THE TECHNOLOGIES OF FUTURE
IN YOUR HANDS TODAY

UNIQUE METHOD OF
THE CONTACTLESS
PIPELINES
INSPECTION
SINCE 1989 ON THE MARKET

- 7 doctors of sciences
- Up to 200 professional employees
- Own scientific and industrial equipment

OUR CUSTOMERS:

"Halliburton " (USA); "Total Fina Elf" (France); "Mahrukat" (Syria); USAID (USA); Unilever SNG (Great Britain); NKK Corporation (Japan); "Lukoil" Oil Company; "Transneft" Corp; "Lukoil" Co. Ltd; "Diamonds of Ruissia-Sakha" Co. Ltd; "TNK-BP" Corp; "Moscow Oil Refinery" Corp; "Rosneft" Corp; Russian Open Society "United Power Systems of Russia"; "Jukos" Inc; JSC "Russian Railways"; Ministry of Defense of the Russian Federation; Ministry of the Natural Resources.
POLYINFORM main activity

- Providing environmental safety
- Expertise of industrial safety
- Industrial construction
POLYINFORM main activity

**Industrial safety expertise**

- Contactless magnetometric defectoscopy
- Electrometry
- Visual inspection control
- Ultrasonic thickness and hardness measurement
- Ultrasonic defectoscopy
INDUSTRIAL SAFETY - PROBLEM

- Pipelines **TEAR-AND-WEAR**, operating for more than 20 years
  
- Lots of the pipelines are **IMPASSIBLE** for in-tube (traditional) inspection

- **NO ADEQUATE SOLUTION** for inspection of underwater pipelines
Innovation technology of the contactless inspection of pipelines using unique magnetometric system KMD-01M based on magnetoresistive nanostructures

**ADVANTAGES:**

- **REMOTE** diagnostics of pipelines' state
- **STOPPING** or **CHANGING** the mode of operating is **NOT REQUIRED**
- **ON-LINE** detecting of anomalies
- **ACCURACY** for the critical level defects up to 93%
- Creating **DIGITAL MAP** of the defects with GPS links and **AUTOMATIC TRACING**
- **NO PREPARATION NEEDED**
- **HIGH EFFICIENCY** (up to 20 km daily per 1 shift)
- Inspection of the **IMPASSIBLE** for in-tube and contact defectoscopy methods

**Types of definable defects:**

- Stress-deformed condition
- Bundles of metal
- Corrosion fatigue
- Local damage (pitting, loss of metal etc)
- Changing the pipelines geometry
PHYSICAL PRINCIPLES of KMD-01M OPERATING

The systems work is based on the Villari effect (magneto-elasticity effect) which means the changing of the magnet magnetization under the influence of mechanical deformations and stresses in the pipes metal.

The diagnostics is based on the interpretation of various parameters of the magnetic field graphics which are continuously fixed while the receiving block moves along the pipeline.
NOVELTY

- The device KMD-01M is based on the thin-film magneto-resistive transducer, which measures full magnetic induction vector in the four points.

- One of the main factors determining the high sensitivity of KMD-01M and diagnostics selectivity is applying of magnetoresitive nano-films having the range of advantages:
  - Nano-sensors key advantages:
    - High magnetic sensitivity
    - Wide range of operating frequencies
    - Low hysteresis
    - Low voltage bias
    - Low temperature drift
    - Low temperature coefficient of sensitivity

The magnetogram of anomalies received in real time mode
Science and technical feasibility and approving

New design, technological solutions and software developed for the diagnostic equipment are protected by patents

In 2010 the project received a positive conclusion of the Scientific-Technical Council of State Corporation "Russian Corporation of Nanotechnologies", signed by three active members of the Russian Academy of Sciences

In 2011 the project has passed the technical expertise of 10 independent experts of the Skolkovo Found for receiving the status of the innovation project. The company became a participant of Skolkovo Found
The system is certified by State Standard of Russia as a measuring tool. The inspection method and the system are patented in the State Register of the Useful Models of Russia (7 patents). The company processes the License on the activity on executing of expertise of industrial safety.
OBJECT: main gas pipeline (ø 1020 mm) AО "Intergas Central Asia" (Kazakhstan), 2010

Scope of work: Inspection of the pipeline with the system of magnetometric diagnostics KMD-01M

OBJECT: field and gas gathering pipelines (ø 159 - 600 mm) of Oil Company «Lukoil - West Siberia», 2010

Scope of work: inspection of pipelines via NDT (nondestructive testing) methods with the help of magnetometric system KMD-01M

OBJECT: filed oil pipeline of TPP «Langepasneftegaz», (ø 159-420 мм), of Oil Company «Lukoil - West Siberia», 2011

Scope of work: Inspection of the pipeline with the system of magnetometric diagnostics system KMD-01M

OBJECT: gas pumping stations near towns Rzhev, Smolensk, Volhov (ø 1020 mm), OAO "Gazprom", 2011

Scope of work: Diagnostics of input and output gas compressor stations pipelines with the system of magnetometric diagnostics system KMD-01M
EXPERIENCE

The diagnostics using the system KMD-01M was carried out on the pipelines of different types, destinations and level of readiness for operating

**OOO «Kazmunajgas», Kazakhstan**  
- main gas pipeline «Central Asia - Center», ø 1220 mm.

**OAO «Lukoil - West Siberia», Russia**  
- gas collecting pipeline TPP «Yamalneftegaz», ø 260-400 mm  
- field oil pipelines TPP «Kogalymneftegaz», «Pokachineftegaz», «Langepasneftegaz», «Urajneftegas» - ø 159-400 mm

**OAO «Bashneft», Russia**  
- field pipeline, ø 159-420 mm

**OAO «Oil Company «Rosneft», Russia**  
- field pipeline «RN-Uganskneftegaz», ø 530 mm

**OAO «GAZPROM», CY «Lenorgenergogaz», Russia**  
- gas pumping stations - KC «Rhevskaya», KC «Smolenskaya», KC «Volhovskaya», ø 1020 mm

**«Saudi Aramco», Saudi Arabia**  
- main pipeline, ø 31”
### SPECIFICATION OF KMD-01M

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
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<tbody>
<tr>
<td>The distance between the magnetometers block and the pipeline</td>
<td>Up to 10-15 pipes diameters depends on operating pressure</td>
</tr>
<tr>
<td>The diameters of inspected pipelines</td>
<td>From 159 mm</td>
</tr>
<tr>
<td>The instrumental error of current coordinate defining</td>
<td>± 0.5 m</td>
</tr>
<tr>
<td>The defined defects</td>
<td>From 20% of metal loss (the pipes wall thickness)</td>
</tr>
<tr>
<td>Memory size</td>
<td>Enough for non-stop writing of information about 500 km of pipeline</td>
</tr>
<tr>
<td>Productivity</td>
<td>Up to 20 km daily per the shift (2 persons)</td>
</tr>
<tr>
<td>Temperature range</td>
<td>From -30 °C up to +55 °C</td>
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</table>
TYPES OF DEFINABLE DEFECTS:

- Stress-deformed condition
- Corrosion fatigue
- Local damage (pitting, scuff, mechanical damages, etc)
- Changing the pipelines geometry

Pitting with the loss of metal 22%. Was detected by the contactless method at the underground pipeline

Local defect of scuff type detected by the contactless method at the underground pipeline
The disturbance of geometry of the underground pipe that caused the stressed-deformed condition of the supercritical level

The area of pit corrosion found at the underground pipeline by the contactless method
EXAMPLES OF THE DEFINED DEFECTS

Corrosion damage on bottom side of underground pipes, loss of metal

The damage of "scuff" type at the underground pipeline
Examples of the defined defects

The areas of pit corrosion, defined by the contactless method at the underground pipeline. The depth of the pipe - 4 m
The areas of pit corrosion, defined by the contactless method at the underground pipeline. The depth of the pipe - 4 m
Zone of the corrosion defects marked as the result of the contactless inspection with KMD-01M. The coincidence of the measured coordinates of the anomaly with fact is well seen (0.5-1.0 m)
POSSIBILITIES OF TECHNOLOGY FOR THE PIPELINES INSPECTION

Technology's capabilities

<table>
<thead>
<tr>
<th>Zone</th>
<th>Loss of metal*</th>
<th>Instrumental error</th>
<th>Positioning error</th>
<th>Defect detection %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>0-30 %</td>
<td>±25%</td>
<td>± 0.5 M</td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td>31-50%</td>
<td>±15%</td>
<td>± 0.5 M</td>
<td>90-95%</td>
</tr>
<tr>
<td>Red</td>
<td>&gt;51%</td>
<td>±10%</td>
<td>± 0.5 M</td>
<td></td>
</tr>
</tbody>
</table>

* Pipeline section technical condition range (green - good, yellow - permissible, red - non-permissible). The above ranges can be adopted as per clients request

Technology's Limitation

Besides from the mentioned above error we need to have all information about the pipeline (length, diameter, weld joints, protection sleeves, etc)
METHODIC OF MEASURING WITH KMD-01M

Complex is operated by two operators:

**The first operator** locates the pipeline with the pipeline finder as well as links the route with the GPS receiver to the reference points.

**The second operator** measures the fluctuations of the constant magnetic field with the magnetometers.

Based on the received data the areas of stress concentration due to the corrosion teat-and-wear, stressed-deformed condition, pipelines geometry failure, and other defects are defined.

While measuring the system automatically records the GPS-geographical coordinates.

The processing and interpretation of the received data take place after the measuring.
THE TECHNIQUE OF PIPELINES COMPLEX DIAGNOSTICS

The complex diagnostics of oil & gas pipelines technical conditions is carried out in four stages:

I stage Collecting all necessary information and preparing the measuring equipment.

II stage Field inspection with KMD-01M – magnetometric contactless measuring with the simultaneous data visualization. At the same time detecting of GPS - coordinates is made. While working the received data can be transferred to the Data Processing Centre through Internet.

III stage The processing and interpretation of the received data is held. By the customers request the opening of the pipeline can be made with the NDT - additional control by non-destructive methods (measuring of thickness and hardness).

IV stage The analysis of the received information is executed, the electronic maps of the discovered anomalies are designed and then the final objects technical condition conclusion is made.
The signal received from the magnetoresistive sensors is amplified and converted using an analog-digital converter into the code that comes to a computer.

The software processes incoming information and displays on the monitor in real time the magnetograms for each component of the field at four points of space.
Electronic map showing the binding of supercritical levels defects requiring additional defectoscopy control at the field pipeline with the definition of geographical coordinates.
PLANNED DESTINATIONS AND DEVELOPMENT

Placing the device at a all-terrain car

- Purpose: increasing the productivity up to 75 km daily per a team (depending on the route).

Placing the device at a submersible

- Purpose: inspection of underwater pipeline passages

Placing the device at a pilotless aircrafts

- Purpose: increasing the productivity and extending the areas available for inspection (deserts, swamps and taiga).