device for applying a polymer foam composition installed on it;*
- ✓ *applying a localizing foam polymer composition using a high pressure unit and a controlled spray gun;*
- ✓ *visual monitoring of decontaminated areas.*

*Environmental parameters in the work area BV:*

- ✓ *operating temperature-from 0°C to +60°C;*
- ✓ *relative humidity at a temperature of +25°C no more than 90%;*
- ✓ *the temperature of individual fragments of the surface of the base on which the mobile device moves can reach 300°C;*
- ✓ *gamma radiation exposure dose rate not less than 102 Gy/hr;*
- ✓ *integral exposure dose of gamma radiation is at least 104 Gy.*

*The BV operates reliably both in untrained natural conditions and in an environment specially adapted for human habitation (inside houses, in transport communications, etc.). The Bv design provides high mobility, as well as the installation of various equipment for carrying out certain operations.*



### **1.1.3. Mobile device.**

Based on the created mobile device, it can be build various robotic complexes using a variety of attachments.

The following is an example of using a mobile device (MD) to capture and transport roll-up (MRC1) and unwinding (MRP1) mechanisms both before and after decontamination. It is envisaged that the movement of PA will take place mainly in closed industrial premises. In these areas, there may be narrow straight corridors, turns, cable paths, thresholds and slopes (ramps). All this imposes additional requirements for maneuverability and turnability of the mobile device, especially in the presence of "clumsy" swivel brackets.

If necessary, the mobile device moves (both forward and reverse) on a flat solid surface (concrete, asphalt, metal floor, ceramic tile) and can overcome the following obstacles:

- ✓ thresholds up to 50mm high;
- ✓ slopes up to 15 degrees;
- ✓ rectangular recesses (cable channels) up to 20 mm wide.

Also, it provides straight-line traffic on a lane no more than 1m wide.

Climate conditions:

- ✓ operating temperature – from minus 10°C to plus 40°C;
- ✓ relative humidity – no more than 80% at a temperature of plus 25°C;
- ✓ atmospheric pressure – normal.

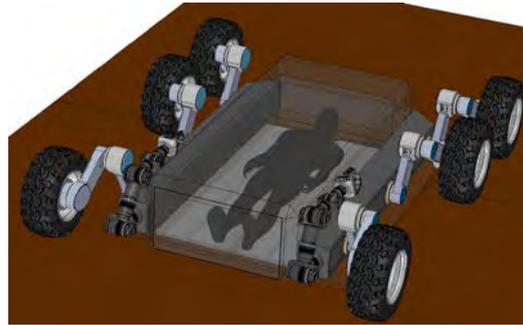
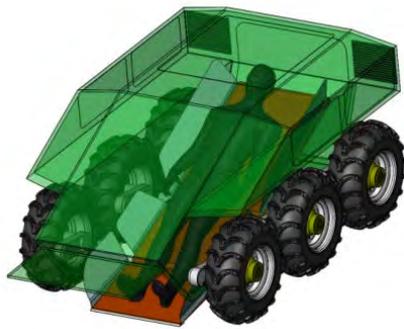
In addition, the operation of the mobile device is associated with exposure to radiation: the maximum exposure dose of ionizing radiation – 10<sup>2</sup> Sv/h.

Due to the absence of open cavities, pockets, etc. the proposed mobile device can withstand treatment with water and aqueous solutions, including surfactants, as well as mechanical action to remove radioactive contamination.



#### **1.1.4. Mobile robotic complexes for evacuation of victims from the scene of accidents.**

*Designed for collecting and evacuating victims from the scene of an accident or emergency. MRC for evacuation consists of a self-propelled high-pass chassis, systems for collecting the victim (injured) and loading it on board a mobile robot, power supply, technical vision, communication, remote control. Additionally, they can be equipped with one or two manipulators, a life support system, and other systems.*



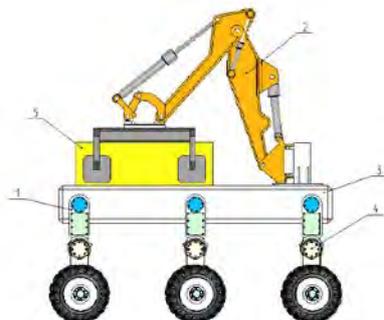
#### **1.1.5. Transport robotic platforms.**

*Robotic transport platforms (TRPs) are designed for transportation of various cargoes, including dangerous ones, at nuclear industry enterprises. They consist of a movement system and a manipulator.*

*When moving with a load, the TRP can overcome:*

- ✓ *small obstacles, slopes, slopes, rapids, barriers up to 15-20 degrees;*
- ✓ *barriers with a height of 700 mm and a width of 300 mm with support on an obstacle, obstacles less than 200 mm – stepping over;*
- ✓ *inclined surfaces with support in a horizontal position of the TRP body and the load, which is carried out due to the joint work of different locomotor modules.*

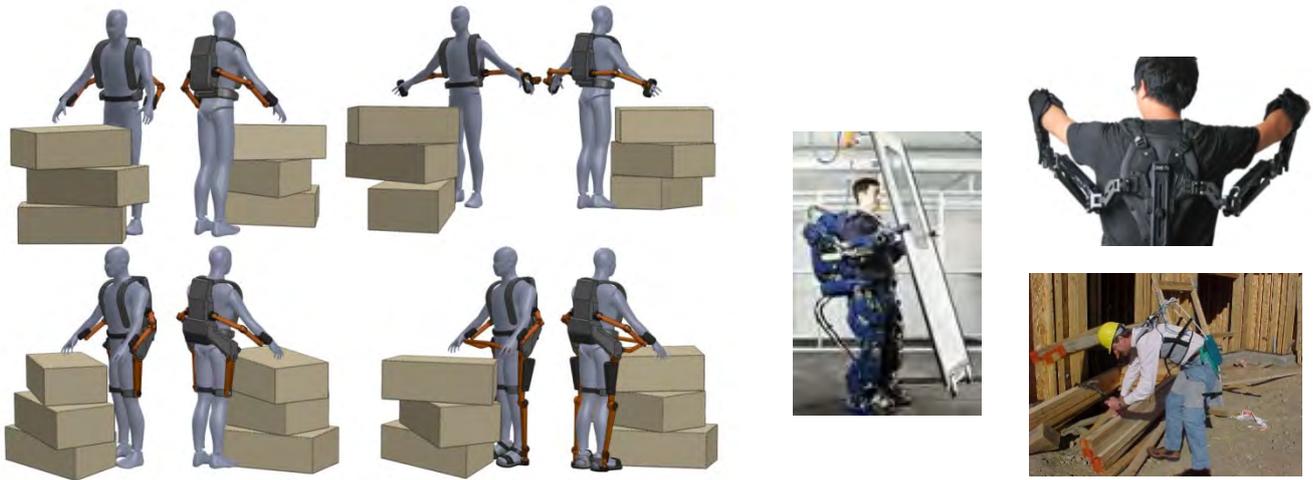
*The turn can be performed in on-board mode (due to the difference in speed or direction of rotation of the wheels on different sides).*



## 1.2. Exoskeletons.

Designed to increase physical capabilities, increase productivity and reduce the impact of weight, dynamic and static loads on the functional state of the body and employee performance, reducing physical fatigue.

Industrial exoskeletons are used to work with heavy tools when performing monotonous routine operations (shifting loads with frequent slopes, clearing debris, lifting and carrying supports, etc.) or to support hands when working above the head.



## 1.3. Self-propelled manipulators for assembling the arched mounts

Designed for work on unloading, delivery and construction of permanent metal arch supports during mining operations with an area of 15-20 m<sup>2</sup> and provide:

- ✓ **safe operation** by temporarily blocking the bottom hole space,
- ✓ **reducing the physical load** on sinkers when installing the upper arch elements,
- ✓ reduction of time for construction of the support and, **consequently**, a **significant increase** in the production of a team of tunnellers in **the working shift**.

The movement of the self-propelled manipulator is carried out on a mass-produced suspended monorail.



## **2. Innovative non-standard equipment, machines, mechanisms, etc.**

The proposed **innovative non-standard technological and bench equipment** allows to **automate production operations, improve product quality and increase the company's profit** by increasing production efficiency. Such equipment is designed and manufactured for specific production tasks facing the customer.

The non-standard equipment developed by us is designed on the basis of the technical specification and meets all the requirements of the customer, including the level of performance, intensity of use, climatic conditions of operation, etc. This equipment is also used to solve the problem of import substitution.

Examples of implemented projects for **non-standard equipment** are shown below.

### **2.1. Technological and bench equipment for assembly and welding of products, including:**

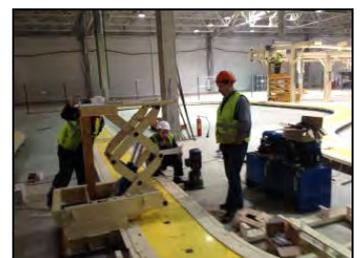
#### **2.1.1. Rotary table welding robot.**



#### **2.1.2. Assembly line of engines.**

The proposed equipment allows you to automate production lines for the production of various types of products. This project includes:

- ✓ execution of works on designing of the line,
- ✓ programming,
- ✓ production,
- ✓ supply of equipment and materials,
- ✓ installation and commissioning works.

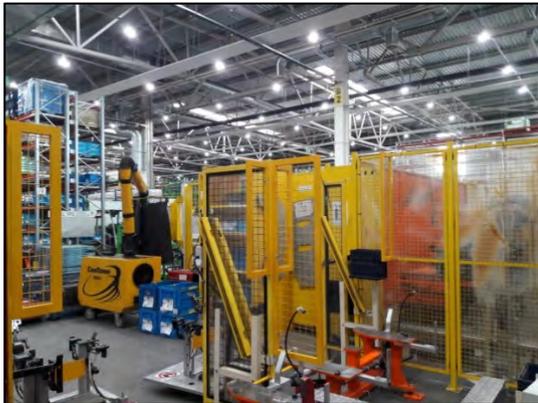


### ***2.1.3. Technological equipment for assembling the spars.***

*The proposed equipment allows to automate (using a robot or manipulator) welding/riveting of products and their components produced by the manufacturer. Below is an example of such equipment, namely technological equipment for the assembly of spars.*



### ***2.1.4. Technological equipment for assembling car parts.***



### ***2.1.5. Devices for welding the cab frame.***

*The offered equipment makes it possible to simplify manual welding of components of products manufactured by the manufacturer. Below is an example of such equipment, namely devices for welding the frame of the cabin.*



**2.2. Training and bench equipment, including:**

**2.2.1. The basic part of aircraft simulator.**



**2.2.2. Stands for the assembly of car seats.**



**2.2.3. Stands for testing, debugging and simulations of various operations.**

*Stand for setting  
the propeller-steering columns*



*Stand for the assembly  
of car seats*

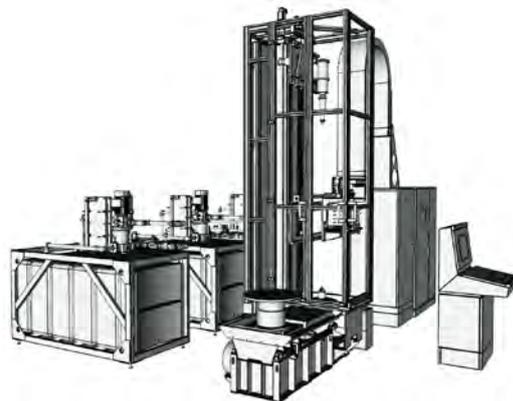


**2.3. Machines and plants for induction heat treatment (quenching and tempering) with high frequency currents (HFC), including:**

**2.3.1. Universal quenching machine for surface quenching HFC of different types of parts (bushings, axles, shafts, gears)**

The universal induction quenching machine HFC quenches parts with a length of 2000 mm, a diameter of 300 mm and a weight of up to 500 kg. Consists of:

- ✓ quenching machine for quenching water sprayer, which is mounted on:
  - mechanisms for moving the upper center,
  - table rotation mechanism,
  - sprayer with quenching liquid supply and collection system for cooling parts;
- ✓ HFC equipment that includes:
  - the power source, which is a transistor converter with a power of 250 kW and a frequency of 10 kHz, complete with a cooling station for the elements of the heating station,
  - capacitor bank,
  - quenching transformer with inductor and short circuit;
- ✓ station for circulating the quenching fluid;
- ✓ filters for cleaning the quenching liquid;
- ✓ control panel;
- ✓ air preparation units;
- ✓ flue gas cleaning systems.



**2.3.2. Installation for induction heating and straightening of stamped parts of medium and large diameter pipelines.**



**2.3.3. Robotic automatic machine for induction heat treatment of parts with a laser marking unit and automatic determination of the hardness of processed parts.**



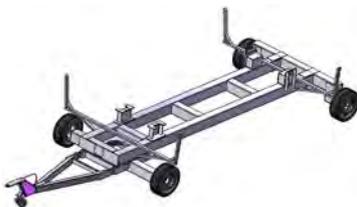
**2.4. Mechanisms of displacement, measurement and positioning, including:**

**2.4.1. Moving system of sliding roof of a cruise ship.**



**2.4.2. Transport carts for various operations (indoor and outdoor).**

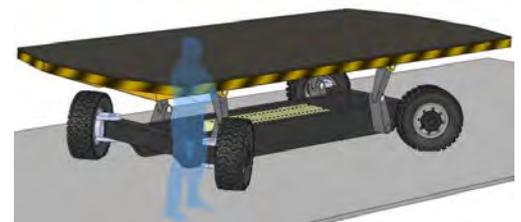
*Transport cart*



*Lift table*



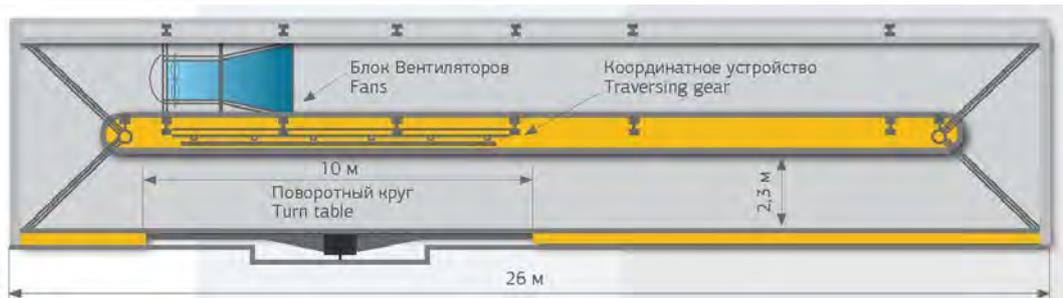
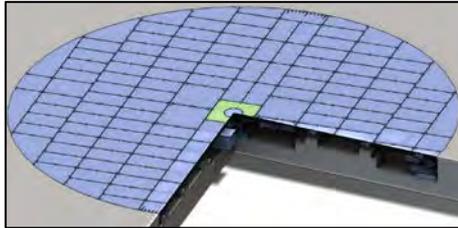
*Transfer car*



**2.4.3. A measurement system for pipes.**



**2.4.4. The positioning of the landscape, rotary table.**

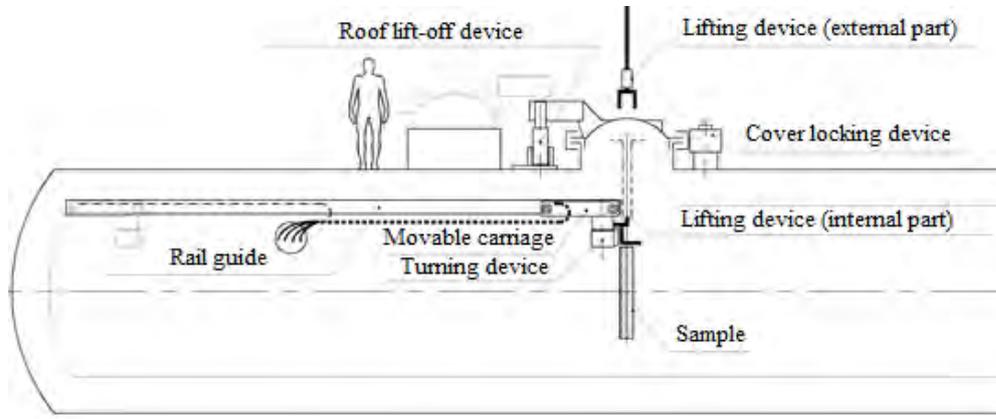


**2.4.5. System for installing the bottom of the car body on skids.**



## 2.5. The equipment for retrofitting obsolete production lines.

The proposed equipment allows to modernize production and make the transition to new modern technologies. Below is an example of one of these projects, namely the re-equipment of a variable pressure pool for testing hydroacoustic coatings.



**3. Innovative  
technologies and equipment  
for  
robotic and mechatronic systems  
industrial and special purposes, including:**

**3.1. Synchronous motors with permanent magnets**

*Brushless built-in synchronous motors with permanent magnets (gate motors) are designed to solve problems that require high specific characteristics in small dimensions.*

*The developed and patented unique design and production technology of electric motors ensures high efficiency and low losses due to the tight laying of conductors in the groove and optimized heat sink.*

*The proposed synchronous motors replace products TQ-Robodrive, Kollmorgen, Parker, Allied Motion, Wittenstein, MTI Torque Systems etc.*

*Advantages:*

- ✓ *developed and manufactured in Russia from domestic components;*
- ✓ *bodyless design for flexible integration into the target system;*
- ✓ *hollow rotor for transit circuits;*
- ✓ *materials with high thermal conductivity and a maximum temperature of + 180°C;*
- ✓ *high efficiency due to tight laying of conductors in the groove;*
- ✓ *small moment ripples due to optimal electromagnetic structure;*
- ✓ *built-in temperature sensors;*
- ✓ *version with Hall and water leakage sensors;*
- ✓ *resistance to ethylene glycol and other media;*
- ✓ *operating ambient pressure up to 70 MPa.*



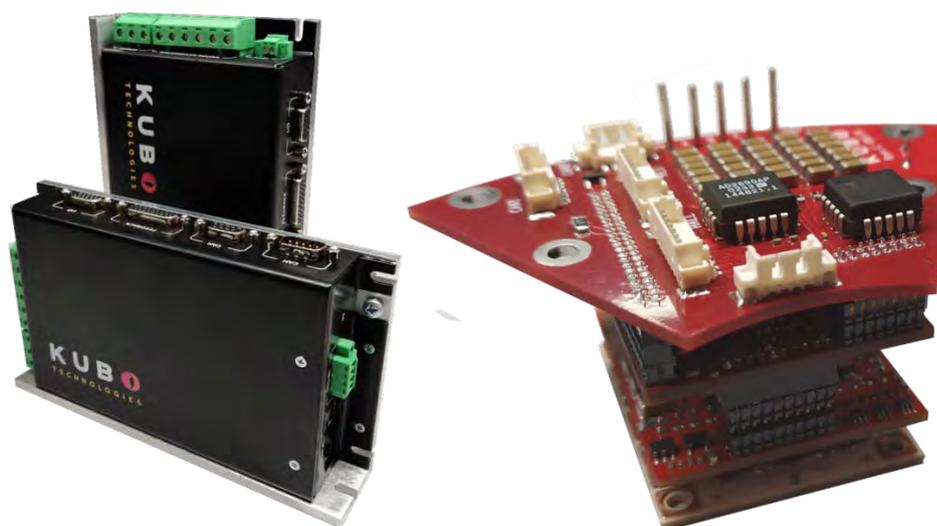
### **3.2. Digital servo amplifiers with interfaces EtherCAT u CAN**

*Digital servo amplifiers with EtherCAT and CAN interfaces are designed for controlling synchronous electric machines with permanent magnets as part of mechatronic and robotic systems.*

*The offered solutions replace Elmo Motion Control, Ingenia Motion Control, Advanced Motion Control and other products on the domestic market..*

*Advantages:*

- ✓ *complete solutions for robot hinge control;*
- ✓ *high specific power and small dimensions;*
- ✓ *EtherCAT, CAN, RS232, Ethernet interfaces;*
- ✓ *developed peripherals for connecting feedback sensors;*
- ✓ *it is possible to order the performance of servo amplifiers on the domestic element base, including in radiation-resistant design and hybrid technology.*



**4. Innovative technologies and systems for:**

**4.1. Accelerated automation of technical products, including:**

**4.1.1. Wagon W17K-02.**

*Accelerated automation of the technical product air-wheeled self-propelled cargo car W17K-02 produced by the Kopeysk machine-building plant, which is designed for transporting ore and coal from the bottom to other delivery means in order to ensure continuous operation of combine complexes.*



*Within the framework of this automation (for 4.5 months):*

- ✓ *hardware controls were developed and manufactured;*
- ✓ *the digital platform for accelerated automation SignaLogic was introduced;*
- ✓ *factory and bench tests of the W17K-02 were conducted.*

**Local control panel**



**Magnetic station management**



**The elements of the management system**



#### **4.1.2. KSP-35 tunneling combine.**

*Accelerated automation of the technical product KSP-35 tunneling combine produced by Yasinovatsky machine-building plant, which is designed to transport personnel and cargo to mining operations.*



*Within the framework of this automation (for 4.5 months):*

- ✓ *hardware controls were developed and manufactured;*
- ✓ *the digital platform for accelerated automation SignaLogic was implemented;*
- ✓ *factory and bench tests of the KSP-35 Combine were conducted.*

**The elements of the blocks of automation**



**Local control panel and operator screens**



#### **4.1.3. Diesel locomotive ZIM-120.**

*Accelerated automation of the powerful and eco-friendly Diesel locomotive ZIM-120 – one of the main components of the underground transport system designed to transport personnel and cargo to mining operations.*

*Within the framework of this automation (for 4.5 months):*

- ✓ *hardware controls were developed and manufactured;*
- ✓ *the digital platform for accelerated automation SignaLogic was implemented;*
- ✓ *factory and bench tests of the Diesel locomotive ZIM-120 were conducted.*



#### **4.2. Continuous monitoring, control of the state of physical parameters (quantities) and management of various objects.**

*The proposed systems are designed for continuous monitoring, monitoring of the state of physical parameters (quantities) and management of various objects, including technological equipment, both locally and remotely, taking into account incoming data. These systems are used in cyclic and continuous technological processes.*

*The main element of the control system is the control unit, built on the basis of programmable controllers, which, in turn, operate on the basis of a specially developed algorithm.*

*The software implementation of the algorithm is based on a specially developed hardware and software complex SignalLogic, which allows to:*

- ✓ create systems for remote monitoring, control and management of technical products, machines and industrial lines;*
- ✓ ensure the safety of personnel;*
- ✓ control and process up to 4 thousand different parameters per second (in a single-processor version);*
- ✓ prevent operator errors, control critical parameters and vital parts of the system;*
- ✓ increase the service life of mechanisms;*
- ✓ implement new features and unique performance characteristics;*
- ✓ significantly reduce the turnaround time for the automation of technical products.*

*In special cases, to increase the number of processed parameters, it is possible to cascade the system (in proportion to the required volume of processed values) or create a distributed computing architecture on board the managed object.*

*Management systems have the widest "geography" of application. The proposed solutions can be applied in various fields of mechanical engineering, including transport, energy, machine tool construction, etc.*

*They are designed both on existing and currently produced ones on the domestic and foreign markets, blocks and sensors, as well as on those developed according to the customer's specifications. A complete set of design documentation for the production of products on the customer's territory or under the order is prepared for prototypes of blocks and sensors developed according to the customer's technical specifications.*

*Product features:*

- ✓ design flexibility that allows for further adjustments with minimal labor costs;*
- ✓ testing and debugging of the system, allowing you to assess the degree of compliance with the customer's technical task, to conduct simulations on virtual devices;*
- ✓ scalability;*
- ✓ cross-platform - work on servers and personal computers (x86/64 platforms), as well as controllers and ARM platforms, it is possible to port almost any modern processors;*
- ✓ visual design on the basis of the logic elements in common packages (PCAD, Altium Designer, Schemagee, and others);*
- ✓ integration with industrial controllers - work with controllers of domestic and foreign production: ARIES, WirenBoard, WAGO, etc.*
- ✓ integration with a wide range of buses (CAN, ModBus, ProfiBus, etc.).*

Also possible:

- ✓ preparation and support of mass production of electronic components,
- ✓ development of specialized software.

Examples of implementing the SignaLogic hardware and software package include, in particular, the following works performed by us:

#### **4.2.1. Management systems, monitoring and analysis of the serviceability of certain components of the running gear of railway rolling stock.**

A wireless module for temperature, vibration and acoustic noise control (MTVN) with an Autonomous power source (battery and vibration power source) installed on the control cover of the axle box is developed and offered.

Wireless modules transmit data to the head unit via a radio channel, such as messages about exceeding the warning or emergency threshold for temperature, vibration, and acoustic noise levels.



The head communication module transmits the current status (norm, warning, accident) and ID (axle number or car number) to the conductor, driver or remote operator using the GSM module. The head module can be made in the same housing as the MTVN and installed on the locomotive axle box using standard screws for fixing the control cover, or as a separate device in an agreed mounting location. The need to combine the modules into one is due to the requirement to transmit information to a remotely located operator and the exclusion of the need to install a separate module with a remote control inside the car.

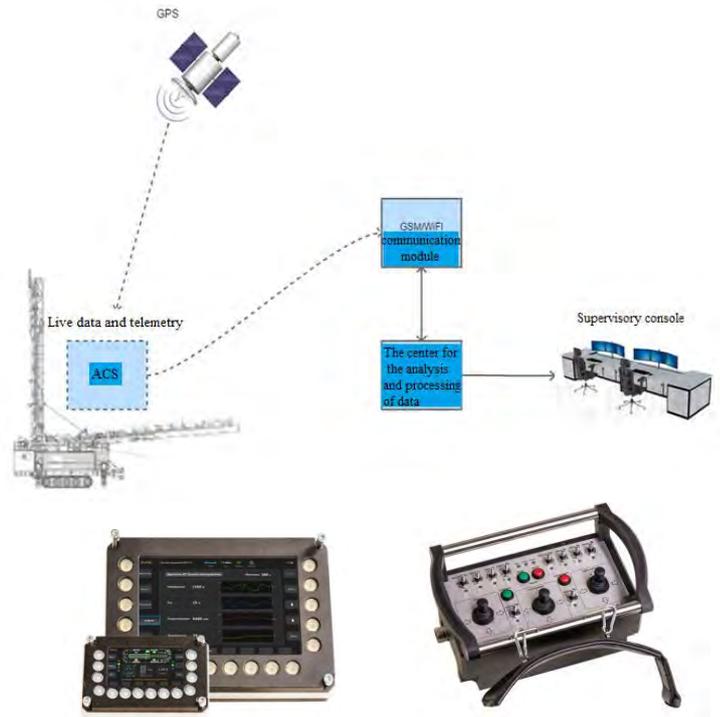
Upon additional request, a survey module of the head module can be developed, which is a screen with real-time output of current states (norm, warning, accident) in the form of a mnemonic diagram or table.

#### **4.2.2. Automated control system for drilling and rolling machines**

The developed automated control system (ACS) for the drilling roller machine (DRM) allows to:

- ✓ provide remote monitoring and monitoring of readings via GSM or satellite terminals;
- ✓ produce:
  - monitoring and diagnostics via mobile devices (tablets, smartphones);
  - self-diagnosis and control of operating modes, and also send a report to the dispatcher based on their results;
  - monitoring the position in space - roll, platform and actuator pitch;
  - control of the speed of rotation/rpm, speed of lifting/lowering of actuators.
- ✓ remotely control the technical product of the DRM via a remote control radio;
- ✓ perform positioning of the system by GPS coordinates;
- ✓ keep a log of both regular and non-regular events;
- ✓ perform control and monitoring of operation parameters:
  - diesel power unit in part:
    - ❖ coolant, intake and exhaust gas temperatures;;
    - ❖ engine speed;
    - ❖ oil level and temperature;

- ❖ fuel level in the tank;
- running electric motor, in part:
  - ❖ its capacity;
  - ❖ electrical parameter;
- ✓ provide protection of the running motor from overheating, phase misalignment, current protection;
- ✓ perform control:
  - pressure in the pneumatic system,
  - cable length of the cable drum,
  - on-board power supply of secondary voltage 380,220,24,12 volts
  - etc.



*The main innovative solutions include hardware and software that provide information acquisition and processing to optimize production operations. Equipping the equipment with digital controls (ACS) makes it more productive, safe and efficient. Remote management reduces the risk to life, which is accompanied by the work of the operator in dangerous situations.*

### **4.3. Load monitoring of supporting structures and condition monitoring for fatigue of materials or hidden defects.**

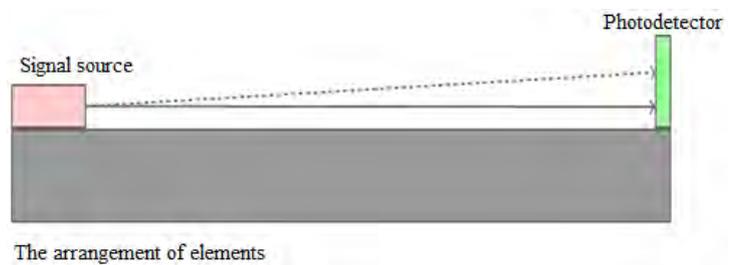
Monitoring the load on supporting structures and monitoring the condition for fatigue of materials or hidden defects allows you to determine the permissible (operational) deflection of frames, metal beams or reinforced concrete structures.

Measurement of the deflection of structures during transverse bending due to operational load and other reasons during operation is performed by optical and / or radio gyroscopic method, i.e. the receivers are positioned along the axis of the beam.

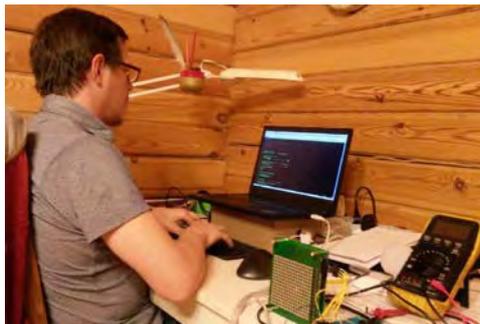
Possible reasons for the increase of the beam deflection:

- 1) degradation of materials;
- 2) defects and fault formation (cracks, corrosion, etc.);
- 3) increased load.

The proposed system allows you to determine the probability of structural failure and, accordingly, prevent them. Also, it allows to evaluate the load on the torsion.



In addition, the system has the ability to calibrate, self-diagnose and test the serviceability of measurement units, as well as a digital output (Modbus) for connecting to the ACS. Sensors can be interfaced with current parameters of electric motors to synchronize events during load measurements on operating actuators.



### **4.4. Provisions:**

#### **4.4.1. Optimal ventilation and temperature conditions in the premises of various objects.**

In order to adjust the temperature conditions in the premises of various facilities, including train stations, depots, etc., it is proposed to use a heat controller and a software package of our development. The heat controller is designed to control a multi-circuit water heating system, a boiler and a circulation pump based on signals from room thermostats and maintain the set temperature in each hall or room (8 independent heating zones). The integrated control function of the heating boiler and

circulation pump provides significant savings in electricity and gas, as well as extends the service life of the boiler and pump.

*Advantages of the proposed system:*

1. **The regulation of online** hour remote temperature controls, monitoring of system health. Accident monitoring and prevention system.
2. **Efficiency:** automatic regulation of heating in the building — real savings on heat resources up to 30%.
3. **Automatic analysis and optimal control of the power** of heating devices taking into account the specified parameters.
4. **Self-learning:** the system adapts to operating conditions (room types, heating capacity, environmental conditions).
5. **Set schedule (individual programming):**  
the ability to set the temperature program by the hour and depending on the day of the week in each individual room.

#### **4.4.2. Alternative sources of electricity for control cabinets and lighting of various objects.**

A power supply module for control cabinets is offered, which includes an inverter, solar panels, a li-ion battery, a charge-discharge controller with a battery balancing system, a diesel or gasoline generator (on demand) and a telemetry unit for transmitting the current state of the module.

As a power supply line, the existing cable network can be used with the replacement of incandescent lamps and DRL lamps with led lights with a power supply voltage of 220V, with a total electric power of up to 500W (at the request of the customer, a large power can be provided).



The module can be made on the basis of a 20-foot container with solar panels located on the roof. Additionally, if necessary, it is equipped with a mast and floodlights.

The module is designed according to the following schemes, in the case of:

- 1) **sufficient solar radiation:** photovoltaic panels, charge controller, li-ion batter;
- 2) **insufficient amount of solar radiation** (short daylight hours, smoke, clouds, winter time): gasoline or diesel generator, charge controller, li-ion battery.

The module is equipped with a telemetry controller with a GSM gateway and the ability to work both on the light sensor and on remote control. The GSM telemetry controller transmits the following parameters: battery charge, fuel level, light level, air temperature, and a message about opening the container door. Also it is possible to add a remote dispatching system that displays the current status of power modules on the monitor screen in real time.

## 5. Innovative technologies and equipment for automated control systems

*Piezo-commutation technologies and equipment for automated control systems are offered, namely:*

- ✓ "call" piezo button,;
- ✓ piezopanel, piezoclaviatura and specialized control panels in accordance with the technical requirements of Customers;
- ✓ push-button traffic light posts (PBTLPs) for pedestrian traffic light crossings, including PBTLPs for people with disabilities.

*Based on the technical specification, experimental design work is carried out to solve any customer's tasks and create innovative designs of piezogenerators for pulsed and repeated use.*

*Plutocracy, piatanesi and piezogravimetry are produced in various configurations, different designs and housing materials (steel, aluminum, bronze, plastic), dimensions and shapes (planar, volumetric), the nominal voltage requirements of ergonomics (the presence of illumination, colors, etc.).*

*The advantages of the proposed innovative piezo-commutation structures of the new generation are:*

- ✓ reduced weight and size characteristics by 3-5 times;
- ✓ increased operating temperature range with guaranteed lower limit of operability  $-60^{\circ}\text{C}$ ;
- ✓ application for a wider class of technical systems, including those operating in extreme (Arctic, space, underwater) operating conditions.



**6. Innovative  
technologies and equipment  
for  
highly reliable nondestructive testing of  
materials, compounds, etc., including:**

**6.1. Materials for responsible products.**

Highly reliable non-destructive **testing systems** designed for diagnostics have been developed, implemented or are in various stages of implementation **for the benefit of various companies:**

- ✓ **machining products** (shafts and axes of mechanisms, including wheel pairs and axle bearings of railway cars;
- ✓ wire rods, rods of non-ferrous and ferrous metals;
- ✓ **drill pipes** in the oil and gas industries;
- ✓ **rolled ferrous and non-ferrous metals;**
- ✓ **contact wire for various electric vehicles;**
- ✓ **compounds** made by the method of **friction welding** with stirring;
- ✓ **changes in electrical conductivity** across the entire cross section of the material;
- ✓ products made of **carbon fiber composite materials;**
- ✓ etc.

Developed and offered **technology and equipment** focused on the eddy current inspection method and allow **the early stages to identify** not only surface but also **internal**, located around the cross section of the object material, **defects assuredly** and also have **a number** of operational **advantages**, including:

- \* high reliability exceeding 90%;
- \* can be integrated into an existing production line;
- \* contactless method of information retrieval;
- \* ability to work through coatings (paint, dirt, ice);
- \* full automation of monitoring and analysis of the received data;
- \* no influence of subjective factors on control results;
- \* low power consumption;
- \* temperature range of application from  $-60$  to  $+60$  °C.

### **6.1.1. Control of wire rod, rod of non-ferrous and ferrous metals.**

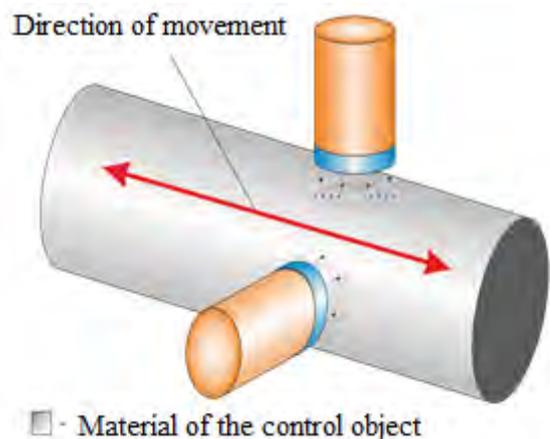
*When using existing eddy current systems for wire rod and rod control, it is possible to detect only surface and subsurface defects. Detection of defects that lie in the depth of the wire rod, modern systems are fundamentally impossible. For this reason, to date, the world has not created reliable systems that allow detecting defects in the wire rod throughout the depth. As a result, when drawing wire rod and making wire, there are gusts, which leads to additional financial costs and reputational losses.*



*Our equipment allows you to control the wire rod along the entire cross section and avoid the negative consequences of insufficient reliable control.*

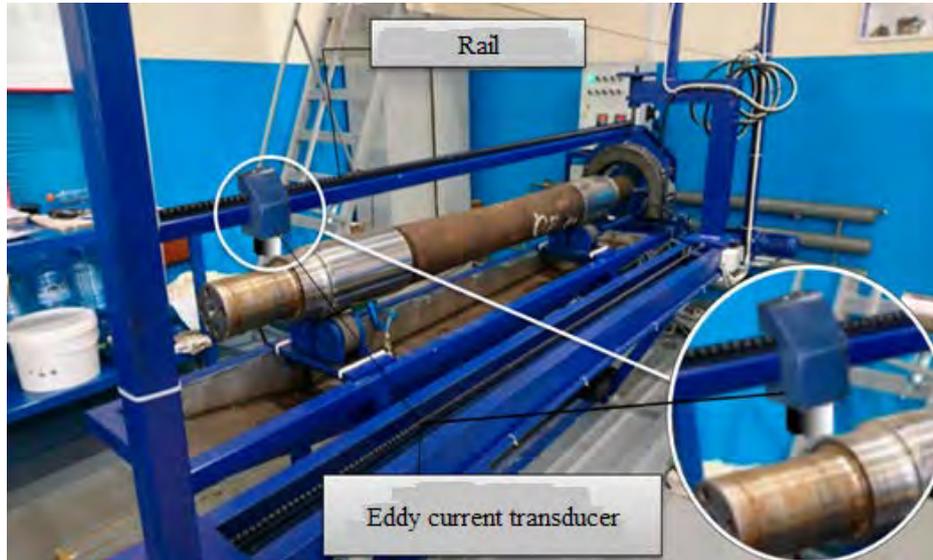
### **6.1.2. Control of drill pipes in the oil and gas industries.**

*Currently, only in the Russian Federation there are about 1200 oil production sites, where more than 3 million new and used drill pipes are stored. Recently, complexes designed for monitoring drill pipes using the magnetic field scattering method have started to appear in production. This method has a number of disadvantages, namely: its application is possible only for magnetic materials, and the sensitivity is significantly lower than eddy current and is mainly focused on detecting fairly large defects. Our proposed method of control can work on any conductive materials and allows you to create technological equipment that allows you to detect any types of defects along the entire section of the pipe.*



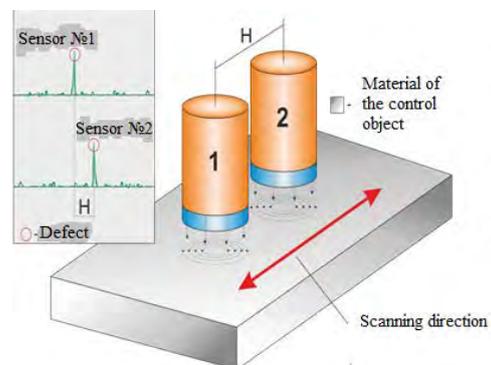
### 6.1.3. Control of machining parts.

Currently, the control of machining parts (axles and shafts of mechanisms, including wheel pairs of railway cars and subway cars, etc.) is mainly performed using ultrasound control. Before performing the control, surface preparation (Stripping, sanding) is necessary. The operation is quite time-consuming and lengthy. Especially when monitoring products in use. When conducting direct control, it is necessary to use an immersion medium (liquid), which, given the curvature of the surface of the object of control, tends to "roll". This leads to a violation of the contact between the sensor and the surface, which can cause false positives and the need for repeated monitoring. When using our technology, all these disadvantages are eliminated. Monitoring becomes more efficient, both in terms of time and cost.



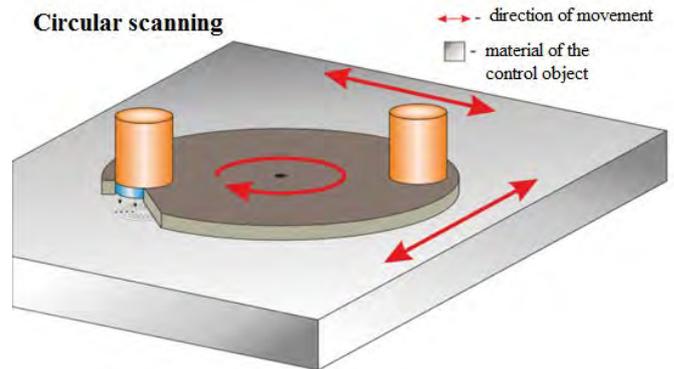
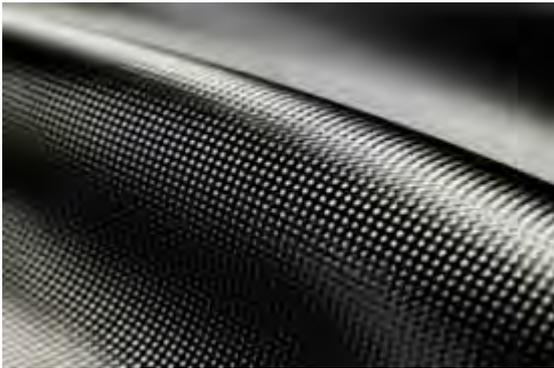
### 6.1.4. Control of rolled ferrous and non-ferrous metals.

The need to use a liquid when conducting ultrasonic testing is increasingly in conflict with modern metallurgical technologies. It is becoming more and more difficult to meet the necessary requirements for the speed of movement, temperature, and surface condition of the object under control. The use of an immersion liquid leads to corrosion of the control object and, as a result, to a deterioration of the product's commercial appearance and consumer properties. Contactless UCS systems are not sensitive enough and are very expensive. When using equipment that uses our technology, these tasks can be solved easier and less costly.



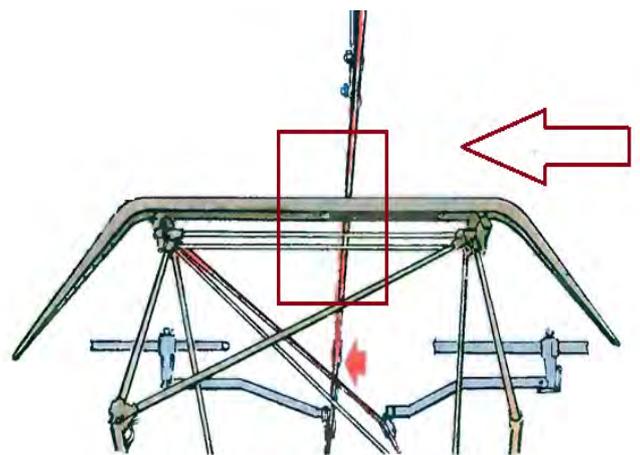
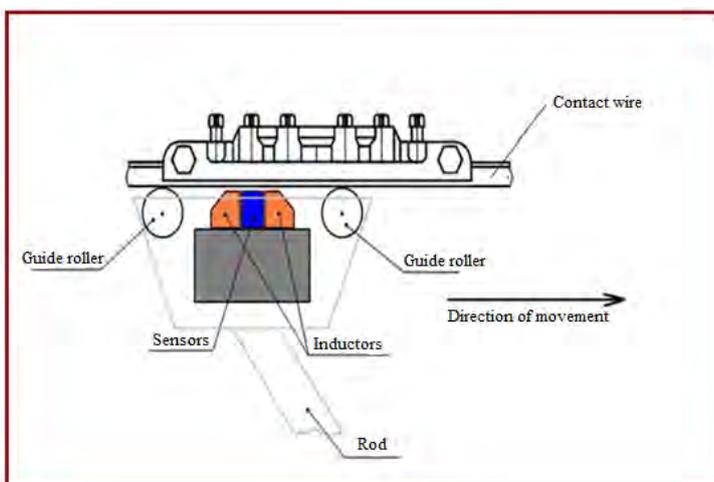
### 6.1.5. Control of manufactured products made of carbon fiber composite materials.

Composite materials (CCM) are widely used in various fields of mechanical engineering. In the aerospace industry, carbon composite materials (CCM), or otherwise carbon fiber, are used in various elements of the wing, fuselage, and main power structures. Many companies in the world are searching for solutions for instrumental control. If in special production conditions it is possible to somehow ensure the required reliability of control (ultrasound and X-ray control), then in operation it is practically not feasible. The method we offer allows you to control products both during production and during their operation, with a high level of reliability and at the same time reducing the cost of control.



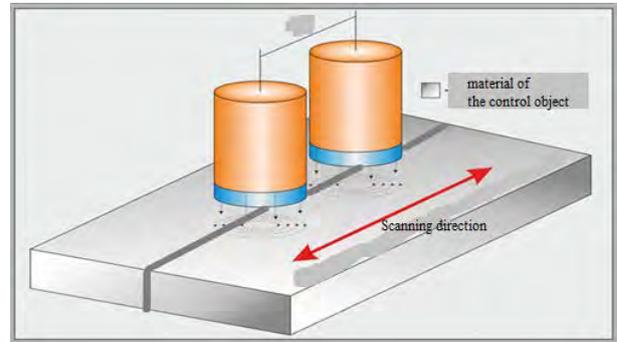
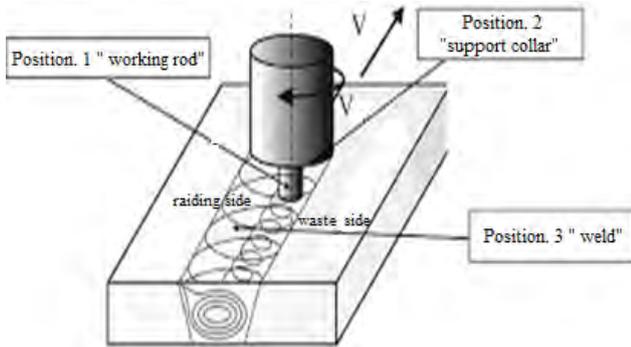
### 6.1.6. Control of the contact wire of various electric vehicle.

Timely detection of cracks in the contact wire that appear during operation of the contact network dramatically reduces the risk of damage to the contact network, which can improve the safety of operation of electric vehicles. The equipment used today can only detect surface damage. We offer control systems that provide guaranteed detection of dangerous defects in operation at operating speeds of electric vehicles.



## 6.2. Control of joints made by friction welding with mixing.

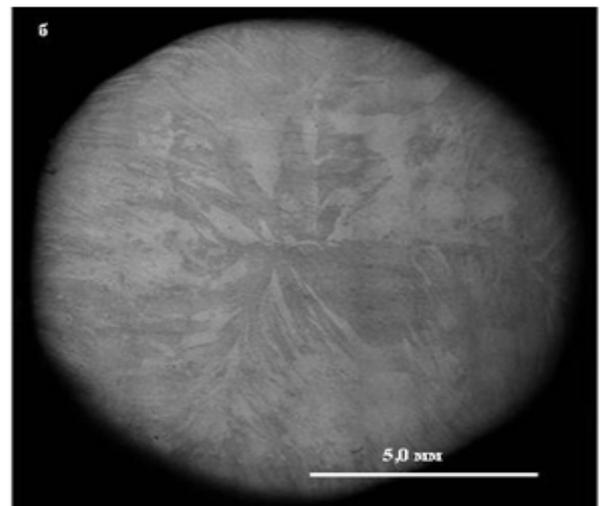
This method is widely used in the world practice for welding aluminum alloys, for such connections, one of the most dangerous and difficult to detect methods of non-destructive testing of defects are defects such as butt lines. They can serve as places of origin and propagation of cracks under load and significantly reduce the strength of the welded joint. These are defects in the form of lines of oxides and butt lines, wormholes or channels. These types of defects are almost impossible to detect using x-Rays and ultrasound control. Our method of control is able to solve this problem with a high level of confidence.



## 6.3. Control of electrical conductivity of product materials.

Used in the production of a complete line of eddy current measurements of electrical conductivity of the material from different manufacturers. Electrical conductivity is one of the quality control factors, for example, when determining the degree of purity and uniformity of metals and alloys. This parameter is taken into account when checking the uniformity of alloys, strength and hardness. In the case of imperfections in the production cycle of manufacturing, various types of structure inhomogeneities may form in products, which are the localities of destruction processes.

All electrical conductivity meters available on the market work only on the surface and subsurface layer of the product material. Our method allows for end-to-end monitoring and debugging of the technology in real time.



#### 6.4. Technical safety systems for railway rolling stock.

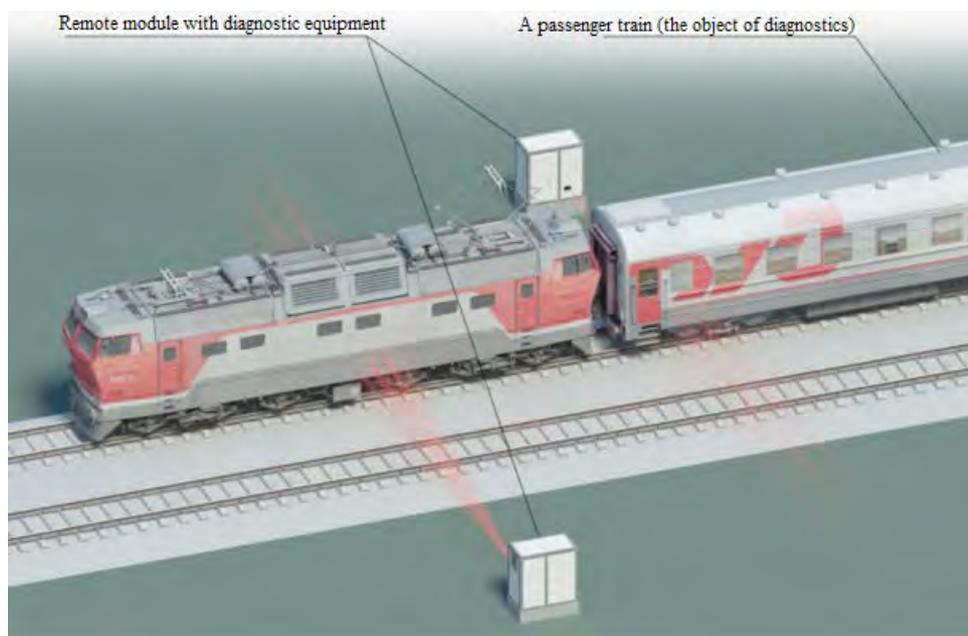
In order to improve the **safety of rolling stock** of railway passenger transport, an information **network** of automated thermal **diagnostics** systems for passenger cars was developed and implemented at Russian Railways, designed to **detect thermal anomalies** that indicate malfunctions of an early stage of development in the **technical systems** of passenger cars.

A **key element** of this technology is proactive monitoring of the technical condition of rolling stock during train movement in a non-contact manner, based on the use of industrial thermal imaging devices and machine vision methods.

The **main advantages** of this proposal, regarding existing alternatives and developments, are:

- ✓ **one-time identification** of thermal **anomalies** in the operation of such **technical systems** of passenger cars as brake linkage, disk brake, axle box, wheel and car electrical equipment (optional);
- ✓ the **identification** of **malfunctions** of potentially **dangerous** cars that are systematically repeated.
- ✓ the **formation of the resulting reporting, analytical and other statements** available in real time in the corporate network JSC «RZD», taking into account the affiliation of wagons at the branches of JSC «FPK».
- ✓ **ensuring prompt delivery** of diagnostic **results** to users (Depot, VET) using **various methods** of information delivery.
- ✓ a **small number of posts of floor equipment** of the system (2-6 sets) required to ensure complete thermal diagnostics within the railway - a branch of JSC «RZD».

During operation at the **test site** of the **North Caucasian Railway** of JSC «RZD», the existing system has established itself as a good tool for automated thermal control of the technical condition of passenger cars.

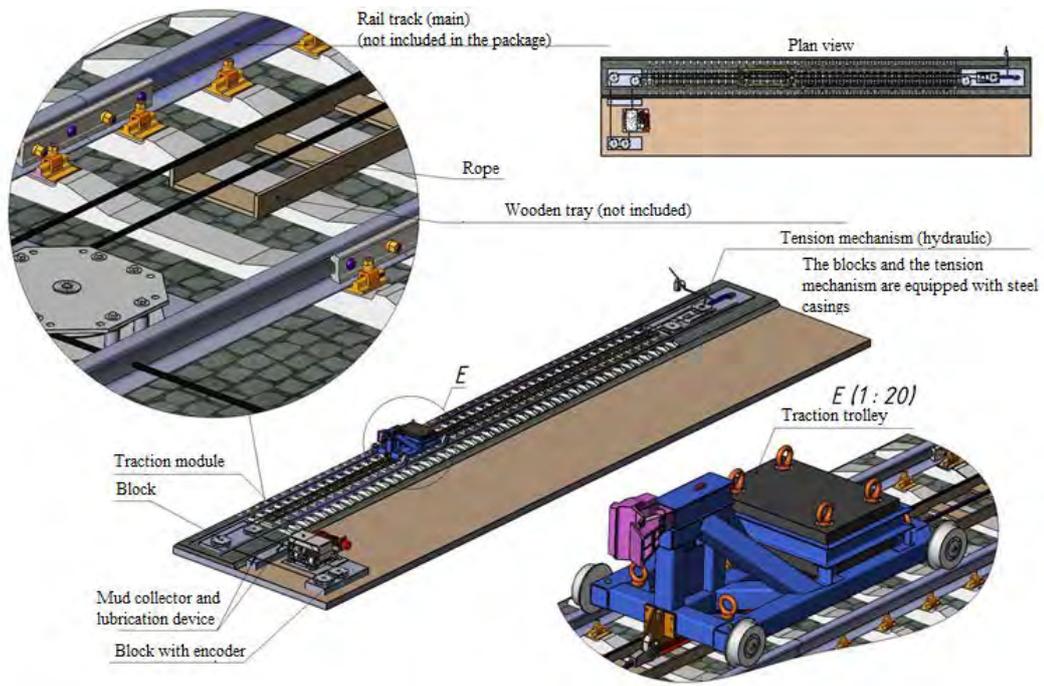


## **7. Innovative automated systems for moving and positioning objects of various types**

**7.1. Automated systems for moving and positioning** have been developed, implemented, or are at various stages of implementation:

- ✓ **railway wagons**, both individual and their rates, to ensure the replacement of traditionally used shunting locomotives;
- ✓ a variety of **large-sized metal-intensive equipment** undergoing processing in various technological cycles (washing, assembly, warehousing, etc.);
- ✓ etc.

In the interests of various companies, **automated systems for moving and positioning are INTRODUCED** at OBJECTS in VARIOUS REGIONS of RUSSIA, including the city of Surgut, Kirishi, etc., as well as in Kazakhstan.



**7.2. Industrial** (drilling rigs, power transmission towers, etc.),  
**residential and social purposes** (with Autonomous life support)  
**in extreme conditions** of the Arctic, the Antarctic and the North.

Is under development a technical project of the **off-road multifunctional self-propelled (walking) platform** with a capacity of 80...120 tons, equipped with navigation and information-computing systems and capable of carrying with a **minimum load** on the environment **year-round** in **extreme conditions** of uncertainty and inaccessibility of the Arctic, the Antarctic and the North is being developed:

- ✓ **drilling rigs** more than 40 m high with a **complete set**;
- ✓ **residential and social facilities** with autonomous life support for 14...20 people;
- ✓ **industrial facilities**, including various energy, treatment and other technological equipment complexes, etc.;
- ✓ **high-voltage support LAP**;
- ✓ etc.

**Because of** the possibility of **year-round** transportation of **heavy objects** on slippery, hummocky, swampy and permafrost soils without **damaging** the gummy layer of **the tundra**, the self-propelled platform **has no analogues** in the world practice.

**The most important** component of the **economic efficiency** of the use of **self-propelled platforms** is **a multiple reduction in the cost and time** of relocation and arrangement of drilling and other settlements, associated with **the lack of need** for:

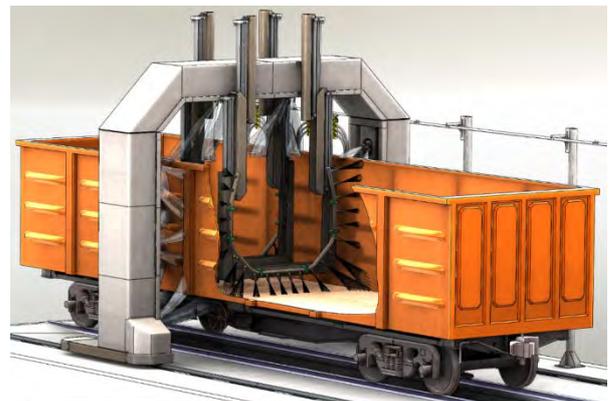
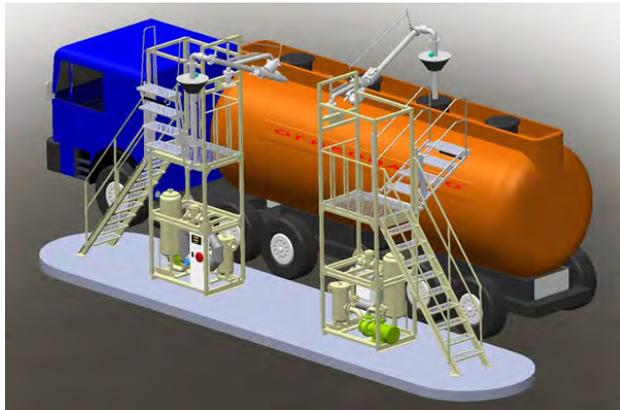
- ✓ construction of temporary and permanent roads;
- ✓ quarrying of PGS;
- ✓ dumping grounds and foundations;
- ✓ organizing a luge train for transporting towers, technological equipment, residential and auxiliary units, etc.;
- ✓ recultivation of lands.

The main **environmental advantage** of the self-propelled platform is **the minimum load** on the tundra land cover, the equivalent load of DEER – 140...280 g/cm<sup>2</sup>.



> **THE PROJECT REQUIRES INVESTMENT AND DEVELOPMENT**

***PROCESSING***  
*(cleaning, washing, rinsing, degassing, drying,  
anti-corrosion and anti-icing protection)*  
***of hard surfaces***  
*various configurations*  
***from any contamination***



**8. Innovative technologies and equipment for internal and external treatment (cleaning, washing, rinsing, degassing and drying) of contaminated hard surfaces, including:**

The proposed technological solutions are focused on the most modern and progressive closed recirculation modes, which allow significantly improving the quality and repeatedly speeding up the process of high-quality surface treatment, while unconditionally ensuring low cost, environmental safety and resource saving of technological processes.

Also, **it should be emphasized** that the data, developed, manufactured and supplied by us **complexes** of technological equipment have the following absolute **advantages**:

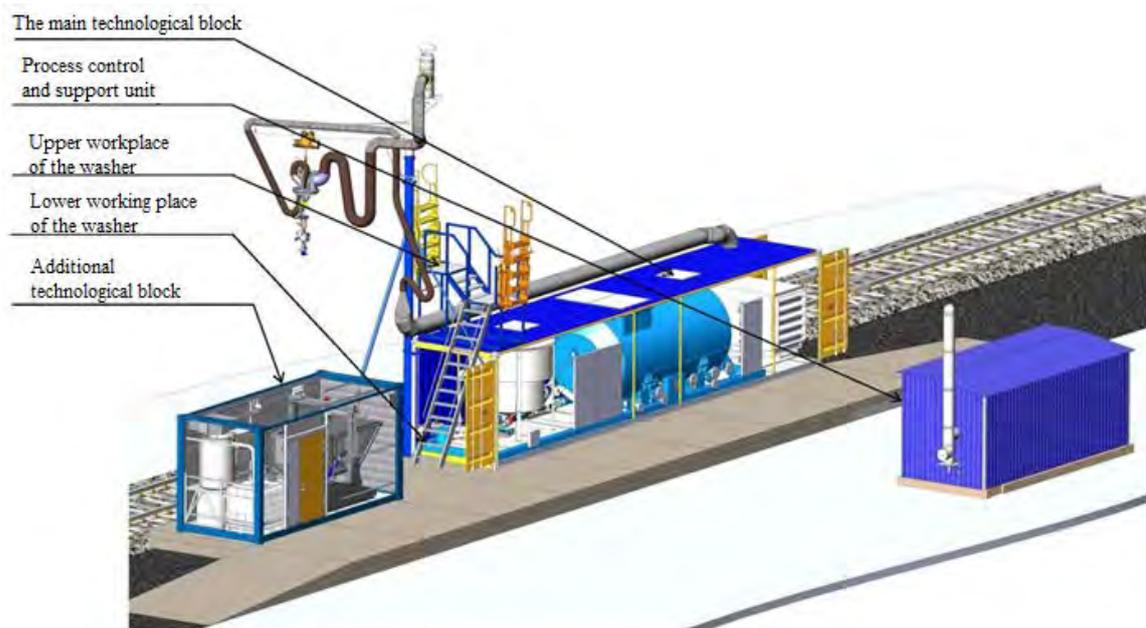
- ✓ **a wide list of laundered goods;**
- ✓ **significant reduction in the time and cost of construction/reconstruction of facilities for this purpose;**
- ✓ **the ability, if necessary, to dismantle this equipment as soon as possible and move it to the desired location;**
- ✓ **the lack of property taxes.**

**8.1. Cargo rail and road transport, tank containers, to be precise:**

**8.1.1. Boilers of tank cars, including:**

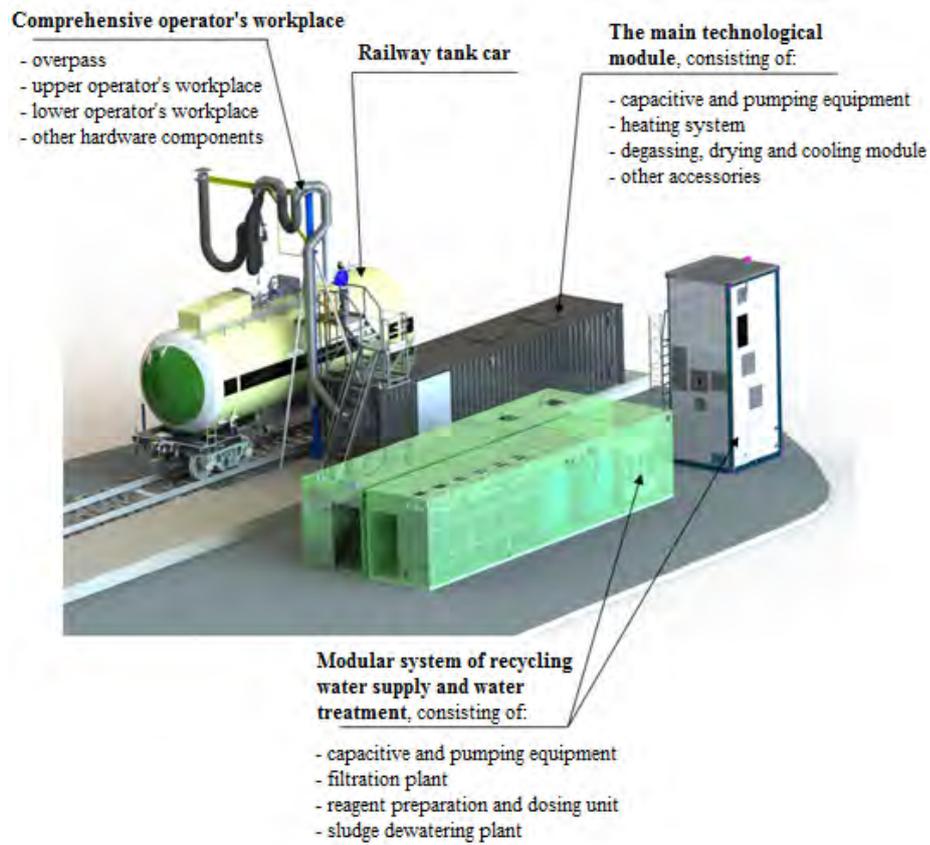
**8.1.1.1. Internal cleaning:**

- ✓ **From under oil cargo**

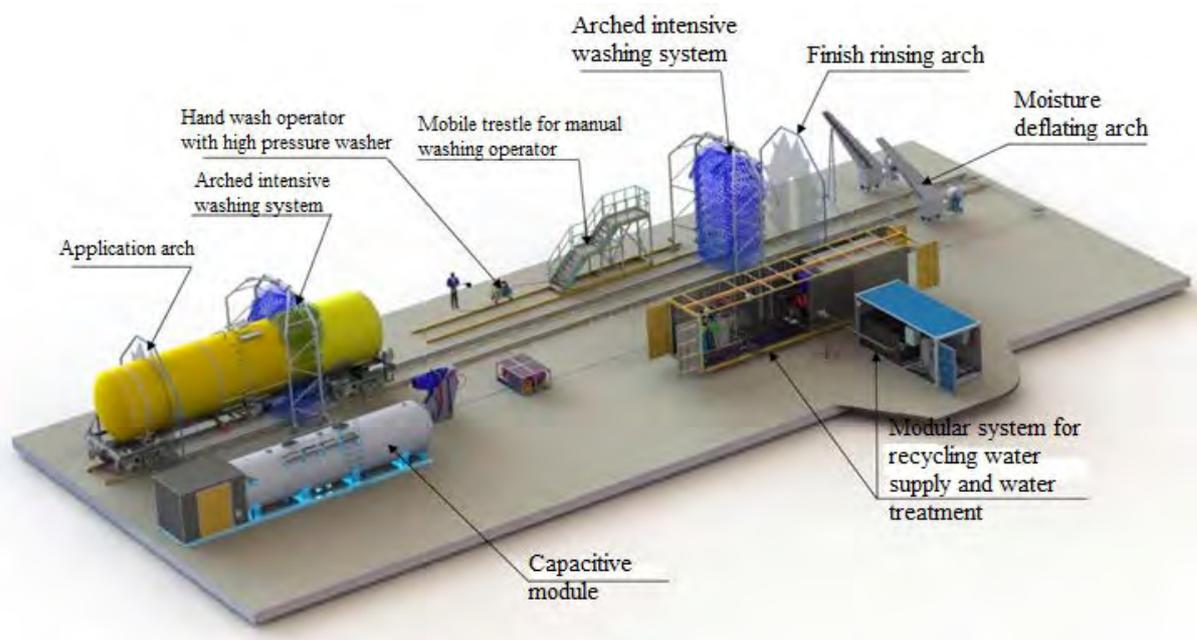


✓ From under **the petrochemical and chemical cargoes**, including:

- *methanol and other alcohols,*
- *acids and other chemical products*
- *etc.*



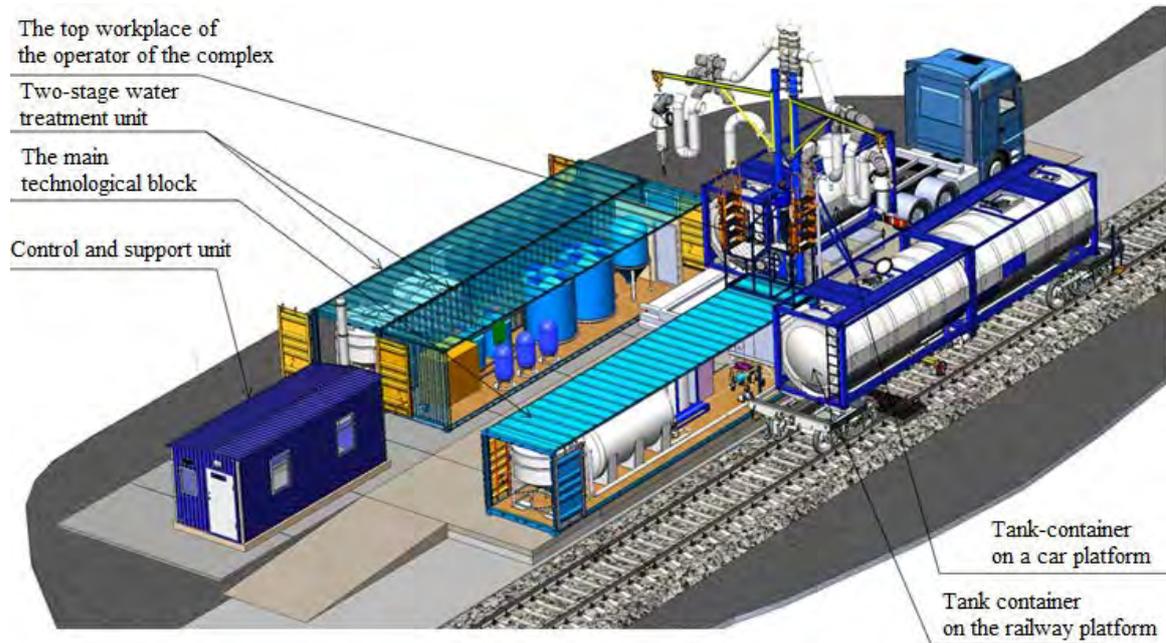
### 8.1.1.2. External cleaning



### 8.1.2. Flasks of tank containers, including:

#### *Internal cleaning:*

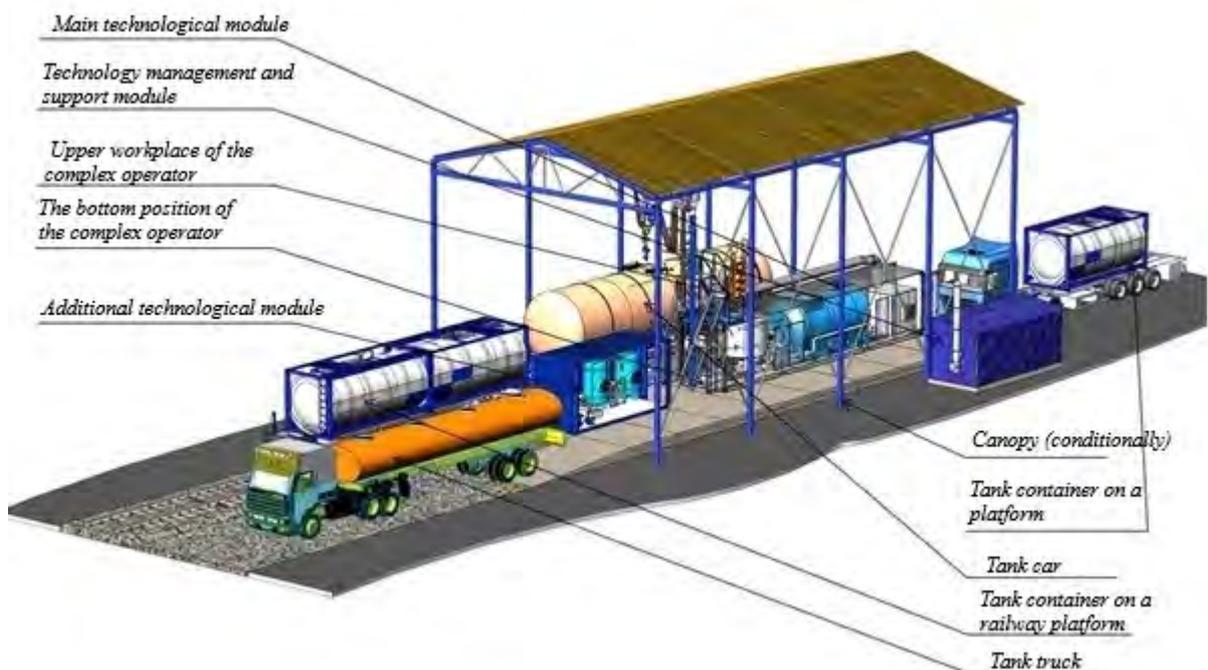
✓ *From under the petrochemical and chemical cargoes*



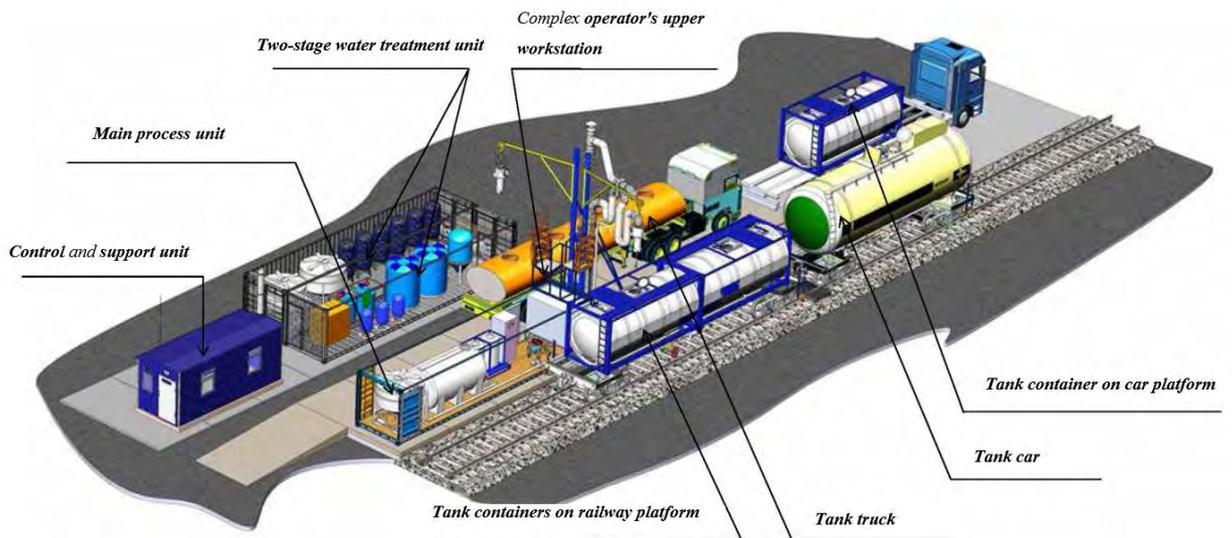
### 8.1.3. Boilers of tank cars, flasks of tank containers and compartments of tankers (combined complexes), including:

#### *Internal cleaning:*

✓ *From under oil cargo*



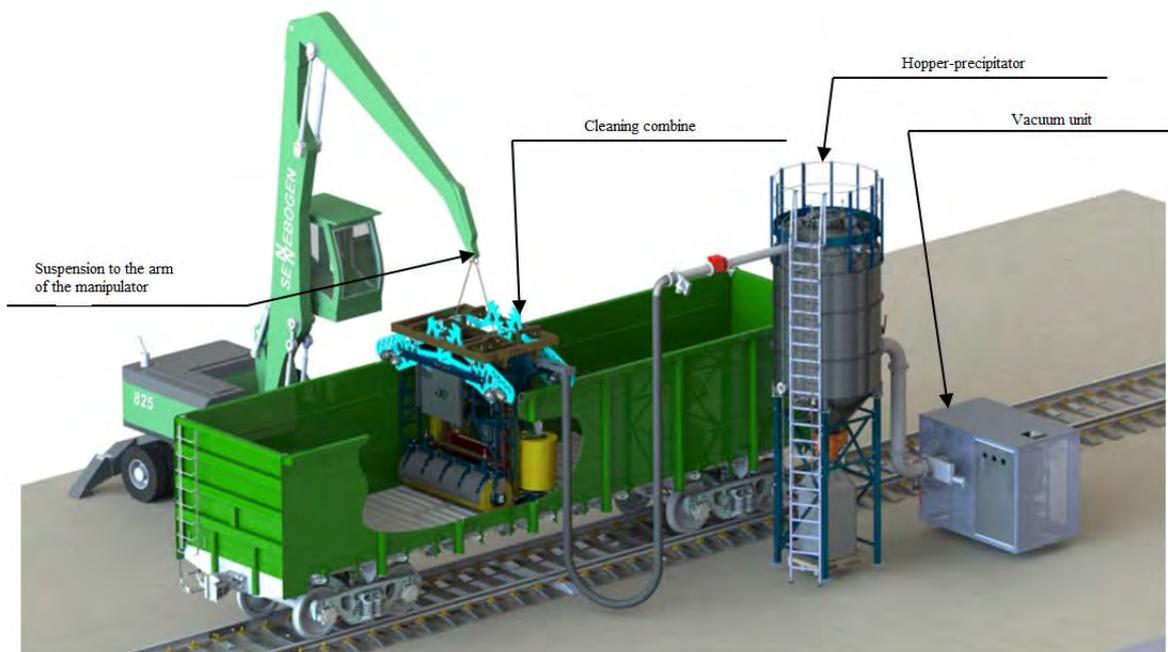
✓ *From under the petrochemical and chemical cargoes*



**8.1.4. Bodies of freight cars of any type (covered, gondola cars, hoppers, refrigerator cars, etc.) from under any bulk, bulk and piece cargo after unloading, including:**

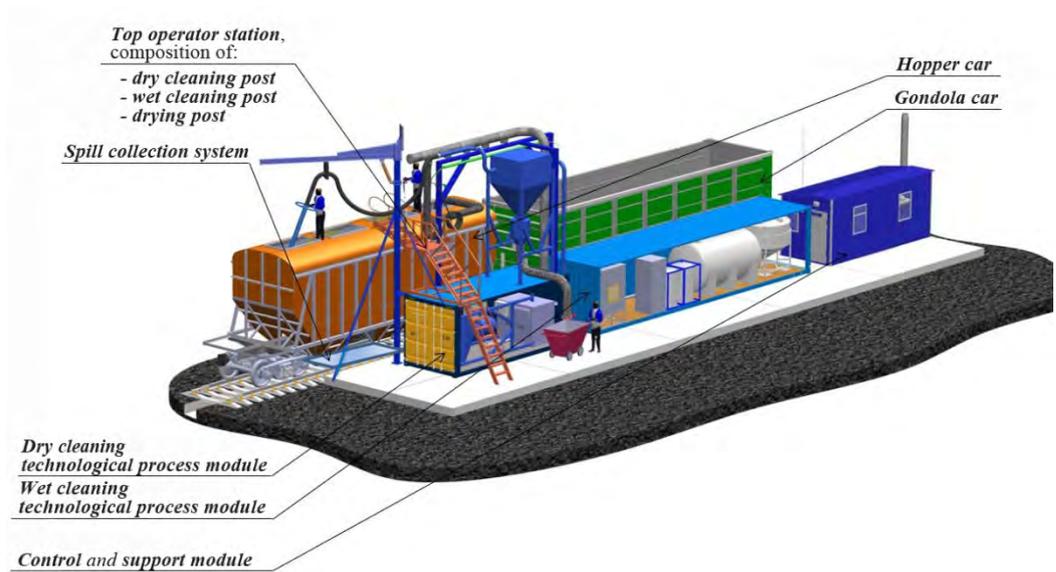
**8.1.4.1. Internal cleaning:**

✓ *Gondola cars  
dry method*



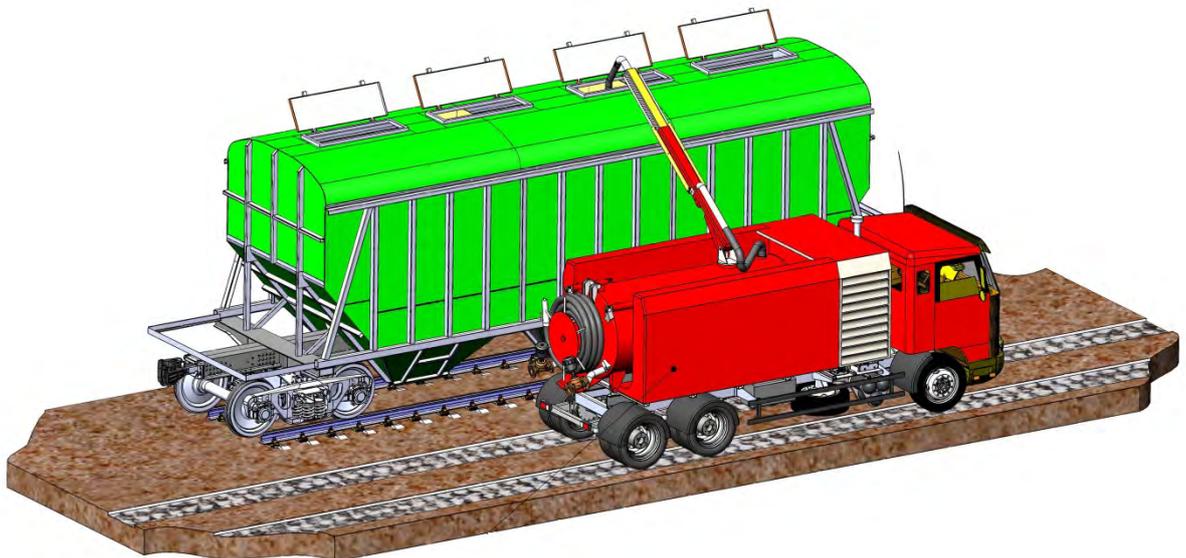
✓ *Open wagons and wagons of the "hopper" type*

➤ *Combined method*

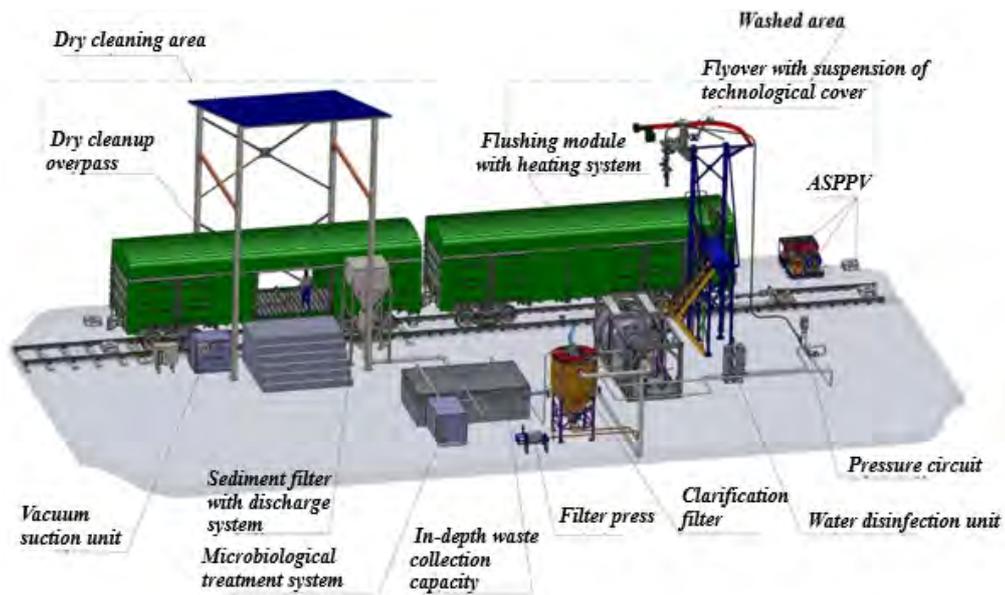


➤ *Way of flushing*

*The advantages of this solution are the mobility of equipment and independence from infrastructure.*

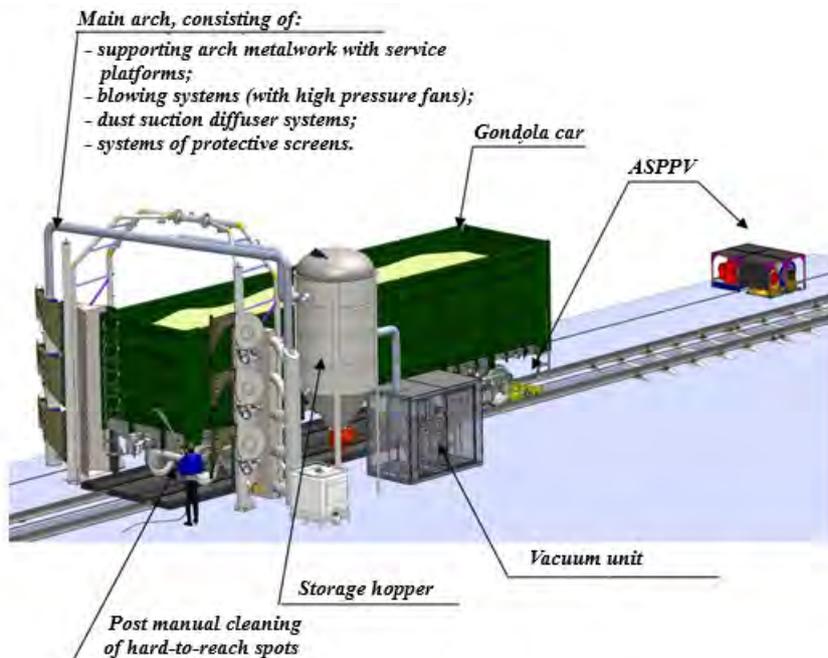


✓ *Covered wagons and refrigerated wagons combined method*

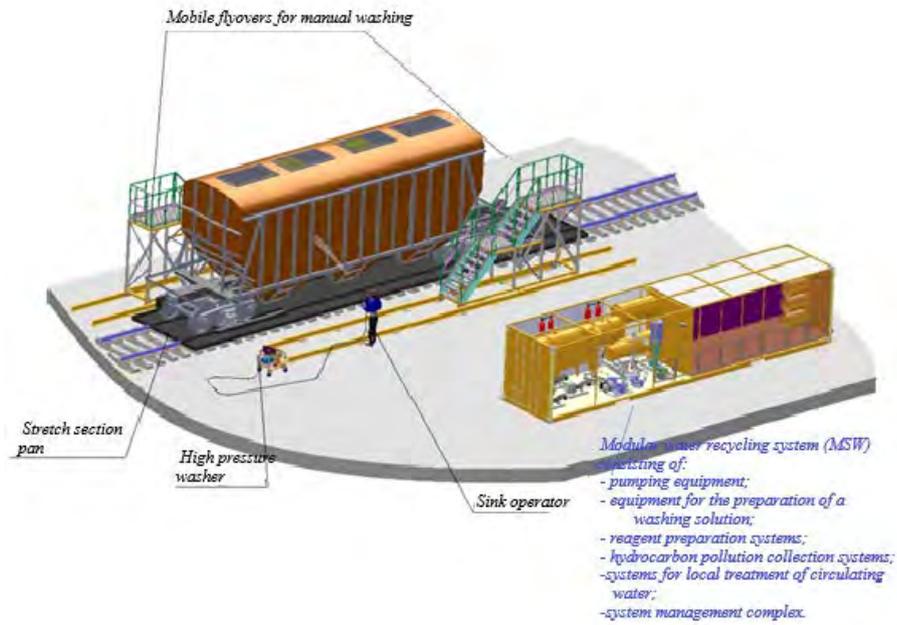


8.1.4.2. *External cleaning:*

✓ *Gondola cars dry method*



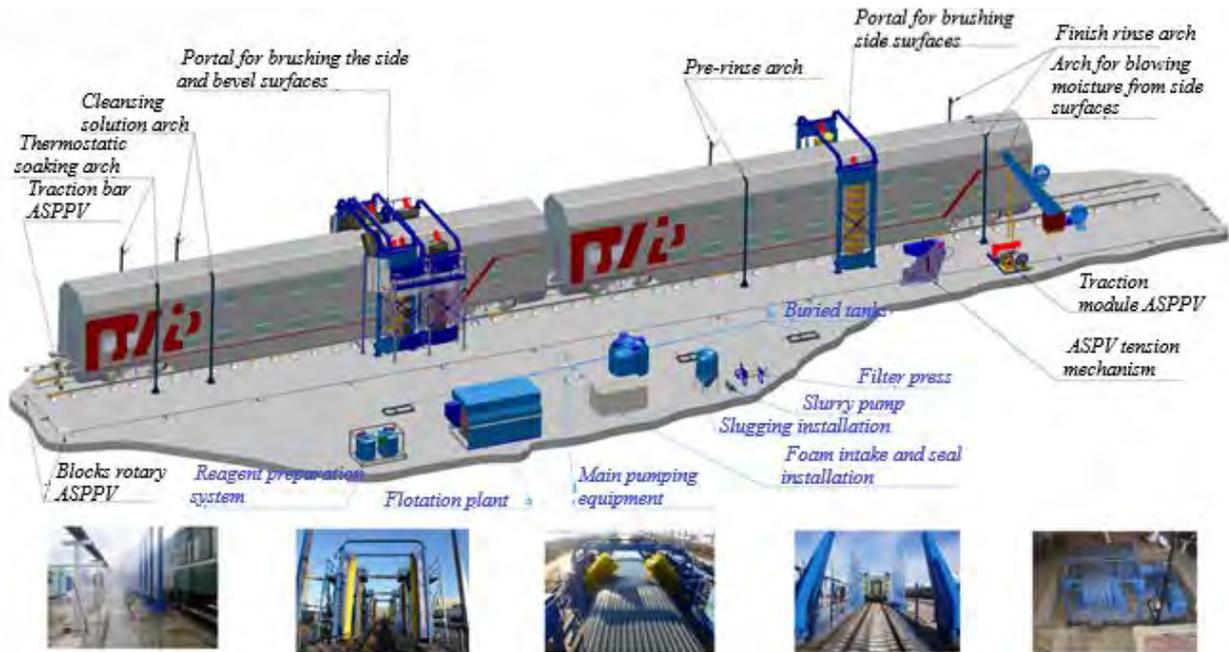
- ✓ *Covered and open wagons, wagons of the "hopper" type and refrigerated wagons washing method*



## 8.2. Passenger railway transport, to be precise:

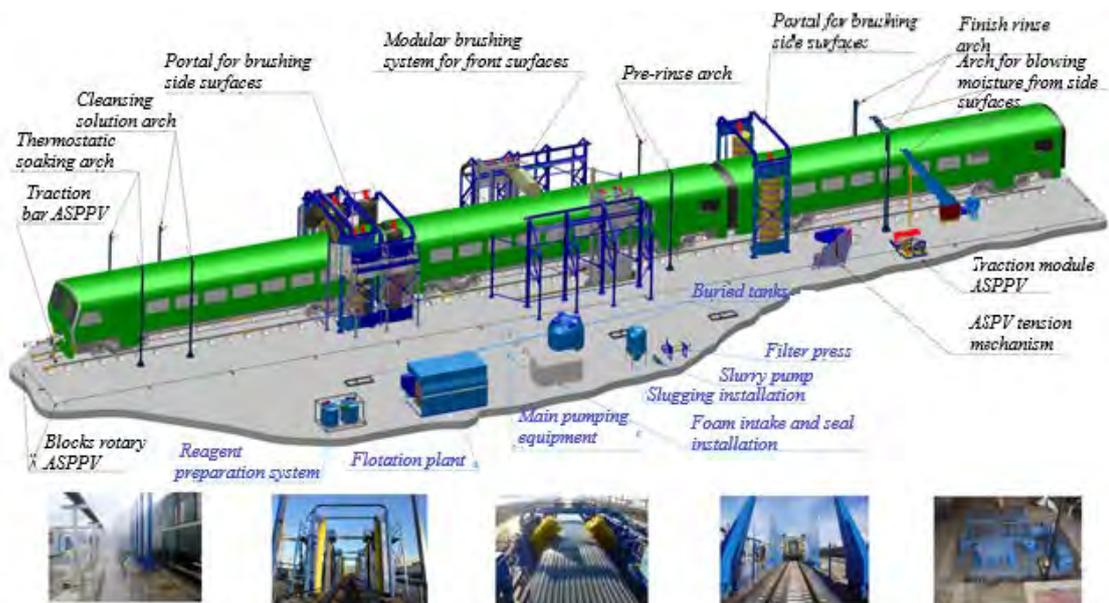
### 8.2.1. Bodies of long-distance cars

#### External washing



## 8.2.2. Bodies of suburban electric trains

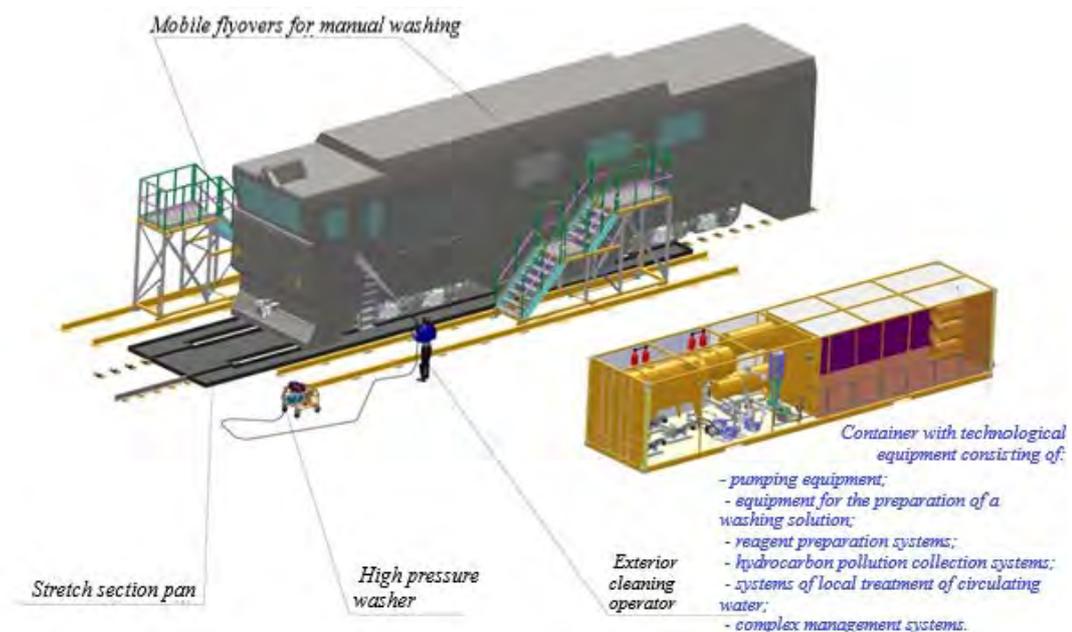
### External washing



## 8.3. Traction railway transport, to be precise:

### 8.3.1. Bodies of locomotives

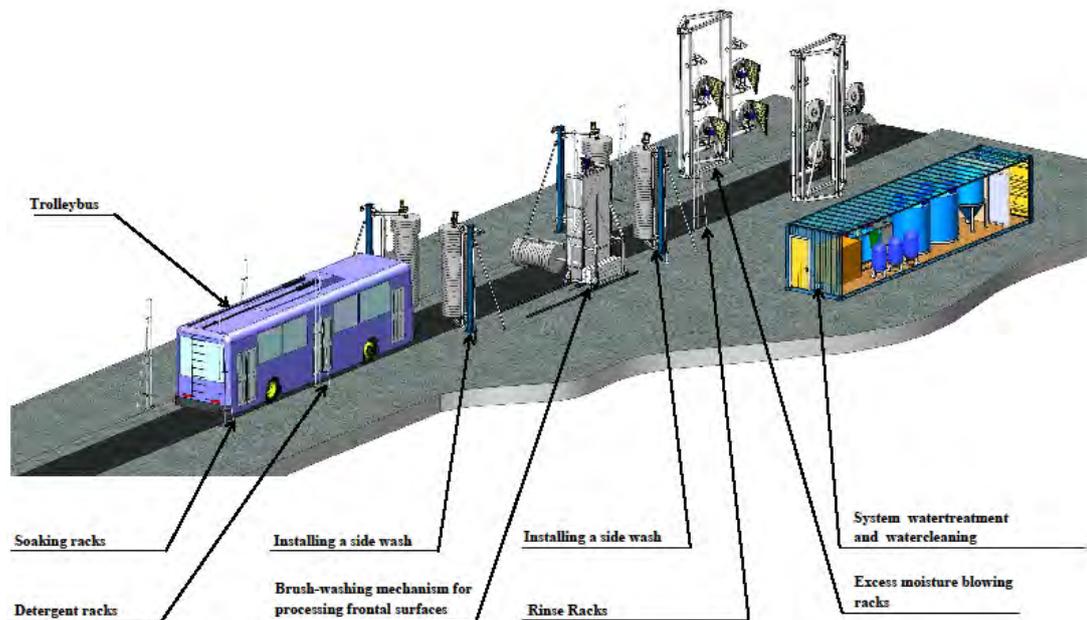
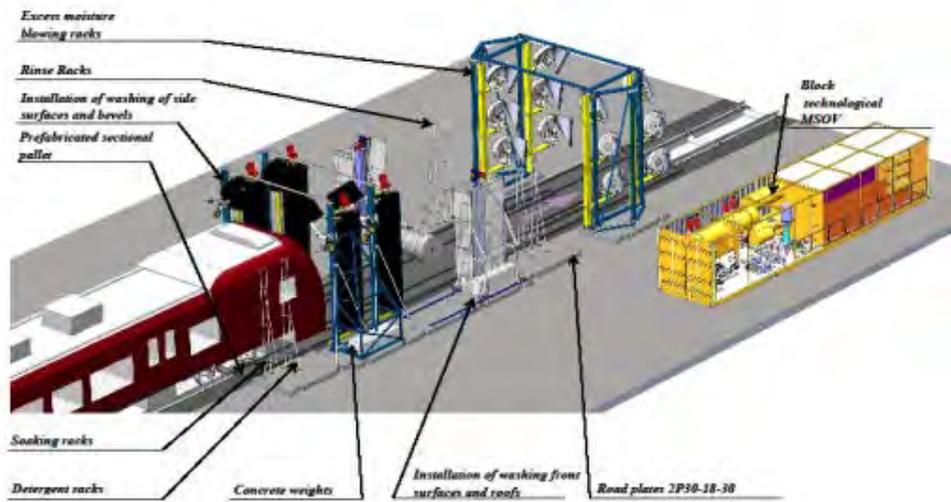
#### External washing



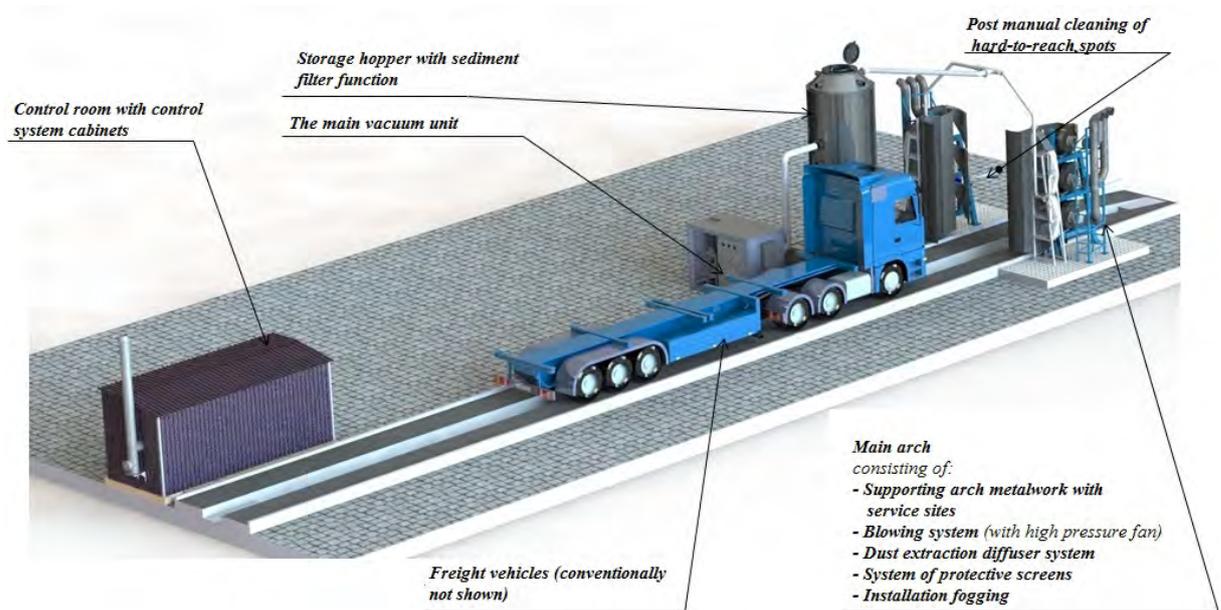
## 8.4. Means of transport.

Technologies and equipment for processing have been developed and are at different stages of implementation in the interests of different companies:

### 8.4.1. Municipal transport, including metro and tram cars, trolleybuses and buses:

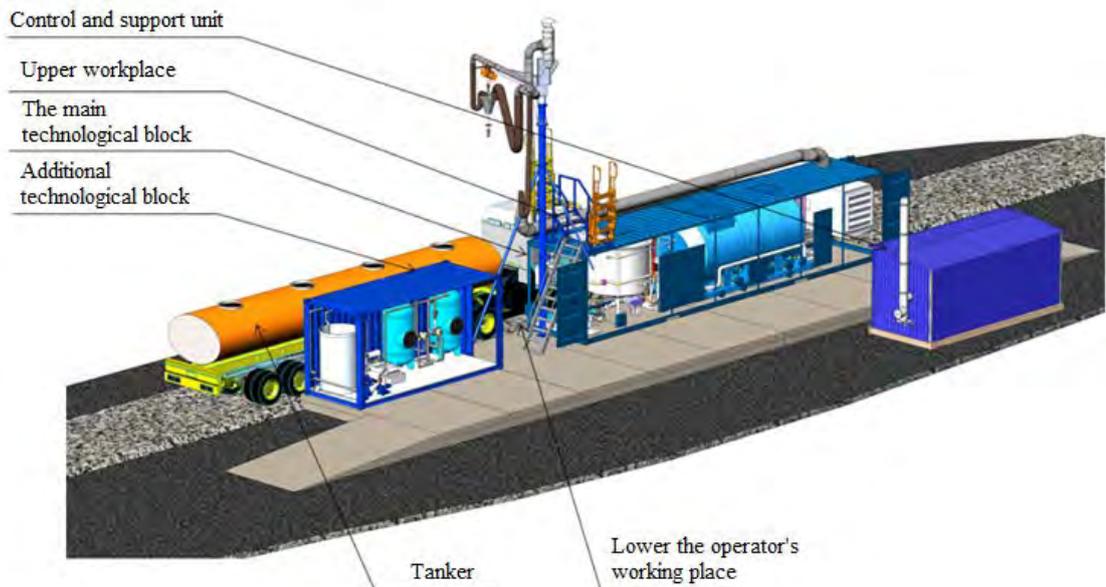


### 8.4.2. Trucks:

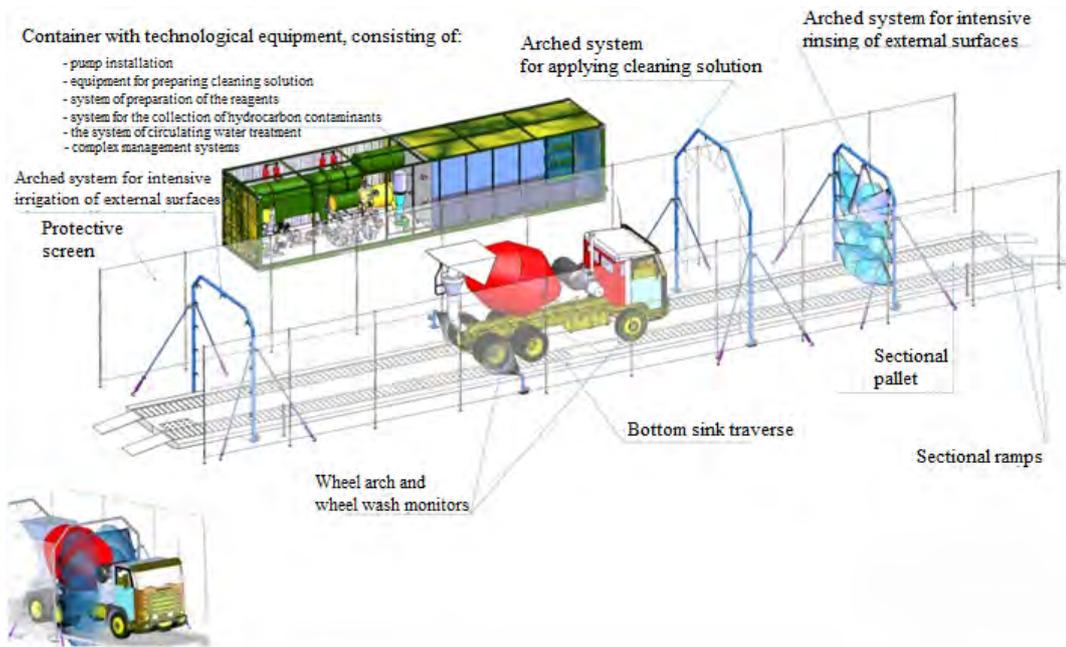


### 8.4.3. Specialized road transport, including:

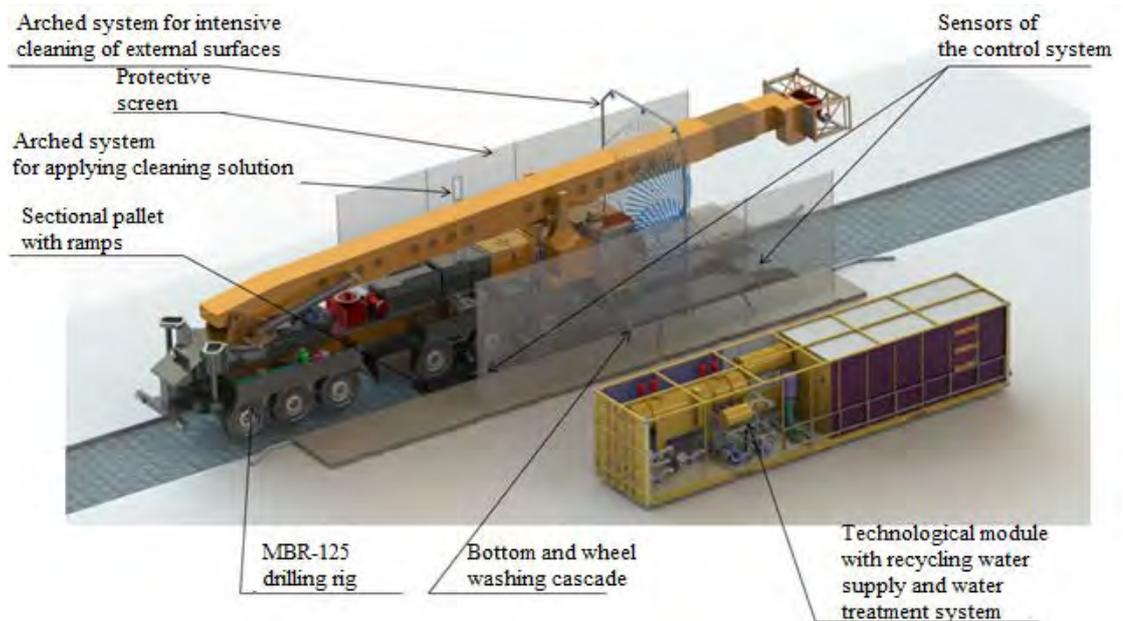
✓ tank cars



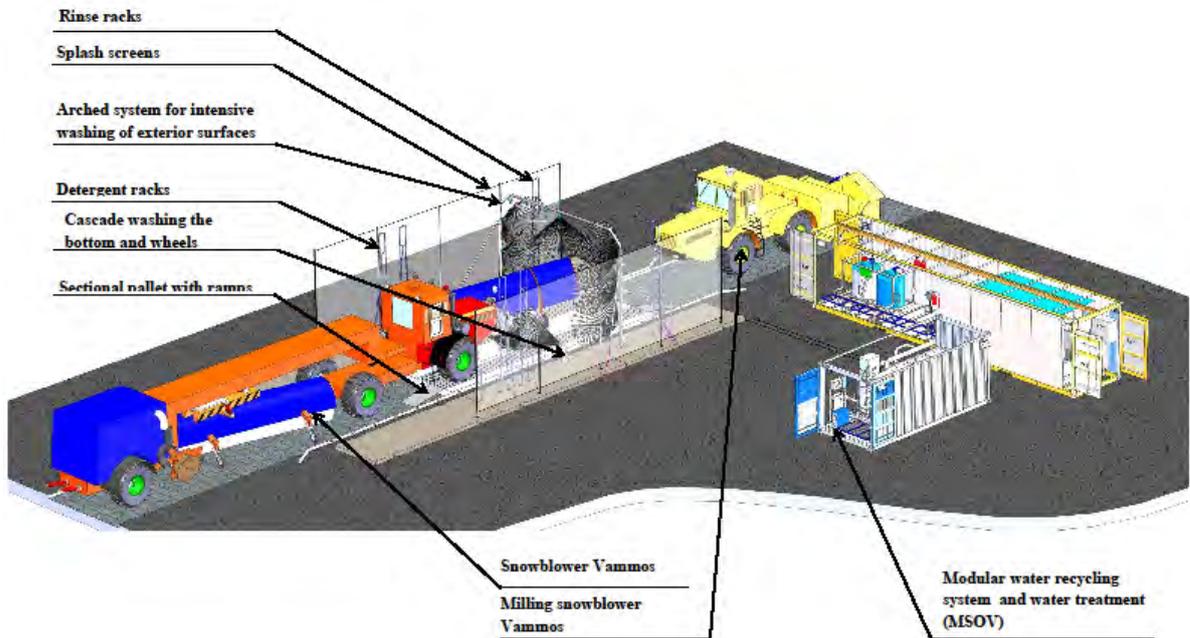
✓ *construction equipment*



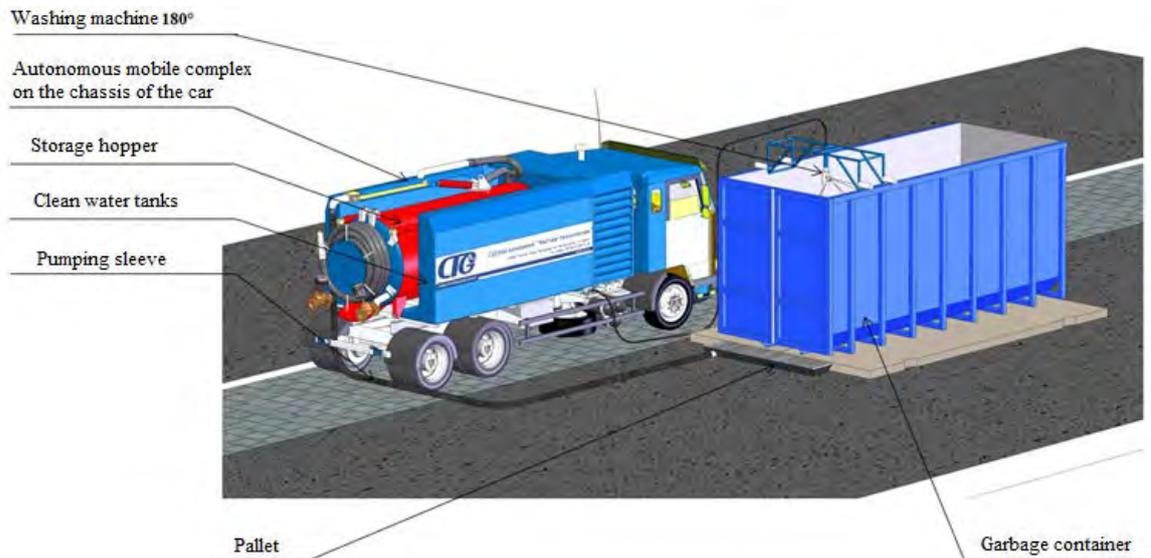
✓ *drilling rigs MBR-125*



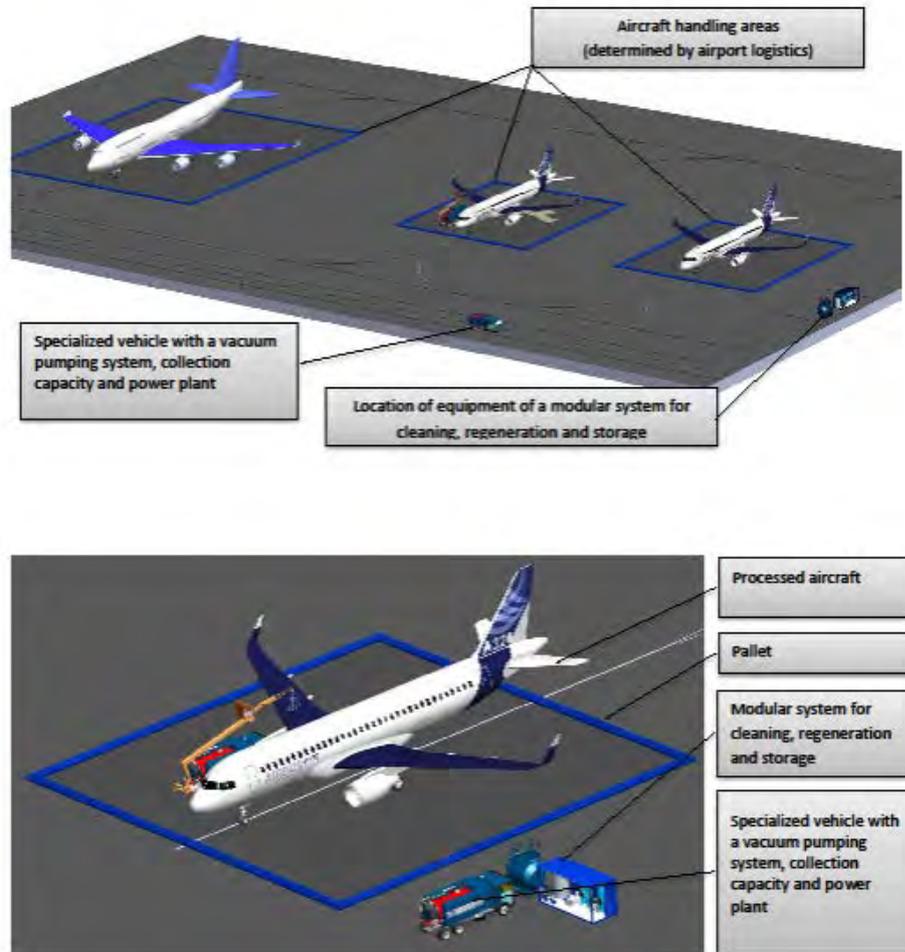
✓ *airfield equipment*



✓ *dumpsters (puhto)*

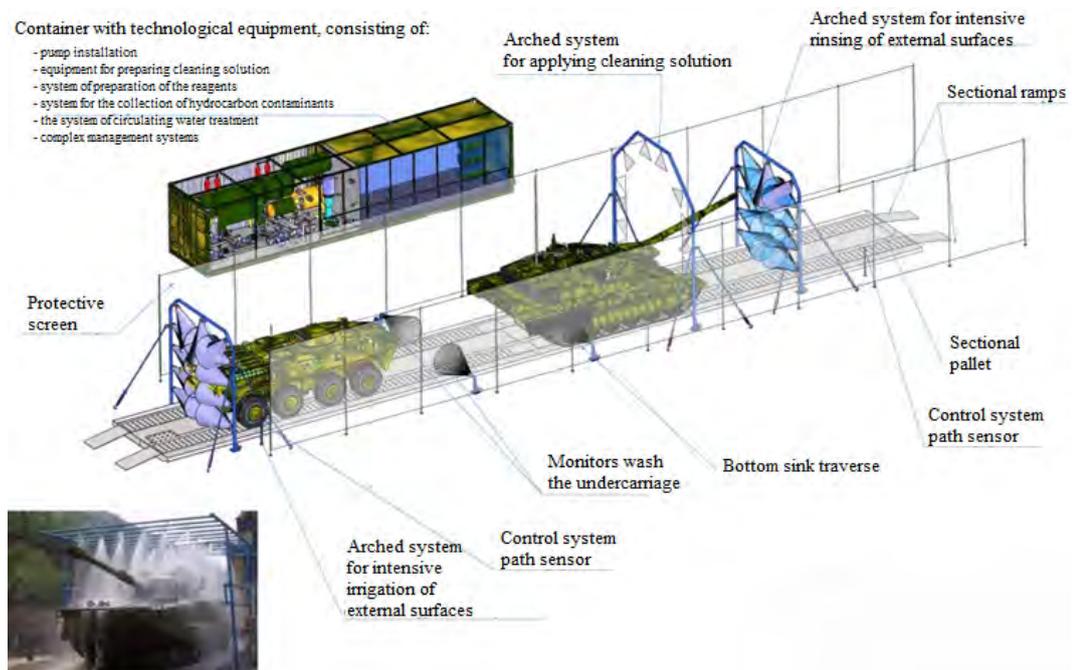


### 8.4.4. Air transport

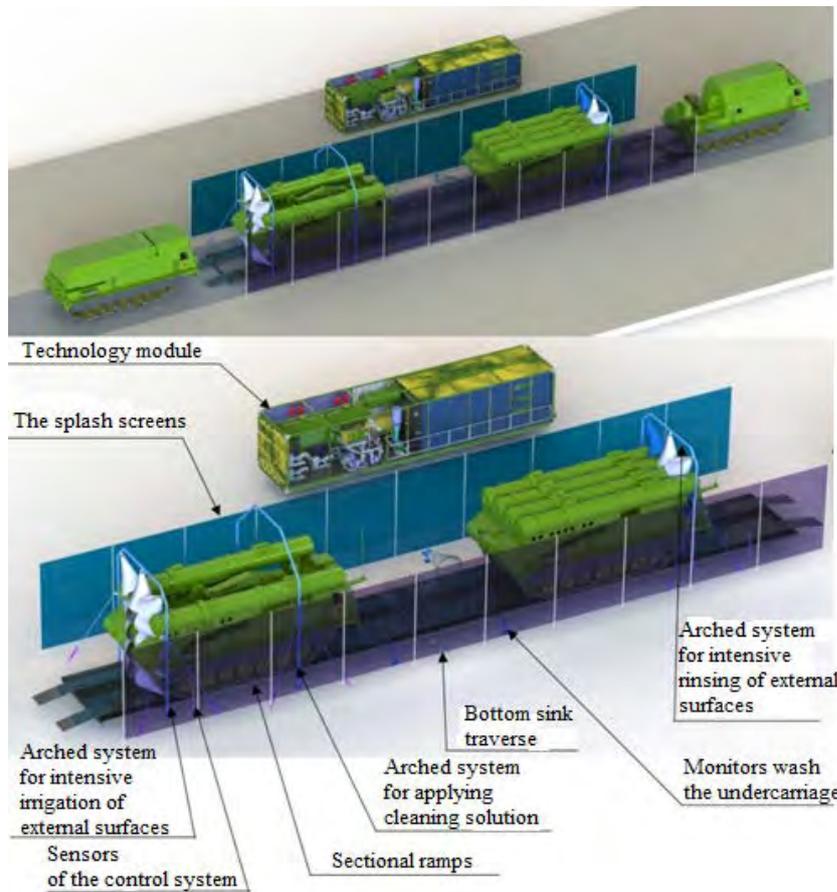
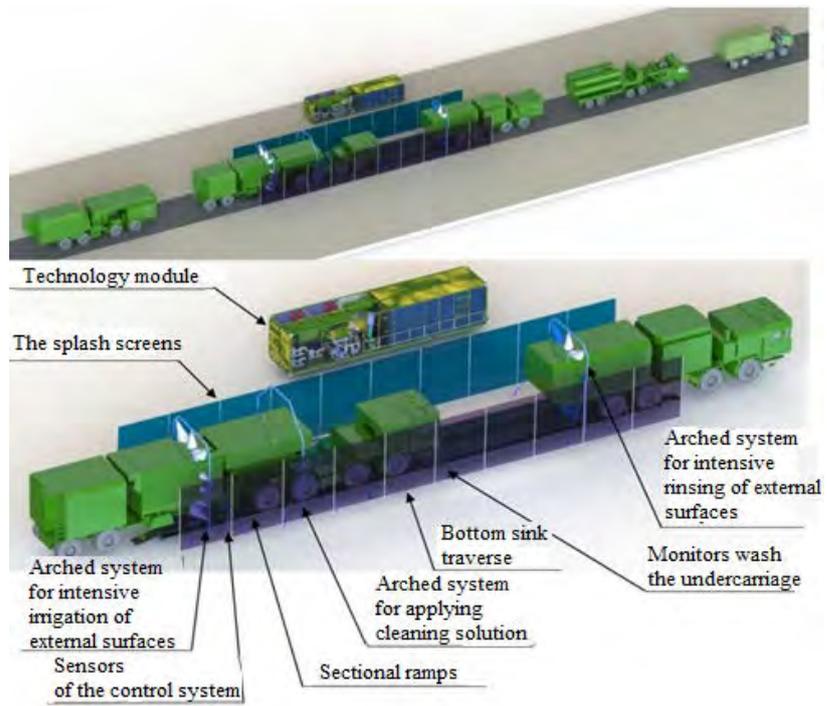


### 8.4.5. Military transport and equipment, including:

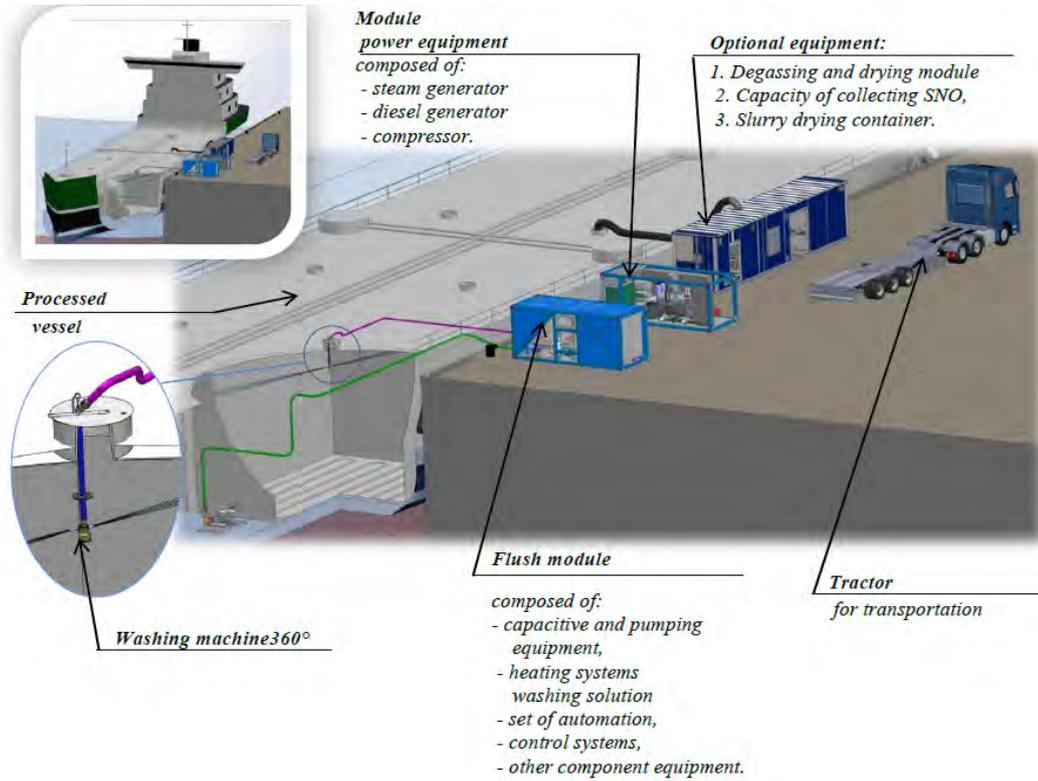
✓ armored vehicle



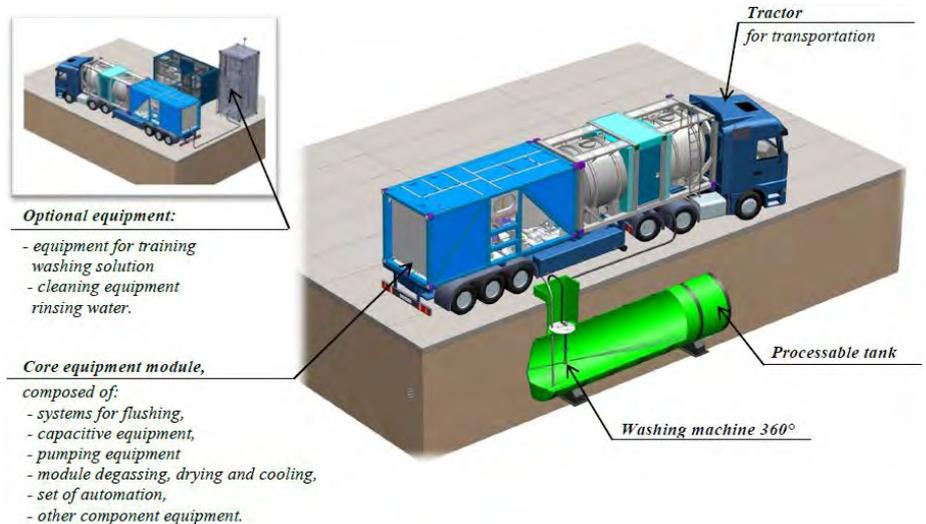
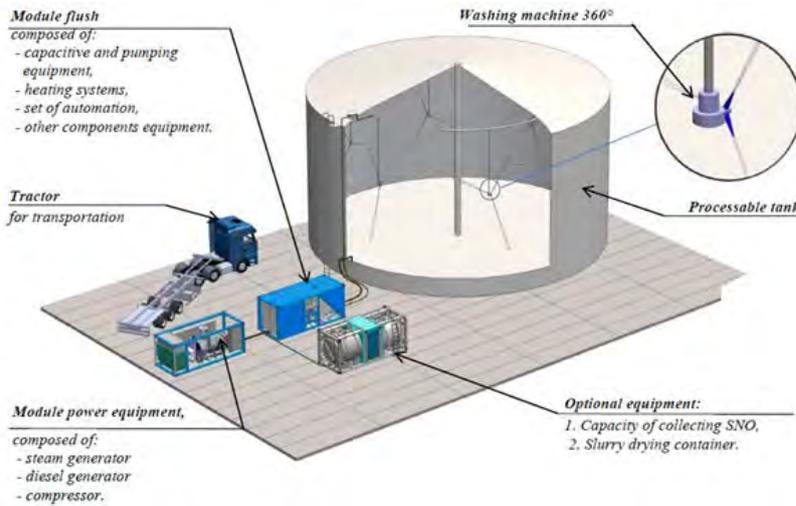
✓ wheeled and tracked



### 8.4.6. Ship tanks of water transport



### 8.5. Tanks of various volumes and purposes, including stationary ground and underground:



**9. Innovative  
technologies and equipment  
for  
washing parts, assemblies and mechanisms,  
for example:**

**9.1. Part washing machines**

*The product is intended for cleaning various parts from oil, oil and mechanical contamination.*

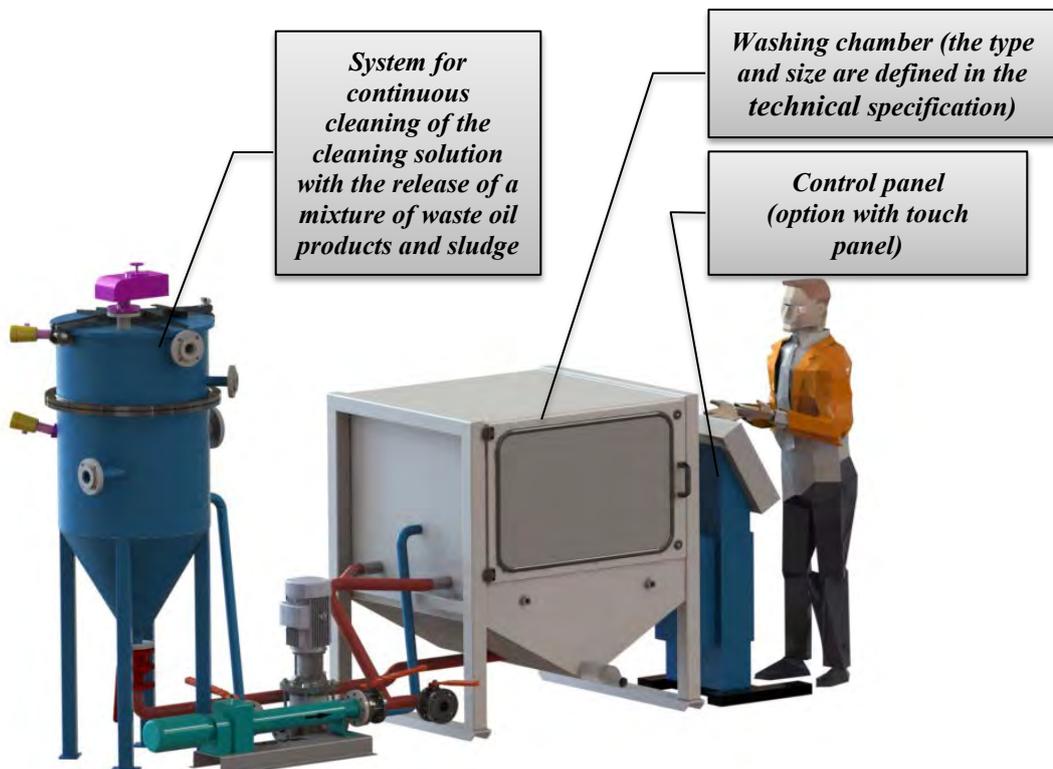
*The parts washing unit consists of a washing chamber, a continuous cleaning system for circulating cleaning solution, and a control panel.*

*The washing chamber is equipped with ramps with injectors that provide the effect of the cleaning solution on the parts from all sides. Additionally, the washing chamber can be equipped with an ultrasonic cleaning system or a mechanical basket drive.*

*The treatment process is based on the impact of a jet of an aqueous solution of technical powdered detergents series "O-BIS" on the dirty surface, in the layer of pollutant formed microscopic cracks, which are filled with cleaning solution. Thanks to special compositions of technical powdered detergents series "O-BIS" and low surface tension of their solutions, high quality of cleaning of details of any configurations is provided.*

*Then, passing through the system of continuous cleaning of the circulating washing solution, the contaminated water solution of the technical powdered detergents series "O-BIS" is cleaned from oil products and slurries.*

*Thus, this technology becomes drainless, which does not require replacing the solution. Only needs to periodically adjust it and top it up.*



## 9.2. Complexes for disassembly and washing of wheel sets of railway rolling stock

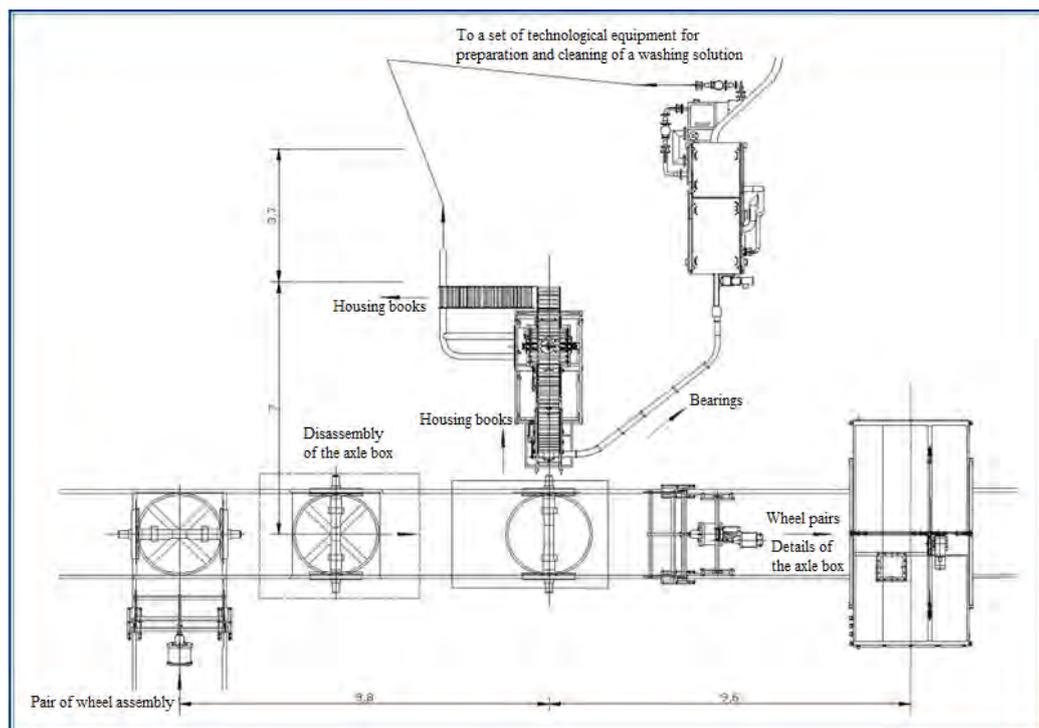
The complex for disassembly and washing of wheel pairs of railway rolling stock is a metal structure with a rail track, under which a pallet is installed for collecting spent cleaning solution. The washing complex consists of a moving line and a washing chamber with a block of distributors.

The washing chamber includes a housing inside which two mechanisms for washing the inner surfaces and two mechanisms for washing the outer surfaces of wheel pairs are installed. The washing chamber is equipped with a curtain lifting mechanism that moves two curtains in a vertical direction along the housing guides.

The complex includes:

- ✓ **lift** for the implementation of the dismantling of the axle box with wheel pairs;
- ✓ **turn table for orientation** of the wheel pairs when passing her in the loop processing;
- ✓ **lift and turntable** - differs from the turntable by the presence of a turntable drive;
- ✓ **washing machine** for washing wheel pairs with a treadmill wheel diameter of  $950 \pm 100$  mm in automatic or semi-automatic modes.

### Scheme of the complex for disassembly and washing of wheel pairs



## 9.3. Machines for disassembling the box cases and pressing bearings before washing

The machine for disassembling the box cases and pressing out bearings is intended for removing the box Assembly from the wheelset, disassembling the unit and redirecting the component parts of the unit to the communication lines with the corresponding washing machines.

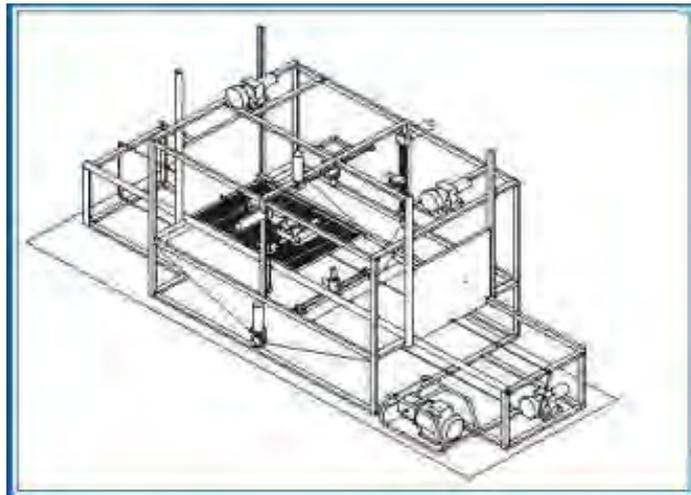
It has overall dimensions of 4500x1400x1650 mm.

#### **9.4. Washing machines for cases boxes and parts**

*The machine for washing cases boxes and parts is designed for washing various parts with dimensions up to 800x800x1300 mm and a weight of up to 300 kg*

*The presence of a latticed pallet for installing parts, as well as 4 movable high-pressure injectors allows for washing and cleaning from all sides.*

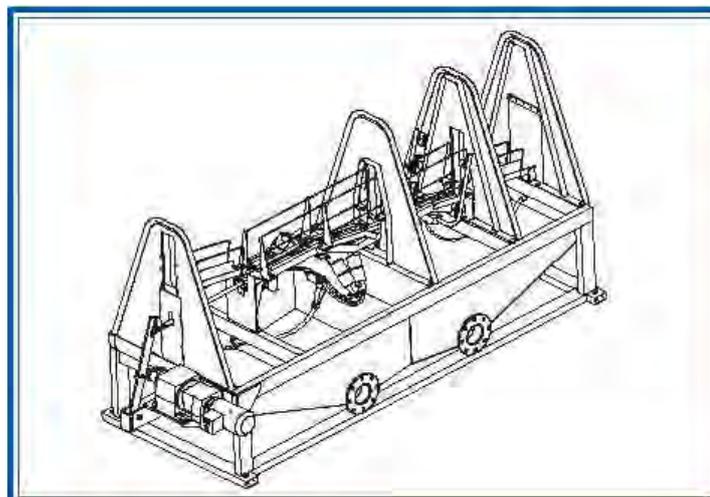
*The necessary quality of washing is provided by adjusting the speed of movement of the injectors and the feed table.*



#### **9.5. Bearing washing, rinsing and drying machines**

*The bearing washing, rinsing and drying machine is designed for washing, rinsing and drying bearings in automatic mode.*

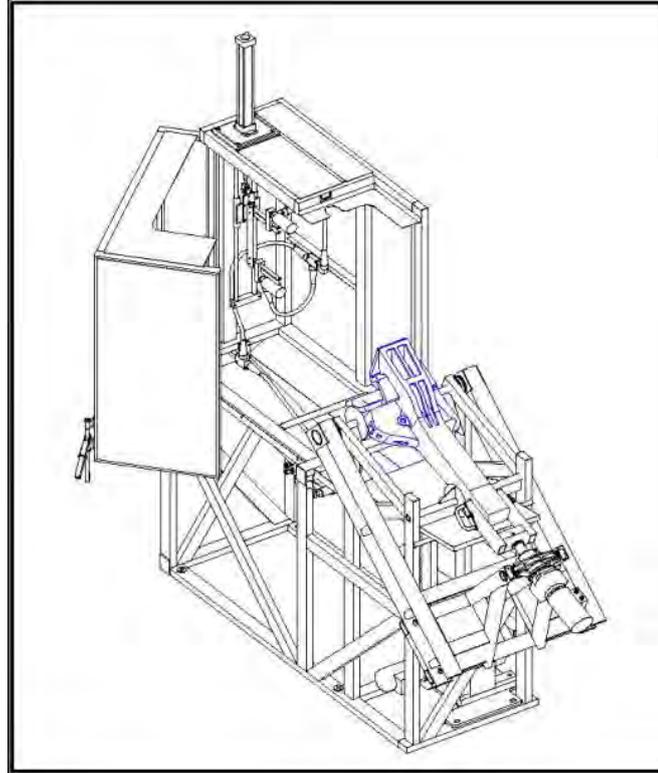
*It has overall dimensions of 5100x1800x1600 mm.*



### ***9.6. Washing machines are coupling devices***

*The coupling washer machine is designed for washing sa-3 auto couplers and their analogues in semi-automatic mode.*

*Has the following overall dimensions 2200\*1400\*1600 mm.*



**10. Innovative technologies and equipment for anti-corrosion protection, anti-icing treatment and painting of all types of rolling stock, as well as metal structures with special materials**

**10.1. Anticorrosive systems for processing and painting metal structures.**

*For various types of paints and metals, there are optimal modes in which the maximum values of adhesive strength are reached, and the service life of protective coatings increases several times.*

*The speed and strength of the interaction of metals with paints is determined by the amount of water on the surface of the metal. The interaction of metal surfaces with water molecules prevents the formation of the closest possible contact between the paint and the metal surface, which, in turn, leads to reduced adhesion strength and durability of the protective coating. On the contrary, high adhesion of coatings blocks the development of the corrosion process and the appearance of sub-film corrosion. To ensure high adhesion, it is proposed to heat metal structures using original inductors-eddy current generators. The dimensions and shape of metal structures do not matter in principle, because tools ensure the mobility of the technology.*

*We have developed and offered innovative technologies **to increase the service life of paint coatings** by improving their adhesive properties by removing water molecules from the metal surface as much as possible.*

*The following way of creating coatings for metal structures is proposed with improved anticorrosive properties:*

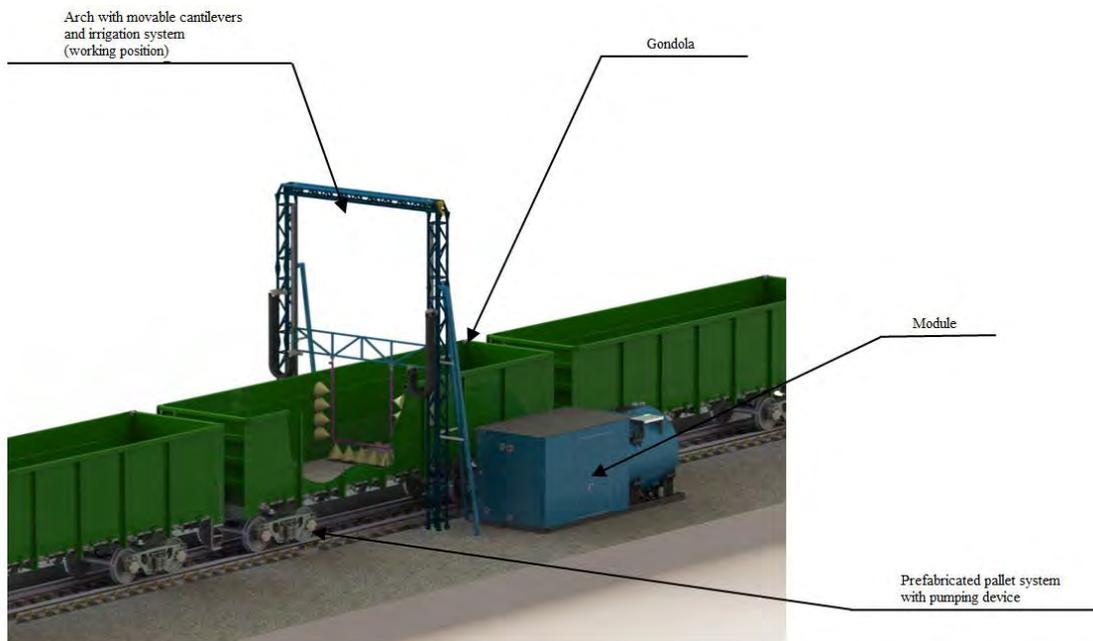
- 1. Choosing the optimal method of preparing the metal surface before applying paint: sandblasting, metal degreasing, priming with organic compounds and heating to 110-120 degrees.*
- 2. Use of paint and varnish materials with corrosion inhibitors and additives of water-displacing action.*
- 3. Application of powder paints, primers with application from sprayers, spray guns.*
- 4. Applying paint to a hot metal surface followed by cooling the metal structure.*



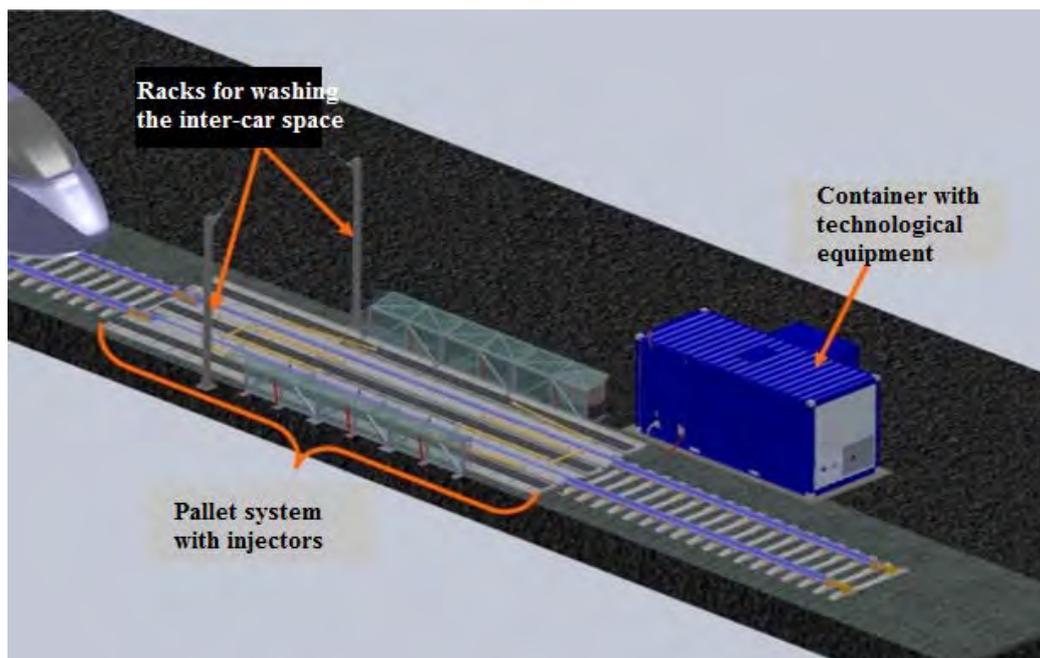
## 10.2. De-icing systems for:

### 10.2.1. Internal and external surface treatments bodies of railway freight cars, including:

to prevent cargo freezing to the walls and bottoms of the bodies



### 10.2.2. Processing and protection of the lower part of bodies and subcar equipment of passenger railway transport



### ***10.3. Special materials for painting rolling stock***

*A special anti-icing paint (enamel) EP-439P has been developed for painting surfaces exposed to icing (freezing).*

*On a painted product (roof overhangs, gutters, metal structures, etc.) due to the hydrophobic surface and low adhesion to ice, ice or icicles can be removed with minimal physical impact, that is, chipping with a crowbar or other similar tools is not required.*

*The service life of this coating, without changing the performance properties (de-icing) is at least 3-4 years.*

***Advantages of anti-icing paint (enamel) EP-439P:***

*1. It is used to protect any surface, including metal, concrete, bituminous coatings (such as "Ondulin") and galvanized steel.*

*2. It is possible to apply any method: brush, roller, air and airless spray.*

*3. Unlike other proposed projects, this solution does not require special equipment and significant material costs. Does not require additional energy sources*

*Enamel on the roof*

*(immediately after application,  
summer 2011)*



*Winter 2011 – 2012*



*Spring 2012*

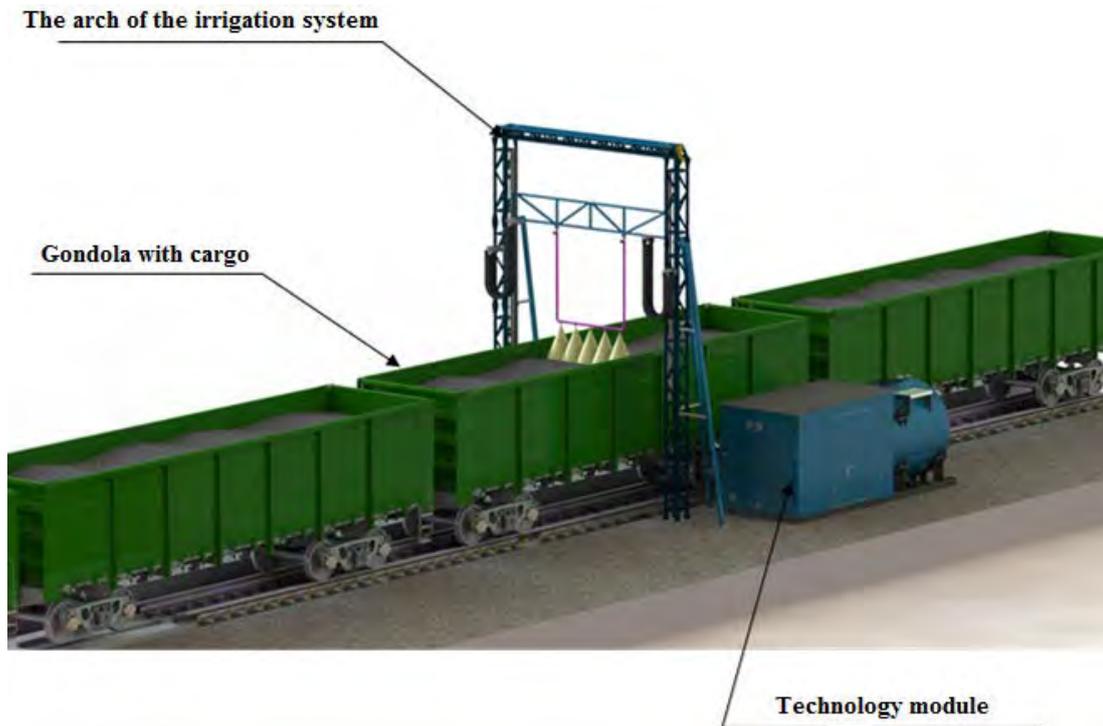


*anti-dust and anti-icing*  
**PROTECTION**  
*of bulk and bulk cargo*

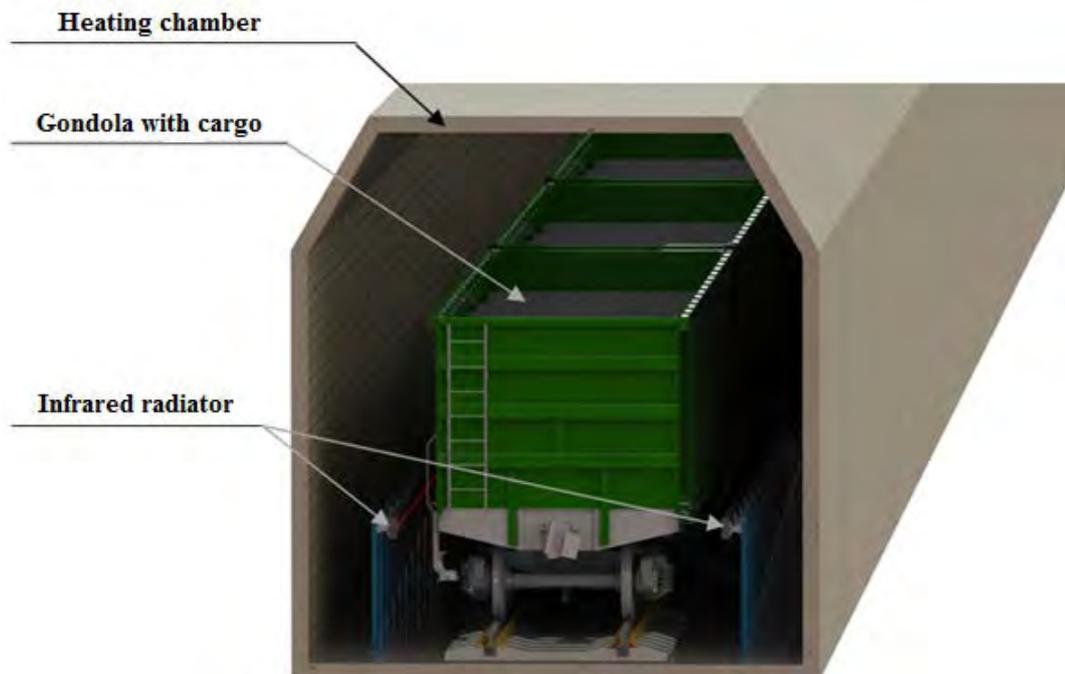


***11. Innovative technologies and equipment for dust protection and defrosting of bulk and bulk cargo during loading, transportation, transshipment and storage, including:***

***11.1. Handling cargo (for example, coal) to prevent its dusting***



***11.2. Defrost cargoes in open-top***



## ***OIL GAS PRODUCTION and REFINING***



## ***12. Innovative technologies and equipment in the field of prospecting***

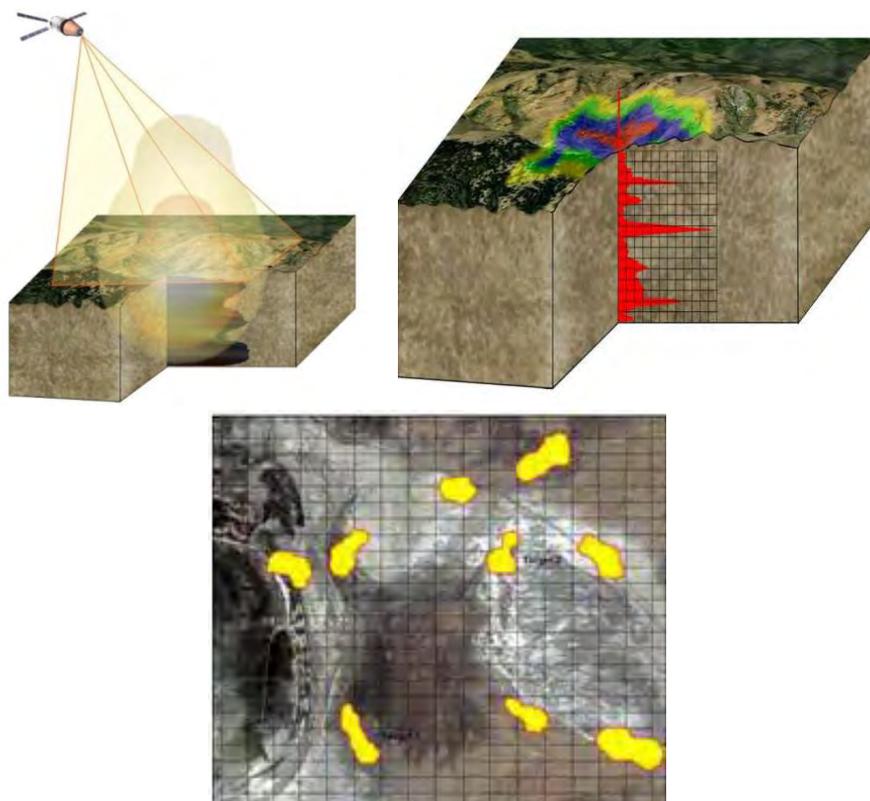
*In the interests of companies associated with mining, a technology has been developed in the field of **geological exploration**.*

*The **proposed technology** provides equally **successful search** in vast areas of **any given chemical element or compound** (hydrocarbons, gold, diamonds, water, etc.), **allows** you to quickly **identify promising areas, specific locations, remotely and with a high degree of accuracy to predict volumes and the content** of the desired **substance**. **Exploration period on the standard block 10 000 km<sup>2</sup> is 5-8 months, the reliability of the information received is above 90%**.*

*The **fundamental difference** between this **technology** and analogues is that the equipment that provides it **registers directly its own radiation** of the desired **mineral** in a given territory, which makes it possible to **determine with high accuracy** not only the **boundaries** of the deposits, but also the **depth and thickness** of the **formations**, and calculate the **volume of reserves, accurate to meters** to determine the **coordinates and depth** of drilling **production wells** or pits.*

*The **technology of geological exploration** proposed by «**CIT**» allows, **without significantly raising the cost, increasing the time and reducing the reliability** of the results, **work** on deep-water shelves covered by ice and other complex subsoil areas. It is possible to completely or partially abandon the use of such expensive, environmentally unsafe and difficult to perform offshore geophysical methods as 2D and 3D seismic, which can dramatically reduce costs and lead time.*

*To date, this technology has been successfully implemented both in the Russian Federation and abroad, including in the USA, Canada, Kazakhstan, Australia, Bulgaria, the Czech Republic, Sri Lanka, Mexico, Venezuela, Uzbekistan, Turkmenistan and other countries.*



### ***13. Innovative technologies and equipment for oil gas production***

*In the interests of companies associated with oil and gas production, wear-resistant **sucker-rod deep pumps (SRDP)** have been developed, which can be used in **deviated and deviated wells**, as well as in **difficult conditions** such as:*

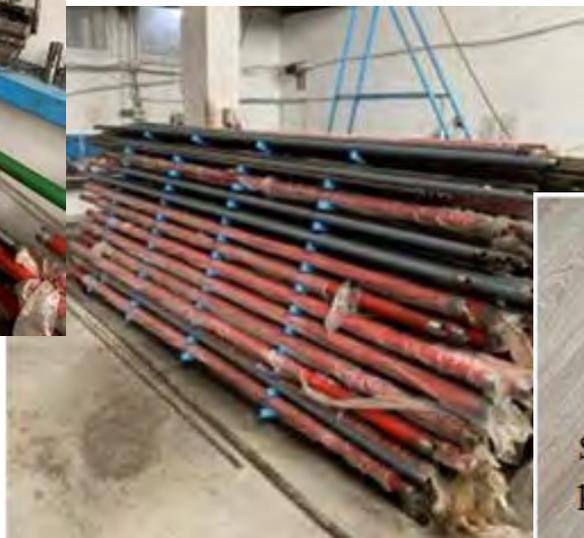
- ✓ increased content of solids and gas;*
- ✓ contamination of (SRDP) components by asphaltenes and paraffins.*

*All of the above problems shorten the life of analogues (standard pumps) and the overhaul period.*

*The economic effect of the use of the proposed pumps is to save costs associated with the **repair** of conventional pumps and to **generate income** from the **sale of additionally received oil volume**.*

*This **equipment has been implemented** at many oil producing enterprises in Russia and the near abroad, the service life of conventional wells is **twice that of similar** equipment from other **manufacturers**.*

*The **equipment offered** by us, its components and assemblies are **patented** and have all the necessary **licenses and certificates**.*



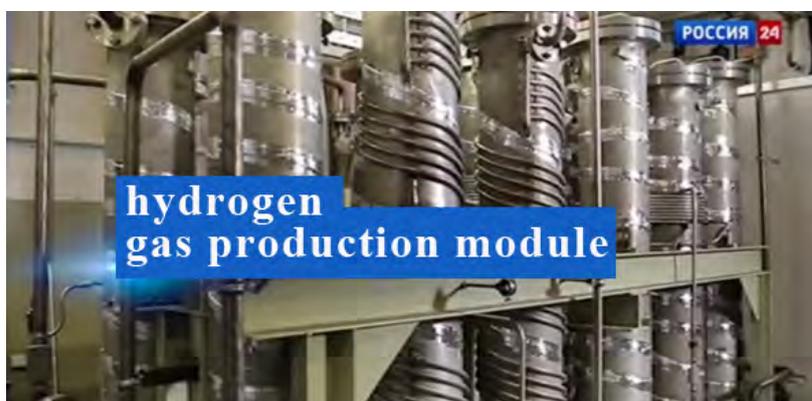
**14. Innovative technologies and equipment for processing of associated petroleum gases and low-tonnage production target chemical products**  
(aromatic hydrocarbons, methanol, hydrogen, motor fuels, carbon black, etc.)

*In the interests of various companies, technologies and equipment have been developed, implemented or are at different stages of implementation for:*

- ✓ *preparation of hydrogen-containing gas,*
- ✓ *production of synthesis gas from natural gas,*
- ✓ *catalytic synthesis of commercial products,*
- ✓ *etc.*

**INTRODUCED** several pilot demonstration and pilot plants,

**DONE** more than 10 development projects and 20 research projects in the field of technologies and high-temperature reactors for producing synthesis gas, including for FSUE Central Research Institute named after Acad. A.N. Krylova, PJSC "KRIOGENMASH", LLC "Gazprom Neftekhim Salavat" and other companies.



> THE PROJECT REQUIRES INVESTMENT AND IMPROVEMENT

## ***15. Monitoring the health status of employees at remote sites***

*A software and hardware complex has been developed to monitor the health status of workers at remote sites. It is proposed to use an electronic medical examination system with photofixation that checks body temperature, blood pressure, pulse, the presence of alcohol in the body and signs of drug intoxication before the start of the shift.*

*The system allows not only to automate the conduct of pre-shift medical examinations, but also to identify problems and warn the employee and employer about them. Possible problems are “risk groups” of workers in dangerous conditions that can lead to critical errors. These conditions cannot be detected using tonometers, since even with generally accepted “normal” numerical values or slight deviations in blood pressure and heart rate from the norm, a person can be in dangerous conditions (overwork, fatigue, stress, and others), which, in their turn can cause an accident. The proposed system allows you to identify these conditions with the help of a comprehensive rapid test and prevent an employee in a dangerous condition from working, and send him to the appropriate specialists.*



***Water PREPARATION, PURIFICATION  
and OZONATION***



## ***16. Innovative technologies and equipment for water treatment, including:***

### ***16.1. Preparation of desalinated drinking water.***

***Ecologically safe and waste-free innovative technologies and equipment for desalination of sea (or brackish) water have been developed, implemented or are at different stages of implementation.***

***The most important distinguishing feature of this equipment is the solution of the problem of economically obtaining clean drinking water in a single ultra-compact «module» that can be assembled / disassembled in literally minutes with the possibility of its multiplication, which allows for the phased provision of any necessary performance and, consequently, investment optimization.***

***Desalination equipment is designed, patented and certified by Russian scientists and is made from high quality materials at modern Russian and European enterprises. It has a significantly lower cost relative to world analogues and does not require significant investments in design, construction and installation works. It is necessary to note the unique corrosion resistance of the materials of this equipment to sea water (up to 15 years).***

***The prime cost (with preliminary treatment) of obtaining drinking water that meets all the requirements of WHO, the EU, USEPA and SanPiN is significantly lower than that of the world's best samples of such equipment, and allows the use of desalinated water, including and for irrigation needs.***

***This equipment is aimed at individuals, cottage villages, hotel complexes, farms, industrial enterprises, settlements, sea vessels (drinking water supply), etc.***

***Currently, hundreds of units have been implemented and are successfully operating in Italy in England, Japan, Turkey, Iran, Egypt, Australia, Indonesia, Malaysia, India, Vietnam, South Africa, Morocco, Russia, etc.***



## **16.2. Water treatment in cold water supply systems.**

For the **purification of water** in cold water supply systems from suspended solids, **multi-stage filtration units** of the UMV type have been developed and are being successfully implemented at various housing and communal, industrial and commercial facilities.

This equipment is installed in the rooms of the water meter nodes after the water meter and / or in front of the boost pumps and **differs**:

- ✓ with a productivity up to 112 m<sup>3</sup> / hour,
- ✓ high degree of water purification (3-5 microns),
- ✓ low power consumption,
- ✓ economical, due to the use of flushing (regenerated) filter elements,
- ✓ when flushing is used on more than 1% of pure water.

UMV installations **solve the problems** of the **presence of mechanical impurities, scale, rust, etc.** in water. and after their installation **does not require additional installation of filters** in each apartment.



### **16.3. Ozonation of water, в м.ч.:**

#### **16.3.1. Integrated water ozonation plants.**

*Integrated installations for water ozonation (IO) are designed to solve the following problems:*

- ✓ *water treatment (purification from Fe, Mn, S, dissolved organics);*
- ✓ *final treatment and disinfection of wastewater;*
- ✓ *final cleaning and disinfection in recycled water supply.*

*Ozonation installations include an ozonizer with short-cycle oxygen generator, stainless steel contact chamber, ejector mixing unit for ozone with water, residual ozone destructor and indication unit and management.*

*The installation works in automatic mode - it turns on and off by the signals of the water level sensor in the contact chamber and the water flow sensor, as well as external signals. The unit is equipped with an oxidation-reduction potential sensor and an ozonizer productivity control system.*



#### **16.3.2. Mobile ozone sanitizers.**

*Mobile ozone sanitizers (sanitary station for ozonation of water) are intended for the preparation and supply of ozonized water with an ozone concentration of 2-3 ppm, which has pronounced disinfecting properties (disinfects bacteria, viruses, mold fungi). Received ozonated water can be used for sanitation and disinfection:*

- ✓ *surfaces of public spaces, production and storage facilities, transport;*
- ✓ *plastic, glass, metal containers, lids, corks for drinks and other food products;*
- ✓ *hard surfaces (floors, walls, tables, equipment) in places of storage and processing of food products, including having direct contact with food products;*
- ✓ *water pipelines and food products;*
- ✓ *production tanks for storage and processing of food products;*
- ✓ *containers for transporting liquids and food products.*



#### **16.4. Physical and chemical cleaning of household, industrial and storm water wastewater**

***In the interests of housing and communal services (HCS) and the agro-industrial complex (AIC), environmentally friendly and waste-free innovative technologies and equipment have been developed for physico-chemical treatment of domestic and highly concentrated effluents.***

***The data offered by CIT, automated complexes provide disinfection of effluents with practical elimination of odors, their purification from bacteria and viruses to obtain demineralized water for use in recycled water supply or discharge into fishery water bodies, as well as, where necessary, drainless purification and evaporation of concentrate to obtain solids of dissolved salts.***

***The above complexes can be used in cottage villages, industrial and agricultural enterprises, including livestock and pig farms, etc. In particular, it is important to equip agricultural hot spots of various regions of Russia with such equipment in order to disinfect and purify wastewater from bacteria and viruses, to improve and rehabilitate rivers, lakes and the ecosystem as a whole from nutrient pollution.***

***Currently, an automated complex of precision physico-chemical treatment of highly concentrated technological and storm drains, which, as a result, are suitable for use in secondary water supply or for discharge into fishery reservoirs, is operated at Predportovy CJSC (St. Petersburg). The annual productivity of the complex is up to 70 thousand m<sup>3</sup>. Drainage water generated during the cleaning process is a concentrated liquid organic fertilizer (up to 10% of the initial volume).***

***The modular design of these complexes allows you to quickly carry out installation and commissioning of products.***



*Air*  
***PURIFICATION and OZONATION***



**17. Innovative  
technologies and equipment  
for  
air purification and ozonation  
including:**

**17.1. Mobile air ozonizers.**

*OGNK mobile air ozonizers are designed for:*

- ✓ *disinfection of air and surfaces (disinfects bacteria, viruses, molds), deodorization of air in residential, public, industrial, storage facilities;*
- ✓ *disinfection and deodorization of the salons of any vehicles, including buses, trolleybuses, trams, subways, suburban electric trains and long-distance trains, air and sea transport;*
- ✓ *extending the shelf life of food products.*



*The proposed ozonizers can be installed both indoors and on vehicles. They are equipped with a fan for distributing the ozone-air mixture over the treated room and an integrated filter for the decomposition of residual ozone to accelerate the process of its removal.*

*The performance of these ozonizers is 2.5-20 g / hour. Room processing is carried out in the absence of people. The microprocessor control system of the ozonizer makes it possible to set the operating time in the ozone generation mode and turn on the generation mode with a delay relative to the Start command, so that the operator can leave the room before the start of ozone generation.*

**17.2. Bipolar recessed air ionizers.**

*The IOKKI-01 bipolar built-in air ionizers are designed to improve the quality of purified conditioned air by saturating the room air with aero ions. The principle of operation of the IOKKI-01 ionizers is based on the sequential generation of clusters of positive and negative ions in the corona discharge at an extremely low voltage on the corona electrode.*

*IOKKI-01 ionizers are installed at the outlet of the air ducts of the supply ventilation system in front of the air outlet grille*

*Air ionizers provide:*

- ✓ *maintaining the aeroionic composition of indoor air in accordance with SanPiN 2.2.4.1294-03 by saturating the polarity with “+” and “-” aero ions;*
- ✓ *air normalization after HEPA filters;*
- ✓ *removal of static charge in rooms.*



***SORTING and PROCESSING***  
***of waste***  
***of various origin***



**18. Innovative  
technologies and equipment  
for  
sorting and processing  
solid, liquid and gaseous  
waste  
diverse backgrounds including:**

**18.1. Mobile waste sorting complexes (MWSC) «Success # 1».**

for receiving solid municipal, industrial and construction waste, built into a 40-foot container and equipped with the necessary electrical equipment. The performance of the proposed MWSC in the optimal basic configuration is up to 100 thousand tons / year, but can be adjusted depending on customer requirements.

MWSC "Success # 1" can be installed on a car semi-trailer length not less than 13.6 m or on any other horizontal surface that meets the necessary conditions for the functioning of the complex.

**Advantages of MWSC «Success # 1»:**

- ✓ the ideal solution for the operational and budgetary launch of the process of sorting solid municipal, industrial and construction waste;
- ✓ suitable for landfills, transshipment stations, transport enterprises;
- ✓ all-season use regardless from weather conditions and climatic zones;
- ✓ convenience and ease of installation / disassembly, use and maintenance;
- ✓ the possibility, if necessary, of transferring MMSK to other sites without significant investment and the implementation of design and construction works;
- ✓ efficiency and security of investments - subsequent sale or modular expansion is possible to increase productivity.



## 18.2. Equipment for waste processing, including:

### 18.2.1. Solid utilities.

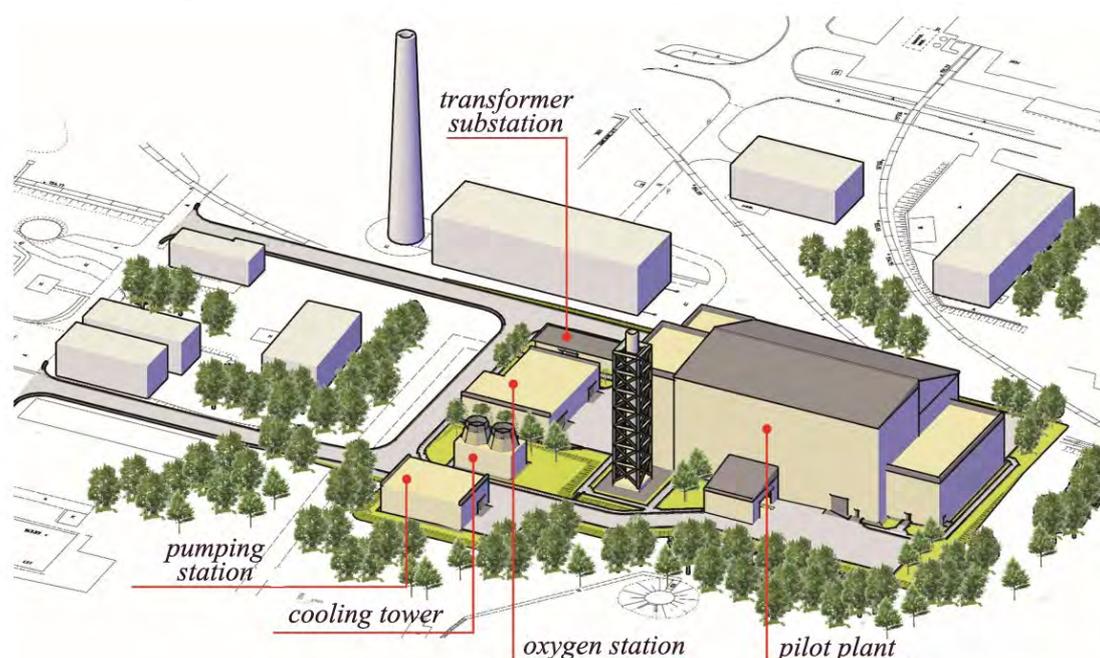
In the interests of various industries and spheres of human activity developed and implemented **environmentally safe and waste-free highly profitable innovative technologies and equipment for thermal processing of solid waste**, including:

- \* which is the result of **human activity** (unsorted solid municipal waste and city sewage sludge),
- \* **industrial** (radioactive, black and nonferrous metallurgy, aluminum industry, etc.)
- \* **medical**,
- \* **1st and 2nd hazard classes**.

Creation of the modern enterprises realizing these technologies will allow to make various commodity production – thermal, electrical energy, cast rubble and ferrous alloy **in the case of recycling MSW or landfill reclamation**, fused clinker and iron alloy **in the case of utilization of steel slag ferrous metallurgy**, alumina clinker and cast iron **in the case of processing of red sludge alumina production of aluminum industry**, slag construction products and iron alloy **in the case of disposal of non-ferrous metallurgy slag decontaminated metal in the case of processing of metal radioactive waste**.

On the basis of the developed «Technology for the disposal of metal radioactive waste based on melting units with liquid metal heat removal», a **project was completed for the construction of a pilot demonstration complex** for the processing of solid radioactive waste using the pilot plant with reference to the industrial site of the Kaluga Research Institute area. **Technical expertise** of this project received a positive conclusion. Also, a project was developed for the disposal of solid unsorted municipal waste for the city of Chelyabinsk, which received a positive conclusion from Rospirodnadzor in the Chelyabinsk region. The **possibility of implementing these projects at other specialized industrial sites of the Russian Federation and abroad** (Germany, Greece, etc.) is being studied.

**Design of the unit and waste disposal technologies** of various origins are **protected by European and Russian patents**.



> THE PRODUCT IS READY FOR PRODUCTION OF A PILOT SAMPLE

### **18.2.2. Organic-mineral screening of solid municipal waste after waste sorting.**

*In the interests of large companies-operators in the field of solid municipal waste (SMW) management, which use mechanized waste sorting systems and secondary product recovery lines in technological processes, a technology has been developed for processing primary organo-mineral screening of SMW after waste sorting.*

*The proposed technology allows to achieve a high technological effect and ensure environmental safety in the processing of solid waste by:*

- ✓ *creening disinfection during deep alkaline hydrolysis of the organomineral mass, leading to the destruction of pathogenic microflora;*
- ✓ *screening neutralization as a result of chemisorption absorption of heavy metals by a mineral matrix;*
- ✓ *ensuring low filtration ability of the material obtained during processing, preventing the leaching of pollutants from its structure and minimizing the effect of secondary pollution during further operation of the material;*
- ✓ *a significant reduction in dropout by 3-5 times from the initial;*
- ✓ *ensuring significant financial savings through the use of material obtained after processing in the technological cycle of the SMW landfill as a material for transfer.*



### 18.2.3. Liquid and gaseous.

In the interests of various industries and spheres of human activity, **environmentally friendly and waste-free innovative technologies** and installations in stationary and transportable design have been developed and are being implemented for the **disposal** of liquid and gaseous waste of various origins, including toxic organ chlorine compounds, pesticides, herbicides, toxic, liquid medical waste, poisons, industrial waste, etc.

In particular, a high-temperature reactor, similar in principle to the operation of liquid rocket engines and providing thermal decomposition of waste at temperatures up to 3500 K without the formation of secondary toxic compounds, is the **main element** of the «VTR» installations. Testing conducted jointly with Mannesmann and the leading institute of the EEC for Ecology and Life Safety Institute Fresenius (Germany) confirmed that the concentrations of the most harmful and toxic products such as polychlorinated dibenzodioxins in the gas mixture at the «VTR» outlet are an order of magnitude lower than the requirements of the EEC for emissions into the atmosphere and the content of these products in drinking water.



The equipment of the project allows the thermal **processing** of liquid wastes of various origins, including waste **pesticides** and **agrochemicals**, **organic substances**, spent solutions of organic and inorganic **acids**, as well as those that arise during the chemical treatment of metals. These liquid wastes are disposed of by burning them at high temperatures (not less than 1800 °C) in the operational state of the installation. Technological schemes and the composition of plant modules depend on the type of waste processed.

> THE PRODUCT IS READY FOR PRODUCTION OF A PILOT SAMPLE

#### **18.2.4. Saline production.**

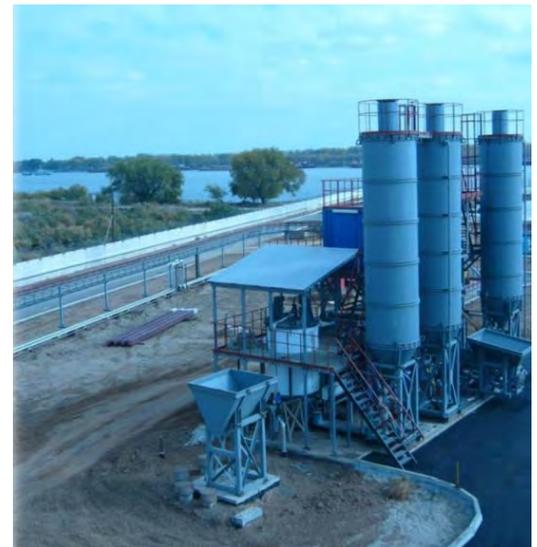
*In the interests of industrial enterprises that generate semi-saturated waste and / or wastewater contaminated with chlorides in the process of implementing their technological cycles, as well as companies whose activities are associated with the desalination of sea water for municipal needs, a stationary set of equipment has been developed for the processing of saline industrial waste.*

*Salt-saturated water and solutions with a concentration of chlorides and sulfates of up to 200 g / liter are formed as a result of human activities in the form of waste drilling fluids, drilling wastewater, waste after using reverse osmosis and desalination plants to produce drinking water from salt water, as well as the waste of a number of industrial plants. These wastes cannot be disposed of by accumulation in sludges or by dumping at sea. Evaporation of them to obtain technical salts is not always advisable, especially if hazardous compounds are present in the waste composition.*

*For environmentally safe processing of various brines, an integration mineral-matrix technology (IMMT) of geo-polymerization can be applied, consisting in combining waste with a modified clay substrate of high chemical activity (a modifying complexing additive) and a number of natural local materials. The implementation of IMMT allows to process saline waste into stabilized artificial rock - GUT geopolymer. The binding of chlorides and sulfates contained in saline waste is carried out due to the chemical processes of alkaline hydrolysis that occur during the production of HUT material. The desorption of chlorine and sulfate ions into the aqueous medium from HUT resulting from such waste processing is significantly reduced.*

***Advantages** of the proposed complex of equipment:*

- ✓ *the ability to process waste with a high chloride content;*
- ✓ *high environmental effect achieved by the maximum suppression of migration activity of chlorides;*
- ✓ *obtaining as a result of processing environmentally friendly building material suitable for geotechnical works or its further implementation;*
- ✓ *simplicity of the processing process and low qualification requirements for staff;*
- ✓ *high reliability and maintainability of the proposed equipment.*



### 18.2.5. Well drilling.

*In the interests of oil and gas companies engaged in the extraction of hydrocarbons or service companies providing services for drilling and / or disposal of drilling waste, as well as field exploitation (soils contaminated with oil products), a mobile complex of equipment has been developed for processing well drilling waste, including neutralization of drilling sludge, waste drilling mud and drilling wastewater. In this case, waste processing can be carried out both jointly (two or all three types of waste), or separately (one type of waste).*

*The proposed set of equipment is block-modular, consists of four building blocks having dimensions of standard 20 or 40 foot sea containers. Such a constructive solution allows to minimize logistics costs, reduce time spent on installation and commissioning, optimize the process of relocation of the installation to a new operation site. After delivery to the place of placement, the equipment can be used immediately without installation, as it is mounted inside the container. The equipment complex is equipped with instrumentation and is equipped with modern automation systems, including a remote control mode for parameters and equipment control is provided through a remote control (outside the 5-meter zone).*

*The equipment complex can be made in various climatic modifications, if necessary, it is understaffed with special (auxiliary) equipment.*

*Advantages of the proposed technologies:*

- ✓ *high environmental effect achieved by the maximum suppression of the migration activity of pollutants and heavy metals;*
- ✓ *ability to provide joint processing of liquid and solid phase wastes;*
- ✓ *obtaining as a result of processing environmentally friendly building material suitable for geotechnical work;*
- ✓ *simplicity of the processing process and low qualification requirements for staff;*
- ✓ *high reliability and maintainability of the proposed equipment;*
- ✓ *mobility and modularity, which greatly simplifies the process of mounting / dismantling equipment and moving equipment if necessary.*



### 18.2.6. Organic (food).

In the interests of various catering enterprises of animal husbandry, food retail, etc. **ecologically safe and non-waste innovative technologies and equipment for the disposal of organic waste of various origins have been developed and are being implemented, which allow them to be processed locally into useful products (feed, fertilizers, biofuels) without negative impact on the environment.**

A distinctive feature of the proposed technology is the drying process: **in a sealed closed circuit, without the use of additives (enzymes, water, microorganisms, etc.) and in the absence of odors the weight of the feedstock is reduced proportionally to the evaporated (up to 90%) moisture, with the result eventually without changes in composition sterile (due to processing temperature up to 170°C) dry fraction retained useful elements (fats, proteins, carbohydrates, minerals, etc.) and condensed filtered technical water.**

The use of this technology provides:

- **the transition** from collection, transportation, treatment and disposal to **local processing** of organic waste directly at the site of their formation to **obtain useful raw materials for secondary use**, which will significantly **reduce** the amount of **organic waste in MSW** and simplify access to inorganic secondary material resources;
- **compliance** with the requirements in the field of **environmental safety** and sanitary standards.

The offered **equipment** is supplied with **the widest range, from mobile, with a capacity from 20 to 2000 kg/day, to complexes with a capacity from 2 to 200 tons per day.** A separate line for **the processing of livestock deaths, with reinforced shafts and blades allows to process whole carcasses, with sterilization due to the temperature of the chamber up to 170°C and heating the processing product 98-100°C for 5 ... 8 hour cycle.**

This technology and equipment are successfully used in Germany, Switzerland, England, France, Poland, Italy, Japan, China, South and North America, Australia, UAE, Africa.



***ELIMINATION OF CONSEQUENCES OF  
ENVIRONMENTAL POLLUTION***



**19. Innovative  
technologies and products  
to eliminate the effects of oil and oil products spills  
on water and land, namely  
natural peat sorbent «ARCTIC»**

*Natural peat sorbent «ARCTICA» is designed to eliminate the effects of oil and oil products spills in the water area and on land, as well as the rehabilitation of oil-contaminated land and water bodies. Once on the surface of spilled oil products, the sorbent absorbs and holds them in its volume, forming a stable floating conglomerate, which is easily removed from any surface.*

*The sorbent is made from environmentally friendly natural raw materials - high-level, poorly decomposed sphagnum peat of the moss type, free from radiation and toxicological pollution. The sorbent made by special technology has high porosity and has excellent sorption, hydrophobic properties with respect to petroleum hydrocarbons. Oil absorption is 8-10 g of oil per 1 g of sorbent, the time of oil saturation to a maximum of 5-10 minutes, the period of oil preservation in the volume of the sorbent excluding its spontaneous runoff is unlimited, the buoyancy of the oil-saturated sorbent is not less than 72 hours.*

*Domestic peat sorbent «ARCTICA», unlike analogues obtained on the basis of synthetic resins and polymers, has a number of obvious advantages:*

- ✓ is environmentally friendly for the environment, animals and people;*
- ✓ works in any weather conditions and extreme (-50 ... + 60 °C) temperatures;*
- ✓ differs in high buoyancy;*
- ✓ is completely inert in the absorption of petroleum products, does not increase in volume and does not lose mechanical strength;*
- ✓ has a high degree of water purification;*
- ✓ easy to assemble and dispose of;*
- ✓ during storage it does not cake and does not lose quality indicators;*
- ✓ at the expiration date, it can be used in agriculture, horticulture, gardening.*

*Peat sorbent is easily applied to the surface of the emergency spill manually or mechanically. The used (saturated with oil) sorbent is collected by an oil sorter or manually by shovels and must be disposed of by burning in boiler plants as high-calorie secondary fuel or in specially prepared open areas.*



**20. Innovative  
technologies  
for soil stabilization (strengthening)  
and reclamation of disturbed territories, including:**

**20.1. Technologies for soil stabilization (strengthening)**

*In the interests of design and construction companies associated with the implementation of large-scale infrastructure projects and development of territories as well as companies whose activities are connected with the necessity of operation of extended objects of engineering infrastructure and resources of the wires developed a set of technological approaches, design solutions and methodologies in the area of stabilization (strengthening) of soils.*

*The proposed technological complex provides an effective solution to a wide range of technical problems and allows for the construction of facilities of the preparatory, main and final periods in the territories of the stacked weak, from the point of view of bearing capacity, soils of natural and man-made addition (wet, thixotropic, flowable, ecochallenge, organo-mineral, organic and technogenic soils of the heterogeneous composition and Genesis), including in case of their local abundance along the track line feature or at the site of placement of ancillary buildings and structures.*

*Over the past 20 years developed and implemented more than 80 unique geotechnical and geoenvironmental technical and technological solutions, and they participated in the development 5 of national standards in construction. Developed by the center of design, technological and technical solutions are successfully applied on objects of regional and Federal value and have a positive opinion of the relevant government departments.*

**Advantages of the offered technology:**

*The implementation of the proposed technologies of production of construction works:*

- ✓ *allows to obtain a positive economic effect on the level of 5-7%;*
- ✓ *significantly reduces the time of construction of line or area object;*
- ✓ *releases customer service related to the management of the production process of excavation;*
- ✓ *increases the reliability, durability and run time infrastructure facility during the operational phase.*



## **20.2. Remediation technologies for disturbed areas**

*In the interests of design and construction companies related to the implementation of projects in the field of development of territories violated by human economic activity, as well as companies operating in the field of eliminating accumulated negative damage, including waste disposal sites, a set of technological approaches, design solutions and techniques in the field of reclamation of disturbed territories has been developed.*

*The proposed technologies provide an effective solution to a wide range of environmental engineering problems, allow the return to economic circulation of previously unsuitable contaminated areas, as well as the disposal of deposited waste or contaminated soils to produce an environmentally friendly building material with specified physical and mechanical characteristics.*

*The proposed methods, technologies and solutions were applied as part of a positively implemented project for the restoration of disturbed activities of the heating and energy complex of the inner-city territories of St. Petersburg with an area of more than 100 hectares.*

### **Advantages of the proposed technologies:**

- ✓ *high reliability and environmental efficiency;*
- ✓ *a wide range of proven technological, structural and geotechnical solutions to ensure the desired result;*
- ✓ *significant positive economic effect, with the possibility of implementing investment projects.*



# CONSULTING



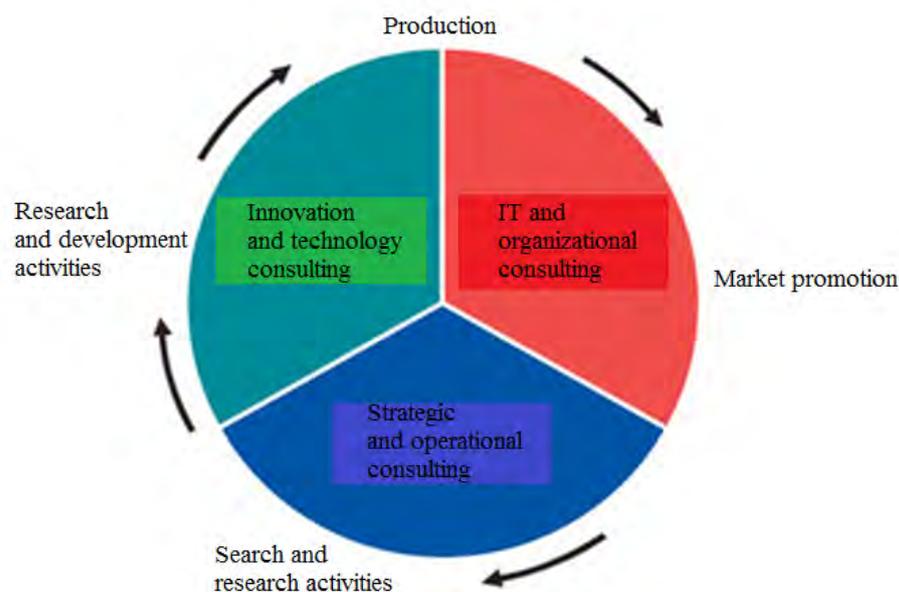
# GENERAL PROBLEM

## 21. Multidisciplinary innovation consulting

Multidisciplinary consulting involves a comprehensive solution to the problems associated with the implementation of the innovation cycle from research, development and production of innovative products to its promotion on the market.

Multidisciplinary innovation consulting includes the following areas:

- ✓ innovative technology,
- ✓ informational and organizational,
- ✓ strategic and operational.



Comprehensive **diagnostics of the enterprise** is accompanied by a detailed analysis of factors affecting the losses generated, determination of the size of losses and preparation of an optimization and innovative development program (technological audit, analysis of business processes, finding critical areas of inefficiency, calculating the potential for reducing costs, increasing productivity and competitiveness).

The implementation of the optimization and change program, as well as the formation of an innovation management system at an enterprise, includes:

- ✓ creation, management and training of an innovation development team;
- ✓ technology optimization, search for effective solutions to non-standard technical and managerial tasks;
- ✓ development of concepts for innovative products / services;
- ✓ technical and business technology expertise;
- ✓ selection and optimization of innovative products;
- ✓ assistance in the implementation of design documentation for an innovation project;
- ✓ protection of intellectual property rights;
- ✓ structuring and support of all stages of the implementation of innovative turnkey projects.

We also offer the development of a **personnel management program** with the aim of using modern methods of organizing the production process and implementing projects to develop innovative activities of the company at the enterprise. An audit of the existing personnel management system of the organization is carried out, reengineering and optimization of HR business processes, as well as the development of a package of motivational programs and the creation of personnel assessment centers

**22. Development  
of regional sustainable development systems,  
contributing  
to the improvement of people's quality of life  
and increase the regional gross product**

*It is almost impossible to create a system of sustainable development of Russia due to its vastness. But it is quite possible to develop and implement a **system of sustainable development** of individual **regions**, thereby reducing the **anthropogenic impact** on the **environment**, **increasing the quality of life of people** and **increasing the gross regional product** in real and monetary terms.*

**The development of regional sustainable development systems includes:**

- ✓ *technological solutions and recommendations on the use of the territory,*
- ✓ *forecasts and the creation of a socio-economic development plan for the region,*
- ✓ *planning the diversification of social life,*
- ✓ *proposals for switching to own energy sources,*
- ✓ *proposals for the complete non-waste processing of any types of waste generated in the region,*
- ✓ *branding of the territory*
- ✓ *etc.*

*The implementation of the systems of sustainable development of the regions that we have developed will improve the quality of life of their people by achieving a balance in socio-economic and environmental development, based on the rational use of the entire resource potential of the region. Of course, the system takes into account the geographical, historical and ethnographic features of the territory, as well as the features of the economy, infrastructure, industry and potential capabilities of individual cities belonging to this region.*



## **23. Environmental design and financial and economic modeling of the regional waste management system**

### **23.1. Environmental design.**

*Environmental design involves a **comprehensive solution to the problems** of the Customer in the field of **waste management**. It is possible to **develop any environmental documentation** in this direction - from basic to industrial design of infrastructure facilities.*

#### **Benefits:**

- ✓ **support of project documentation until the moment of obtaining permits** (licenses, certificates, sanitary and epidemiological conclusions and examinations);
- ✓ **financial guarantee of the result.**

#### **Some proposed projects:**

- ✓ *development of basic environmental documentation, including:*
  - *standards for the formation and limits for waste disposal, maximum permissible emissions, regulatory allowable discharges into water bodies;*
  - *delivery of environmental reporting;*
  - *registration of waste passports and quality certificates of finished products;*
- ✓ *design of sanitary protection zones;*
- ✓ *reconstruction of landfills;*
- ✓ *landfill reclamation;*
- ✓ *construction of landfills, waste sorting and processing complexes;*
- ✓ *accompaniment of inspections of regulatory authorities on environmental and sanitary issues;*
- ✓ *litigation*
- ✓ *etc.*

*The proposed direction of design is based on environmental and economic approaches. The decisions laid down in the environmental documentation are the basis for determining the effectiveness of waste management projects for the enterprise and the investor, as well as the basis for understanding the sources of return on investment.*

### **23.2. Financial and economic modeling.**

*The development and implementation of a financial and economic model of a regional waste management system will reduce the anthropogenic impact on the environment, improve the quality of life of people and increase the gross regional product in real and monetary terms. Using financial and economic modeling, it is possible to develop both a concept of a separate enterprise and a business plan for the comprehensive development of the waste management sector in the region.*

*Combining efforts and building a strategy for the economic system of regional waste management will reduce the percentage of their disposal to 10-20%.*

## 24. Renewable alternative energy

Much attention is paid to the **development of wind energy** - the **wind generator** was developed using turbine technologies on a vertically axial principle of operation.

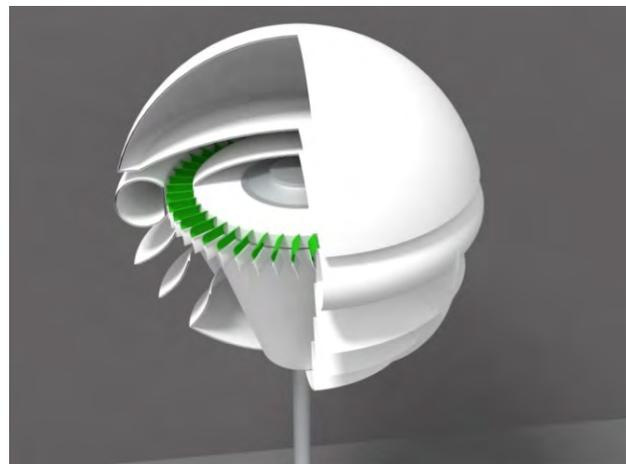
Wind generator, made in the form of a ball, is made of light polymeric materials, which provides a **significantly lower cost** in comparison with analogues. Three guide rings provide airflow to the wind wheel, which is directly connected to the electric generator.

Wind generator works not only on horizontal, but also on ascending air currents, which allows you to place it on poles, ground, roofs of buildings, ridges of a mountain range, etc., where air currents repeat the terrain.

The **design** of the proposed wind generator, in contrast to the horizontally axial three-blade system, **has** a number of **significant advantages**:

- ✓ **higher** level of **reliability** compared to three-bladed wind generators, as no wind orientation required;
- ✓ **significantly reduced noise level** due to the use of short turbine blades;
- ✓ **elimination** of foreign **objects** on the **plane** of **rotation** of the wind wheel due to the closed system;
- ✓ it is possible to **use** in **any**, even the most aggressive, weather **conditions** (snow, hail, heavy rain, etc.);
- ✓ **operation** is provided in a **much wider** wind **range** - **more than 30 m/s** (the rotation of long three-bladed wind generators is already limited at a wind speed of 12 m / s)..

**Wind generators** with a power of 100 W are mainly **focused** on **traffic services** to provide electricity for traffic lights, pedestrian signs, long-distance radio communications, traffic police cameras and other equipment with a capacity of not more than 50 -100 watts. Currently, the design of wind generators with a capacity of up to 5 kW is being worked out.



## ***25. High-precision operational forecasting of changes in the characteristics of the surface layers of the atmosphere***

*In order to increase flight safety, a complex of technological equipment MTR-7 was developed, which provides high-precision operational forecasting of changes in the characteristics of the surface layers of the atmosphere at minimal cost.*

*MTR-7 allows to predict the probability in real time:*

- ✓ *icing of aircraft,*
- ✓ *occurrence of turbulence zones,*
- ✓ *the appearance of fog,*
- ✓ *extreme air pollution,*
- ✓ *and other.*



*This complex has unique performance characteristics and can be used as part of meteorological complexes of airfields, spaceports, sports facilities, quarries, etc., can be especially useful in sparsely populated areas and in the far North.*

*Currently, in the world practice there are no analogues, which would be implemented algorithms for short-term forecast of weather events such as aircraft icing, icy rains, fogs, etc. The data obtained by allow to provide in an automated mode (without the participation of staff) high-precision, continuous, real - time prediction of threatening changes in the characteristics of the surface layers of the atmosphere.*

***CHEMICAL***  
*products*



## 26. Innovative chemical products including:

### 26.1. Self-cleaning technical detergents series «O-BIS».

One of the key elements of the proposed technologies are technical powder detergents (TPD) of «O-BIS» series (Patent of the Russian Federation No. 2169175) awarded the Diploma of the Program «100 best goods of Russia».



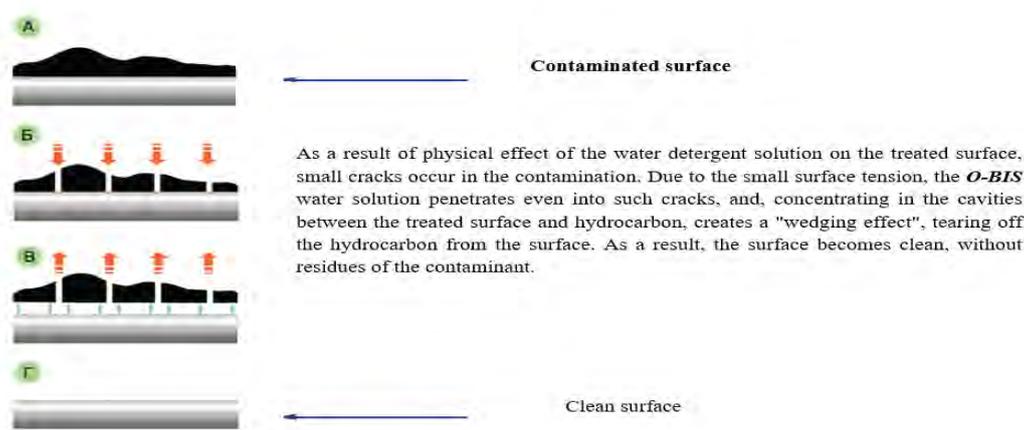
The technical detergents of new generation of «O-BIS» series (wasteless inhibitory self-cleaning washers) are designed for washing (cleaning, degreasing) of hard surfaces from contamination.

These detergents are first detergents that combine washing, inhibiting and demulsifying properties, which makes them fundamentally different from the traditional detergents.

#### **The detergency of water solutions of the «O-BIS» series**

Unlike the traditional detergents that dissolve and emulsify contaminants, «O-BIS» water solutions wet the hard surfaces and, due to the interaction of “competing” surface tension forces, “take them back” from the contaminant. The temperature sufficient for the effective operation of the solution is much lower than the traditional one and varies between 45 ... 55 °C. Only high-viscosity lubricants and oils require a slight increase in temperature.

Below is the scheme of this principle:



Demulsibility is the basis of water solutions of the «O-BIS» series for washing in a closed, drainless mode, since the contaminated water washing solution is separated into solid suspended particles, washed hydrocarbon and water washing solution after washing, which, in turn, can be used many times.

The following modifications of the TPD of the «O-BIS» series are proposed:

*Alkaline* (powder), having high detergency, demulsifying and inhibiting abilities.



**«O-BIS» TPD**

**«O-BIS» technical powder detergent**

(wasteless inhibitory self-cleaning washer) is supplied in polypropylene bags with polyethylene liners of 35 kg each.

TU 2389-005-72489136-2007.

**Purpose:** cleaning surfaces of parts, assemblies, mechanisms, equipment and tanks from oil products, lubricants, fats, vegetable and animal oils, as well as other liquid hydrocarbons.



**«O-BISM» TPD**

**«O-BISM» technical powder detergent**

(wasteless inhibitory self-cleaning multifunctional washer) is supplied in polypropylene bags with polyethylene liners of 35 kg each and in buckets of 15 kg. It has a higher detergency and reduced foaming compared to «O-BIS» TPD.

TU 2389-005-72489136-2007.

**Purpose:** cleaning surfaces of parts, assemblies, mechanisms, equipment and tanks from oil products, lubricants, fats, vegetable and animal oils, as well as other liquid hydrocarbons.



*Acid* (liquid concentrates)



**«O-BISK» TLD**

**«O-BISK» technical liquid detergent** is supplied in barrels of 200 kg.

TU 2383-023-72489136-2007.

**Purpose:** removal of complex contaminants (oils, greases, soot, rust, scale) from the outer surfaces of vehicles and industrial equipment.

## 26.2. Cleaners of various surfaces from old paint.



The proposed **CauTech CP** cleaners are multicomponent, slow-burning, low-toxic mixtures with high volatility and do not cause metal corrosion. They allow you to completely and without damage to the surface being cleaned to remove even chemically resistant paint coatings (LKP). For one cycle of applying a cleaner, up to 3-4 layers of old paintwork are removed. The old coating is completely separated from the base and after 5-40 minutes and is easily removed. You can use a brush or rag to remove peeled paint in small areas. Cleaners maintain their performance even at low temperatures.

It is possible to apply a cleaner on the polluted surface both manual, and machine method. The consumption of the product is from 100 to 200 g / m<sup>2</sup>, depending on the method of application used, the thickness and material of the coating. On large areas, the use of a pressure washer is recommended.

## 26.3. Cleaners of any surfaces from traces of markers, graffiti, adhesive tape, glue and other persistent dirt.



The proposed **CauTech CP-2** cleaners are multicomponent, slow-burning, low-toxic mixtures with high volatility. They are designed to remove traces of adhesive tape, markers, glue, traces of paint from various surfaces, including paintwork on automobiles, windows, furniture, equipment, buildings and metal structures. They can be applied on stone, concrete, brick, wood, metal and other painted and unpainted surfaces.

*CauTech CP-2 does not contain acids and alkalis, does not cause metal corrosion.*

In one application cycle, traces of adhesive tape, markers, glue, paint and other similar contaminants are quickly removed, without causing harm to the base on which the washable contamination is applied, and do not leave traces.

It is recommended to apply the cleaner on a contaminated surface with a trigger at a distance of 5-10 cm from the surface being cleaned, wait 5-10 seconds and after soaking, wipe the contamination with a rag, rag or brush. The consumption of the product ranges from 50 to 100 g / m<sup>2</sup>, depending on the type and contamination and method of application.

## 26.4. Concrete surface cleaners.



The proposed **CauCon R** cleaners are a mixture of organic and mineral acids with the addition of anti-corrosion additives. **CauCon R** is designed to remove traces of cement, concrete and mortar residues from various surfaces, including:

- ✓ car bodies for cement transportation;
- ✓ cars (including paintwork);
- ✓ construction equipment and tools, formwork;
- ✓ stone, plastic and glass facades;
- ✓ natural stone, granite, brick, porcelain stoneware, ceramic tiles
- ✓ etc.

It is possible to apply a cleaner on the polluted surface both manually, and mechanically. In a short time, softens even traces of old concrete. It is recommended to rub the treated surface with a brush, after processing the surface must be washed with water.

## **26.5. Rust converters, including:**

### **26.5.1. Chemical rust converters (CRC).**

*The proposed chemical rust converters (CRC) are high-tech, multifunctional, water-based products that combine the process of cold phosphating with passivation of the surface and short-term preservation by highly effective corrosion inhibitors.*

*CRC is used both during repair work to restore the paintwork of the rolling stock and metal structures of the railway infrastructure, and to prepare new metal structures for painting.*

*The use of CRC increases the service life of anticorrosive coatings by 1.5-2 times, does not require rinsing with treated surface water. CRC have the ability to penetrate under the edges of the old paintwork, inhibiting the further development of corrosion.*



#### **Chemical converter of rust «NOTECH-K»**

*It is delivered in plastic canisters of 25 kg.*

#### **Appointment:**

- conversion of corrosion products on metal surfaces,*
- chemical preparation of rusty metal surfaces and welds before painting or in combination with abrasive blast cleaning (mechanical),*
- processing of reinforcement and other details before hardening of concrete mortar in order to improve its adhesion to concrete and convert loose corrosion products into inert phosphate stones.*

### **26.5.2. Rust Converters CauTech RS.**



*CauTech RS Rust Converters are designed to remove rust from metal surfaces and simultaneously phosphate metal in preparation for painting.*

*The product is applied to a surface previously cleaned of contaminants with a trigger, roller, brush or high-pressure apparatus for 10-20 minutes. After the conversion process is complete, the treated surface must be dried before applying the topcoat.*

*The consumption of the product is from 120 to 150 g / m<sup>2</sup> depending on the condition of the surface being treated.*

## **26.6. Atmospheric corrosion inhibitors.**

*The proposed atmospheric corrosion inhibitors protect metal structures from corrosion and exposure to aggressive environments.*



### **«N-M-1»**

#### **Atmospheric corrosion inhibitor «N-M-1»**

*delivered in euro buckets of 18 kg.*

#### **Appointment:**

- protection against atmospheric and microbiological corrosion during operation, storage, hydrotesting, preservation and transportation in various climatic conditions (continental, marine, tropical, arctic);*
- protection of products from biodeterioration due to suppression of growth of the most common types of molds;*
- protection of equipment from parking corrosion and interoperational conservation of heat and power equipment;*
- obtaining inhibited anticorrosive primers with enhanced protective properties and increased service life of the paint coating*

### **«N-M-1 GI»**

#### **Atmospheric corrosion inhibitor «NM-1 GI»**

*delivered in euro buckets of 18 kg.*

#### **Appointment (feature in comparison with «NM-1»):**

*allow combining corrosion protection during hydraulic testing of steel tanks with subsequent interoperational conservation for a period of at least 2.5 years.*



### **«FMT»**

#### **Atmospheric corrosion inhibitor «FMT»**

*are delivered in plastic cans of 40 kg.*

#### **Appointment:**

- «temporary» protection against atmospheric corrosion of steel products and structures for the period of storage, transportation and the interoperation period;*
- protection of products from biodeterioration by suppressing the growth of the most common types of molds.*

## **26.7. Friction surface modifiers.**

*Mineral modifier of the friction surface (MMFS) is paid to mechanisms subjected to increased wear. It instantly covers the metal surface and has a pronounced extreme pressure and antiwear properties, and is not washed off by solvents, poorly wetted by water and can only be removed by mechanical means. In contrast, many types of additives of foreign and domestic production, MET forms a protective layer and does not go away with further oil change.*

*The main **advantages of using MMFS:***

- 1) **low sensitivity to temperature** in the contact zone in comparison with standard greases (the forming surface is not destroyed even at a temperature of 1200 degrees) while maintaining the coefficient of friction;*
- 2) **reduced wear**, for example, in the system "wheel-rail", the ridges of wheel pairs of carriages;*
- 3) **increase the wear resistance** 2-3 times of any of the friction surfaces (reduction of the ridges truing wheels, replacing tires, etc.);*
- 4) **improve the reliability and durability** of power **units** (e.g., locomotives), the bearing **units** of **rolling stock** (lever-brake systems, friction dampers, swivel wagons, etc.)*
- 5) **lower consumption of electricity and fuel** to 6-13%;*
- 6) increase in useful life of rail, turnouts;*
- 7) significant **reduction** in repair **costs** and reducing **downtime** of process equipment and rolling stock;*
- 8) substantial **improvement** of the **environmental** component of transport operation.*

*Was **successfully carried out durability tests**, including:*

- 1) passenger cars long-distance together with JSC "TVZ", JSC "VNIIZHT", JSC "Russian Railways";*
- 2) of the ventilation unit in the mine in cooperation with the sue "Petersburg metro",*

*By results of the conducted research was the decision to use MMT in the respective structures when constructing passenger cars and in 2012, in accordance with manual No. 056 and # 055, began to be used in all types of repairs.*



### **«MMFS»**

#### **Mineral modifiers of the friction surface «MMFS»**

*are delivered in plastic buckets of 9 kg or other containers at the request of the customer.*

**Purpose:** *creating a protective layer and increasing the wear resistance of friction pairs and machined surfaces (by 70% or more).*

## **26.8. A conditioning polymer compositions (an anti-caking agent) for mineral fertilizers**

We offer traditional air conditioning, and polymeric compounds «CauFert» is intended for prevention of caking and dusting during production, transportation, handling in warehouses, loading and unloading of mineral fertilizers.

The conditioning compositions are applied to the granules of fertilizer in special drums-conditioners, where there is a uniform distribution of anti-caking agent on the surface of the granules, forming a hydrophobic space frame, reducing the tendency of fertilizers to caking and formation of agglomerates.

To ensure a longer protective effect in the conditioning compositions can be used polymer additives for virtually full preventing dusting and caking of fertilizer. The technology used by us allow you to make the formulations up to 20% of the polymer without a significant increase in the drop temperature does not exceed 70 °C. Analogues require temperatures of more than +100 °C, making them unavailable for use on most existing production facilities.

The conditioning compositions of «CauFert» available in ready to use form or in the form of concentrates for the preparation of conditioner compositions directly on-site by mixing them with oils before applying to the drum-conditioning.

The use of concentrates is a trend in the market of anti-caking agent.

**The use of concentrates allows to:**

- ✓ to reduce the cost of processing fertilizers
- ✓ to reduce logistics costs, energy and capacitive Park.
- ✓ to regulate the protective properties of formulations for the production (due to changes in the concentration of active substances in fertilizers applied to the conditioning part).

Ready to use conditioning compositions and concentrates in paste form can be supplied in bulk in tank containers with steam jacket and in drums of 216 liters. Concentrates in the form of flakes supplied in bags or big bags.

## **26.9. Organic odor neutralizers.**



Offered neutralizers CauTO ON are universal neutral instant action agents designed to quickly and effectively eliminate unpleasant odors of organic origin.

Odor neutralizers based on a complex of ricinoleic acid zinc salts at the molecular level act directly on odor sources, destroying the structure of molecules that emit an unpleasant odor. They provide antifungal and bactericidal action, leave no residue.

CauTO ON can be used at solid waste landfills, food and processing enterprises, in automobile, railway and sea transport, in sports halls, sanitary rooms, etc.

The product is applied by spraying directly to the source of an unpleasant odor, after which it is necessary to wait for the natural drying of the composition. Available in various fragrances as well as in neutral versions.

***PAINTWORK***  
*products*



## **27. Innovative paintwork products, including:**

### **27.1. Primer coatings**



#### **«Vlagokor»**

##### **Primer «Vlagokor»**

**Appointment:** it is applied as an independent paintwork material (PWM) or in a complex with other PWM for priming of damp metal surfaces.

*Weatherproof coating in temperate maritime climate and industrial atmosphere, waterproof, resistant to salt fog and gasoline.*



#### **«HS-0320»**

##### **Vinyl primer-ename for rust "HS-0320"**

**Appointment:** it is applied as an independent covering for:

- painting of metal surfaces with residues of scale and tight rust with a layer thickness of up to 100 microns, exposed to an industrial atmosphere containing aggressive gases and vapors;
- primers in complex multilayer coating with weather-resistant enamels, varnishes of type HV, HS for protection of equipment and metal structures exposed to salts, aggressive gases, and other chemical products having a temperature not exceeding 600 °C.

*The proposed enamel primer combines the properties of a rust converter, primer and enamel. Weatherproof coating, resistant to slightly and medium aggressive environments having a temperature of no higher than 600 °C.*



#### **«EP-0199»**

##### **Primer for rust "EP-0199"**

**Purpose:** for use in complex systems of paint and varnish coatings for protection against corrosion of metal surfaces with unremovable rust up to 100 microns thick (automobiles, pipelines, radiators, roofs, etc.), operated in atmospheric conditions and indoors, and also exposed to aggressive gases and vapors, short-term contact with acids and alkalis. It can serve as an independent coating.

*The primer coating is waterproof, weatherproof in an industrial atmosphere containing aggressive gases and vapors, resistant to short-term acid and alkali spills, resistant to mineral oils, gasolines, and detergents.*



### «VL-023»

#### **Primer phosphating "VL-023"**

*Appointment: for protection of metal at interoperational storage for a period of no more than 6 months.*

## 27.2. Paints and enamels



### «Pygma Winiftor»

#### **Fluoropolymer paint (enamel) "Pygma Viniftor"**

*Appointment: for painting metal, plastic, concrete and other surfaces exposed to atmospheric influences in construction, auto, ship, car building, in chemical production.*

*The proposed fluoropolymer paint (enamel) is available in the following grades:*

- ✓ *«Pygma Viniftor»: glossy, matte, semi-matt of various colors for painting metal, plastic, concrete and other surfaces exposed to atmospheric influences;*
- ✓ *«Pygma Winiftor-33»: deep-matte protective green color - for painting metal surfaces exposed to atmospheric influences.*



### «V-EP-012»

#### **Waterproofing (water-soluble) paint «V-EP-012»**

*Appointment: for protection and waterproofing of concrete, brick, asbestos-cement, as well as metal surfaces, operated in atmospheric conditions of temperate climate and at high humidity, as well as under the influence of solutions of salts, alkalis, oils, oil products and detergents.*

*The coating is waterproof, weatherproof, resistant to the static effects of solutions of salts, alkalis, mineral oils, petroleum products, impact resistant.*



### **«VINIKOLOR»**

#### **Enamel «VINIKOLOR»**

**Appointment:** for protection against corrosion of the outer surface of tanks for storing oil and oil products, metal structures of bridges and hydraulic structures, engineering products and metal structures for various purposes, as well as for painting concrete structures.

The coating is resistant to humid atmosphere, fresh and sea water, oil-petrol resistant, resistant to temperature changes from minus 600 °C and short-term exposure to hot water and steam.

Enamel «VINIKOLOR» is produced in the following grades.:

- ✓ **«Vinikolor aluminum»:** a three-pack system consisting of a base, aluminum powder and hardener. Apply by brush, roller, pneumatic spray.
- ✓ **«Winikolor Ts»:** two-pack system consisting of a base and hardener.

Depending on the application methods, it is produced:

- grade A - applied by brush, pneumatic spraying and airless spraying units;
- grade B (highly viscous) - applied with a brush and airless spraying units;
- grade T (thixotropic) - applied by airless spraying units;
- brand U (urethane) - applied by brush, pneumatic spraying and airless spraying units.



### **«EP-439P»**

#### **Enamel anti-icing «EP-439P»**

**Appointment:** for drawing on metal and concrete surfaces for the purpose of their protection against icing (frosting).

Weatherproof coating in all climatic conditions, resistant to fresh and sea water, has low adhesion to ice. Thixotropic enamel.

**ACCUMULATED  
EXPERIENCE AND ACHIEVEMENTS**  
*group of companies «CIT»*

**a) Availability of patents:**

*more than 60 patented objects of intellectual property, including 16 actively used, including 1-in Europatent. In particular, the cost of only one of the patents for the invention confirming our exclusive right to "the Method of cleaning the inner surfaces of tanks..." is 148.20 million rubles.*

**b) License availability:**

*License to carry out activities for the collection, transportation, processing, disposal, recycling and disposal of waste of I - IV hazard classes  
No. 038 00193 / P dated February 13, 2018, issued by the Office of the Federal Service for Supervision in the field of environmental management (Rosprirodnadzor) in the Irkutsk region.*

**c) Availability of SRO:**

- SRO designers «StroyProekt»  
Certificate No. SRO-P-170-16032012 of August 19, 2013,*
- SRO of construction organizations «Commonwealth of Builders»  
Certificate No. C-221-78-1278-78-190417 of 03/05/2017,*
- SRO engineering engineers «StroyPartner»  
Certificate № CRO-I-028-13052010 from 06.11.2016,*
- SRO Association of builders «DORSTROY» Irkutsk  
Protocol No. 137 dated 12/20/2016.*

**d) Availability of certificates:**

- Compliance with the QMS GOST R ISO 9001-2015, ISO 14001-2004,*
- Compliance with the QMS GOST RV 0015-002-2012,*
- Compliance with the requirements of TR TS 012/2011 on flushing complexes  
for cleaning the boilers of rail tank cars,*
- Compliance with environmental management and labor protection,*
- GOST R ISO 9001-2015 (ISO 9001: 2015) No. ST.RU.0003.M0010340,*
- GOST R ISO 14001-2016 (ISO 14001: 2015) No. ST.RU.0002.M0013075,*
- GOST R 54934-2012 / OHSAS 18001: 2007 No. ST.RU.0002.M0013076.*

**e) Availability of accreditations:**

*4 Federal and more than 25 commercial electronic trading platforms recognized the financial condition of LLC «Clean Technologies Group», which is part of the «CTG», and allowed him to participate in the procurement procedures, including Rosneft PJSC (letter ECC / EE-49376-1 dated 08.22.2018), Russian Railways OJSC, branches of the Gazprom Group, etc.*

**f) License availability:**

- State Corporation «ROSKOSMOS» on the implementation of space activities,*
- Ministry of Culture for the implementation of conservation activities cultural heritage,*
- Ministry of Emergency Situations No. 2-B / 00350.*

**g) Availability of instructions, conclusions and approvals:**

*on the application of the development of «CTG»:*

- *«technical guidelines on the use of resource-saving environmentally friendly technologies for the preparation of oil-petrol tanks» in the JSC «Russian Railways»;*
- *the conclusion that:*
  - ✓ *technical detergents of the «O-BIS» series are certified by JSC «Russian Railways»;*
  - ✓ *mobile systems for cleaning contaminated surfaces:*
    - ❖ *are not objects of capital construction and are not subject to state cadastral registration,*
    - ❖ *not subject to mandatory certification in the field of fire safety;*
  - ✓ *due to the lack of influence of the technical detergent «O-BISM» on the properties of laundered fuels (diesel, gasoline, vehicles, etc.), the «CTG» technology is recommended for industrial introduction for the preparation of containers and tanks for their storage and transportation;*
  - ✓ *the technological equipment developed by «CTG» for internal and external processing of containers, tanks, vehicles and other objects with hard surface is not subject to state registration.*

**h) «CTG's» Products**

*awarded the «Best Ecotechnology» Diploma in «the Resource Saving Technologies» nomination at the «All-Russian Ecological Products and Environmental Technologies» Competition, and the Diploma «100 Best Products of Russia».*

**i) Group of companies «CTG»**

*awarded a medal named M.V. Lomonosov «For contribution to the environment and safety.», medal «For merits», honorary badge of RAS «For merits in the development of science and economy of Russia», honorary medal «For environmental safety», recognized as an enterprise corresponding to the status of «Leader of the Russian economy».*