GLONASS technology application for mining transport dispatching

Dmitry Vladimirov
«VIST Group»
General Manager
«VIST Group» develops dispatch control systems for mining enterprises since 1998. These systems are based on satellite navigation technologies and now are successfully applied at more than 20 open pits.

The first project with **GLONASS/GPS** technologies application is:
1999 – 2001 - Poltavsky GOK (Ukraine).

**MONITORING PARAMETERS:**

- Truck location, shown on open pit map
- Fuel level in truck tank
- Load weight
Initial stage of dispatch control system “KARJER” development
Transport monitoring

Load and fuel level control system

Radio-navigation module with GPS/GLONASS navigation unit Navior-14 (produced by “Orizon-Navigatsia”, Smela) or GPS receiver Jupiter 12 (produced by “Navman”)

Display

USW radio station

Sensors (fuel level, suspension pressure, etc.)
On-line enterprise control

**System modules**

- Drivers schedule
- Linear traffic plan
- Road quality control

**For all mobile objects:**
- Shift task forming module
- Cartographic module
- GPS/GLONASS - positioning
- Operations statistics
- Time-sheet (shift totals)
- Fuel level control

**On-board excavator control system** (for electrical excavators)

- Diagnostic system
- Bucket pinpoint positioning system

- Displacement time diagram
- Consist forming module
On-board equipment of mobile objects

- Navigation Unit
- Load, Fuel and Tire Pressure Control System
- Sensors
- Data Communication System
- Smart Panel
Visualization of truck operation parameters
Standart windows

- Downtime reasons entry
- Sensors indication, Extended diagnostics
- Shift statistics

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Visualization of truck operation parameters
Complementary windows

Fuel consumption diagram

Events log
System Users:

RUSSIA:
- Holding company “SDS” (“Chernigovets”, “Razrez Kiselevsky”)
- Siberian Coal Energy Company (SUEK) (Tugnujsky razrez, Zarechny razrez, etc.)
- Magnitogorsk Iron & Steel Works (MMK)
- MECHEL (“Southern Kuzbass Coal Company”, “Korshunovsky GOK”)
- United Company RUSAL
- Ural Mining and Metallurgical Company (UMMC) (Managing company “Kuzbassrazrezugol”)
- Stoylensky GOK
- Mineral and chemical company “EuroChem” (Kovdorsky GOK)
- “Polyus Gold” (“Aldanzoloto GRK”)
- “Polymetal” (“Northern Urals Gold company”)

UKRAINE:
- Severny GOK
- Centralny GOK
- Inguletsky GOK
- ArcellorMittal Krivoj Rog
- Poltavsky GOK

KAZAKHSTAN:
- SSGPO (ENRC)

MONGOLIA:
- ERDENET
Potential of mining transport fleet conversion to GLONASS receivers (for dispatch control system “KARJER”)

Mining transport, equipped with navigation units
(in dispatch control system “KARJER” – about 2,500 vehicles)
The proportion of GLONASS/GPS receivers is less than 1-2%.
Nowadays MNP-M3 receivers (multichannel receiver, produced by “IRZ”) are being used as an initiative.
Advantages of GLONASS using in mining

High precision location is guaranteed even on the bottom of the open pit, as more GLONASS/GPS satellites are visible from the pit. In addition, GLONASS satellites observability in the north is better than for GPS.

Use of dual-systems receivers (GLONASS/GPS) allows to create reliable pinpoint positioning systems, which are operated in real-time mode while using cheaper mono-frequency equipment.

Independence from foreign systems/suppliers
Potentials of GLONASS navigation systems use for mining transport dispatching:

Coordinates are used for:

- **Identification of objects interaction** within open pit (for example truck №36 is loading by excavator №12)

- **Travel calculation** (as the way which is traditionally used for this task solving (travel calculation by counting wheel turns) has significant error)

- **Optimization** (coordinates are used by Optimization module)

- **Road quality control** (coordinates are used by Road quality control module)

- Excavator bucket **pinpoint positioning**
Issues of mining engineering fleet conversion and new types of GLONASS/GPS equipment using within dispatch control system “KARJER”

- Migration from GPS to GLONASS receivers is not cost efficient for customers
- No legal background for getting benefits from using GLONASS systems by private enterprises
- In comparison with GPS receivers GLONASS domestic units are mostly of poor quality and high price
Using GLONASS navigation system within dispatch control system “KARJER”
Integration by retrofit equipment

Variant 1
+ Card-Adapter
+ GLONASS/GPS receiver (IRZ, NAVIS, Geostar Navigation)
  + GLONASS/GPS aerial
  + SOFTWARE UPDATE

Variant 2
+ GLONASS/GPS receiver NovAtel OEMV-1G
  + GLONASS/GPS aerial
  + SOFTWARE UPDATE

Advantages:
Use of existing equipment and cables up to the maximum extend

Disadvantages:
relatively long depreciation timeframe during equipment upgrade
Using GLONASS navigation system within dispatch control system “KARJER”
New external unit installation

Advantages:
Re-equipment doesn’t require long time, so vehicles will be stopped just for a short period.

Disadvantages:
Sometimes it’s impossible to use new units