Intelligent mine – the future of mining

Productivity, safety, reliability

Mine Fleet Management System VG KARIER
For more than 25 years our innovative products help you to make your mines safe and productive

25 Years In Mining

- 150+ Employees
- Turn key solution
- 70+ Clients
- ISO 9001
- 24/7 Support
- State of art solution
- Flexible solution

Long term relations

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**VIST Group:**

**Headquarter** - Moscow

**Branch Offices**
- Kemerovo, Mezhdurechensk, Stary Oskol, Kovdor, Zheleznogorsk, Magnitogorsk

**Subsidiary companies**
- VISTGroup Tekhnicheskiy Centr, Kryvyi Rih (Ukraine)
- VIST Sensor, Minsk (Belarus)
- BV International, Danvers, Mass., (USA)
- Casablanca – 2015 (Morocco)

**Sales and service partners**
- Reutech Mining (SA)
- TTM (Chile)
- Mobilaris (Sweden)
- Mining
- Mining Equipment Manufacturers
- Railway
- Agriculture
- Public transport
Clients: 70+ mines + mining equipment manufacturers

✓ Gold, Coal, Iron Ore, Platinum, Copper, Phosphates, Potash

✓ Mining equipment manufacturers

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THE OWNERS AND TEAM

Private company

Among the team:
- 6 PhD
- 6 laureate of governmental award
- Doctor of Science

ISO 9001 accreditation

Supported by:

Ministry of trade
Ministry of economical development
Safety regulation authority

Ministry of economical development

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Products Portfolio
Products

Stand alone and OEM

- **VG LoadPro** - Payload system for dump trucks
- **VG MineTruck** – Web based reporting for VG LoadPro
- Tires pressure and temperature monitoring
- Fuel monitoring
- Collision avoidance

Dispatching and guidance

- **VG Karier** Mine Fleet Management System
- **VG Drill** High Precision Drills guidance
- **VG Scarex** – High Precision Excavation
- **VG Railway** – Railway Automation and Dispatching
- **VG Fleet** – Public transport dispatching
- **VG Safety** – EHS system
- **ERP 1C system**

Autonomous and tele-operated mining vehicles

- **Intelligent mine®**
  Remote control and autonomous guidance

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**Products**

**VG Holding** – reporting and KPIs for headquarters

**VG Karier**
Mine fleet management system

**VG Drill** – drill high precision guidance

**VG Scarex** – excavators high precision guidance

**VG Railway** – railways automation and dispatching

**VG Fleet** – public and auxiliary transport monitoring

Payload, diagnostic systems, additional sensors

**Audit of mining activities and performance of VG Karier system**

**Collision avoidance system**

**HSE - Software for work orders and safety instruction management**

**Integration with Reutech slope stability monitoring radars**

**1C ERP System**

Autonomous and tele-operated systems for mining equipment
Starting with us you do not have the limitations

- Autonomous
- High precision guidance
- Optimization
- Real time management
- Real time proved statistics

Demo is already in place!
VG LoadPro

More than 6000 systems IN USE
Trucks manufacturer BELAZ OEM
Industrial Rugged Design
2-3% payload and 3-5% fuel measurement accuracy

CAT, Komatsu, Hitachi, Terex and others installations

Installation of on-board equipment to the truck
Trips, payload, fuel consumption, delays and stoppages, overloads – get this and much more on your laptop or tablet!

Wide range of diagrams and reports
<table>
<thead>
<tr>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic dispatching and optimization</td>
</tr>
<tr>
<td>Quality management and blending as well including the high precision navigation for excavators</td>
</tr>
<tr>
<td>Real-time management and reporting for each type of vehicles</td>
</tr>
<tr>
<td>Maintenance planning and health monitoring</td>
</tr>
<tr>
<td>High Precision Drills guidance</td>
</tr>
<tr>
<td>Tires management and diagnostics</td>
</tr>
<tr>
<td>Road quality monitoring</td>
</tr>
<tr>
<td>Repairs and maintenance management</td>
</tr>
<tr>
<td>Overall fuel monitoring</td>
</tr>
<tr>
<td>Remote diagnostics</td>
</tr>
<tr>
<td>Additional features (gas monitoring, water pipes monitoring etc)</td>
</tr>
</tbody>
</table>
## Options available

- **Weighing system for trucks**
- **Fuel level sensor (for every type of equipment) & cable kit**
- **Tires pressure monitoring system**
- **Hydraulic Excavator On-board Equipment for cycle counting and fuel monitoring**
- **Electric Excavator and Dragline On-board Equipment for cycle counting and fuel monitoring**
- **Tanker On-board Equipment for filling monitoring and fuel level in the tanker**
- **Dozer On-board Equipment for work types monitoring (pressure of turbo charger and engine) and fuel monitoring**
- **On-board scales for loader**
- **High precision navigation for Drills and sensors for monitoring of drilling process**
- **High precision navigation for Shovels to improve the quality**
We cover all types of vehicles

Industrial Rugged PC with 7” LCD Touch Screen

Wireless – WiFi, MESH, LTE, GSM

Sensors, Diagnostic and Control Systems

Navigation System Low and high precision

Trucks
Excavators
Draglines
Loaders
Drills
Trains
Dozers
Fuel Trucks
Auxiliary Transport
Water trucks
Graders
VG Karier – Optimization and Dispatching

Fully Web-based system:
✔ Access from PC or tablet with web-browser
✔ Easy to use and learn
✔ No application required even for dispatcher
VG Drill

Project for drilling and guidance
Can be guided externally

Drilling parameters

Drilling BLOCK:
- HOLE: 183
- INCLINATION: 89.97
- TIME OF DRILLING: 00:00:52.6
- AIR PRESSURE: 0.9
- AXILE PRESSURE: 21.6
- ROTATION PRESSURE: 28.0
- LEVEL HIGHT, m: 176.1
- PLAN DEPTH, m: 13.20
- CORRECTED DEPTH, m: 9.30
- REAL DEPTH, m: 0
- OCTADEPT TO DRILL, m: 9.3

FINISH THE HOLE      ADD RIG
Excavator

High Precision GNSS and Sensors

Real time position, shift order and geological model visualization to operator

Shift planning

Blending and Stockpile management

Automatic monitoring of shovel performance
Fuel Monitoring

Fuel Station

Level
Consumption
Incoming
Temperature
Density

RFID Identification

Fuel truck

RFID Identification

Vehicles

Vehicles

Level
Consumption
Incoming
Temperature
Density

RFID Identification

Fuel truck

Vehicles

Vehicles

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Autonomous truck and tele-operated loader

- Fully autonomous moving using high precision (with IMU option) and adaptive driving
- Lidar and radars detection and collision avoidance
- Stereo vision (in progress)
- Loading and uploading
- Integration with VG Karier system
- Tele-operation control

2011-2013

2015-16
Intelligent Mine

6 x 6 truck

Stereo vision

Tele-operation

In Development – chain machines

Following the leader

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VG Karier
Technical description
What is the increase of productivity?

- Optimization and automatic dispatching: 10-15%
- Payload optimization: \(\frac{190}{175} = \approx 8\%\)
- Stops and delays reducing (shift changing, repairs): 4%
- Availability of mining equipment: 4%

Use less trucks for the same hauling volumes and use same truck to haul more!
## Efficiency and productivity

<table>
<thead>
<tr>
<th>Trucks</th>
<th>Absolute increase</th>
<th>Av. for last 3 months</th>
<th>feb</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>Sept.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usage of the load capacity</td>
<td>6%</td>
<td>5%</td>
<td>%</td>
<td>92%</td>
<td>94%</td>
<td>94%</td>
<td>94%</td>
<td>93%</td>
<td>96%</td>
<td>98%</td>
</tr>
<tr>
<td>Average productive time</td>
<td>14%</td>
<td>10%</td>
<td>hour</td>
<td>6,36</td>
<td>6,66</td>
<td>6,69</td>
<td>6,5</td>
<td>6,52</td>
<td>6,92</td>
<td>6,81</td>
</tr>
<tr>
<td>Average fuel consumption</td>
<td>-14%</td>
<td>-14%</td>
<td>g\tkm</td>
<td>119,18</td>
<td>117,62</td>
<td>108,72</td>
<td>110,04</td>
<td>110,56</td>
<td>103,86</td>
<td>100,13</td>
</tr>
</tbody>
</table>

### Automatic data - no human factor

- Usage of the load capacity
- Average productive time
- Average fuel consumption
System Architecture

- **Sensors, Health monitoring systems, On-board PC, Navigation**
- **Mining Equipment**
- **Wireless Communications**
- **ERP, MES, EAM, Geological etc.**
- **System Server**
- **LAN**

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On-board hardware

Intelligent Panel IP-01

- 2 x CAN
- 2x RS232 or RS485
- 1x Ethernet
- Audio output
- USB (optional)
- DVI (optional to connect external monitor)

Analog to digital converter

Input type: mV, V, mA
Output type: RS-485

MESH WiFi modem with antenna

Basic equipment
Navigation unit NB-04 – GPS + GLONASS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver + antenna</td>
<td>In one housing</td>
</tr>
<tr>
<td>Max length of cable</td>
<td>100 m between the IP-01 and NB-03</td>
</tr>
<tr>
<td>Interfaces</td>
<td>CAN</td>
</tr>
<tr>
<td>Power supply</td>
<td>18…32 V DC Protected for overvoltage and changing the polarity</td>
</tr>
<tr>
<td>Max. consumption</td>
<td>1A on 24VDC</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-40°C…+85°C</td>
</tr>
<tr>
<td>Housing</td>
<td>Plastic, IP67</td>
</tr>
</tbody>
</table>

Engine hours calculating sensor

Loudspeaker
Identification of the driver

RFID TAG

Insert ID Number of the driver into on-board PC

Checking the scheduled driver and actual
On-board hardware

No data can be lost
- all data is being stored on on-board PC and sent to server

Voice automatic playing of the messages as well as displaying on the screen
- Operator will be informed twice

Rugged design and metallic housing of on-board equipment
- wide range of operating conditions

Ability for operator to send messages
- communication with a dispatch manager
On-board hardware

- Remote setting and upgrade of SW
  - Availability to do maintenance even from headquarters and vendor site

- RS 232, 485, CAN, Ethernet, DVI available
  - Many additional external devices can be connected

- GLONASS\GPS receiver with internal antenna and CAN interface
  - Mount without coax cable – less distortions and high quality signal
All data is captured Automatically – no any involvement 3a the drivers!

All data is available in plots, diagrams and reports
Calculation of the optimal route for the truck according to the current criteria

Optimization and automatic dispatching

High Precision navigation

Quality management and blending

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Hydraulic shovels

- Inclination sensor 3 pcs.
- Intelligent panel IP-01
- Dual antenna high precision
- WiFi
- Fuel level sensor
- Analog to digital converter
- CAN Crocodile (J1939)
On-board equipment of a drill

- On-board GNSS
  - Accuracy types suitable:
    - RTK fix. – 4
    - RTK float. – 5
  - GLONASS, GPS

- Inclination sensors
  - Tower
  - body

- Reference station

- MeSH

- LAN
Wireless system example

- PTP800 link
- PMP450
- WiFi AP
- AP7161
- PTP800 Links
- PMP450 base and subscriber
Mobile tower with the Security kit

Fixed tower with the Security kit
Mobile solar tower Security kit

GPS/GLONASS and GSM/WiFi unit tracks the position of the trailer in real time and sends the alarm signal if the trailer moves from the position. Unit has the internal battery supply to enable working without external power.

IP video camera allows the dispatcher to check the tower if alert appears.

Monitor opening of the rack with the equipment and sends the alarm.

Wire with the analog signal enables to monitor the existence of solar panels.

Intruder detector sends the alarm signal when the trailer can be reassembled or destroyed, or if its attitude changes.

Stun alarm switches on if alarm condition exists.

Data acquisition module allows to remote control alarm functions.

Portable LED light towers with silent automatic solar-charging power system.
Implementation process

**Engineering and design**
- Study of existing business processes and equipment

**After sales management**
- SLA Contract
- Audit
- Additional sales
- Technical support

**Implementation**
- Hardware, wireless and SW installation
- Deployment the changes of the management and training of the personnel
- Preparation the legal documents (internally for the mine)
- Testing and customization
- Signing –off and providing the documentation

**Preparation the stages of implementation**
- Preparation the changes in management

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Why to work with us!

**Functionality and Wide Range of Products**

**Implementation and Customization**
Huge Experience in Mining
Great Flexibility in Developing Custom Solutions

**Technical Support**
24/7 Phone Support
Service Level Agreements per Client Requirement

**Cost of the System and Maintenance**

**Fast deployment and Return on Investment**
Bank financing is available to own the system

**State of art solution and guaranteed quality!**

**2011, 2015**
New VG KARIER version releases

**TURN KEY SOLUTION**
Including all required additional sensors, systems etc.

**150+ engineers employees**

**15-20% less**
Compared to competitors

**6 months**
Average ROI
## Efficiency of the solution

<table>
<thead>
<tr>
<th>Effect</th>
<th>Clients case studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing of productivity</td>
<td></td>
</tr>
<tr>
<td>Decreasing of the maintenance costs</td>
<td></td>
</tr>
<tr>
<td>Increasing of availability of the mining vehicles</td>
<td>SUEK– 7%</td>
</tr>
<tr>
<td>Eliminate thefts of the fuel – reduce the fuel consumption</td>
<td>SUEK – 15%</td>
</tr>
<tr>
<td>Decreasing of the fuel consumption</td>
<td></td>
</tr>
<tr>
<td>Increasing the productivity of the drilling and quality of drilling and blasting</td>
<td>SUEK – 10% Mechel – 5%</td>
</tr>
<tr>
<td>Decreasing the safety accidents</td>
<td></td>
</tr>
<tr>
<td>Increasing the liability of staff</td>
<td></td>
</tr>
</tbody>
</table>

- **SUEK**: 15%  Arcelor Mittal – 100%
- **SUEK**: 10%  Mechel – 5%
- **SD Coal**: 7%
- **Arcelor Mittal**: 7%
- **Severstal**: 7%
Steps of deployment

Next steps

- Update the list of the vehicles to be included, preliminary offer.
- Reference visit to one of the mines with VG Karier system
- On-site visit for detailed specifications
- Finalizing the specs including towers, power supply etc.
- Installation and training
- Use VG Karier and get benefits!
Thank you for your attention!

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