Economic benefits of using industry-sector monitoring systems based on GNSS

United Nations/Croatia Workshop on the Applications of Global Navigation Satellite Systems
21 April 2013, Baska, Krk Island, Croatia

Olga Nugaeva
State Policy Basic Principles

- Presidential Decree, May 17, 2007

Basic Principles:
- Access to GLONASS civil signals is free and unlimited for both Russian and international users
- Use of GLONASS in critical industries and Government economic sector
- Promotion of GLONASS worldwide commercial use
- Providing GLONASS compatibility and interoperability with other GNSS

- GLONASS sustainment, development and use are carried out under the Federal GLONASS Program
GLONASS Program Results

**Constellation recovery**

- **2002**: 6-7 SV operational
- **2011**: 24 SV operational

**Availability improvement**

- **2002**: 18%
- **2012**: 100%

GLONASS recognized worldwide
The constellation provides global continuous navigation.
GLONASS Program Results

Accuracy improvement

- 2002 35 m (1 \( \sigma \))
- 2012 2,8 m (1 \( \sigma \))

User position accuracy, m

Performance is comparable to that of GPS
Federal Program for GLONASS Sustainment, Development and Use for 2012-2020

- Federal Program for GLONASS Sustainment, Development and Use for 2012-2020 approved March, 3 2012
- Budget for 9 years and workplan defined (2012-2020)
Program Goals

• Maintaining the GLONASS performance at a level comparable to that of other GNSSs

• Further development of GLONASS aimed at:
  • improved performance to be competitive with other GNSSs
  • pursuing leadership in satellite navigation
  • consolidated evolution of system’s components

• Promotion of GLONASS global use

Key Quality Indicator of Program –
guaranteed provision of announced GLONASS performance characteristics
Solutions for performance improvement

- Space segment modernization
  - new signals
  - new clocks
  - accurate attitude control
  - cross links
  - predictable SV behavior

- Ground control segment modernization
  - new OD&TS Software
  - expanded monitoring stations and up-link network
  - more stable system time scale steered to UTC (SU)
  - more accurate geodesy reference PZ-90.11 adjusted to ITRF within cm level (introduced for navigation by the Government Regulation of 28 December 2012)

- Space-based and ground-based augmentations
  - Advanced user receivers
  - Real-time system performance monitoring system
GLONASS is a Russian Space System with unique features and global coverage.


- Enhanced reliability
- Improved precision
- More signals

GLONASS 2013: active satellites provide 100% global coverage.

City navigation: two systems are better than one!

Global service availability:

- GPS only
- GPS + GLONASS

GLONASS/GPS mainstream consumer equipment:

- 2010:
  - Russian vendors only
  - For automobile transport only: 100,000 units

- 2011:
  - Russian & Chinese vendors
  - For fleets of over 400,000 vehicles
  - MTC/ZTE/Qualcomm is the first smartphone
  - First PND models

- 2012:
  - 2012 is the year that GLONASS/GPS devices from all global brands expand on mass consumer market

GLONASS satellite constellation has been deployed. Next objective is implementation of GLONASS technologies.
October 18, 2012

- Extension of the Russian Government commitments on provision of GLONASS open service signals on a non-discriminatory and free basis with no intentional signal degradation for at least next 15 years

- Commitments of the Russian Government to keep GLONASS performance compliant with ICAO SARPs
International Cooperation

- GLONASS is an element of the global GNSS infrastructure
- Compatibility and Interoperability provision
- Development of common GNSS standards
- Promotion of GLONASS worldwide use for all user benefit

Multilateral cooperation in the framework of ICG and Working Groups,
Bilateral working contacts with USA, EU, India, China and other countries on GNSS compatibility and interoperability and global use
## 2012: Multi-constellation – global standard

### Multi-constellation in space

<table>
<thead>
<tr>
<th>Satellite System</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS</td>
<td>Global system – market standard</td>
</tr>
<tr>
<td>GLONASS</td>
<td>Global system since 8 Dec. 2011</td>
</tr>
<tr>
<td>Galileo</td>
<td>Launch of 2 satellites (October 2011) and their commissioning</td>
</tr>
<tr>
<td>Compass</td>
<td>Test mode as a regional system since December 2011</td>
</tr>
</tbody>
</table>

### Multi-constellation on earth

#### before 2010
- GLONASS/GPS – only Russian producers
- Only for motor transport (2010 – 100 thousand psc)

#### 2011
- All world leaders announced about working on GLONASS/GPS chipsets
- All world leaders announced about GLONASS/GPS equipment production for different purpose

#### since 2012
- GLONASS/GPS – mass-market standard in all price segments

---

**Multi-constellation is a benefit for users:**
better product for the same price – higher reliability, higher accuracy
Navigation market: forming, fast growing, global, high-tech

World navigation market is more than $100 bln
Industry segments 2013-2020

- Motor transport: 54.0%
- Agriculture: 1.0%
- Portable devices: 43.7%
- Aviation: 0.5%
- Land surveying: 0.6%

Growth drivers of the Russian market:

1. **Major state and industry projects**: «ERA-GLONASS», equipping of passenger transport, Ministry of the Interior of Russia, “Russian Post” transport, Transneft

2. **Regional projects**: regional special-purpose programs (school busses, emergency ambulance, housing and utilities infrastructure), Intelligent Transport Systems (ITS Moscow), etc.

3. **Consumer navigation**: systems, equipment and services for car drivers, passengers and foot passengers

Source: European commission, May 2012

Basic conditions for implementation of navigation technologies have been provided: legislative framework, prepared and approved industry solutions for different tasks
Development and implementation of GLONASS-based technologies

**Government agencies**
Agency programs (Ministry of Interior, EMERCOM, Federal Penitentiary Service and others)

**Russian regions**
Comprehensive regional GLONASS implementation projects, intelligent transportation systems for cities and national motorways

**For industries**
Russian Post, Transneft, Rosneft and others, road tolling systems (for vehicles over 12 tons)

**Olympics 2014 project**
Development of logistics and transportation center

**Government projects**
- ERA-GLONASS
- GLONASS-based transportation tolling system
- Hazardous freight transportation monitoring
- Digital tachographs (work-rest regime)

**Further development of regulatory and legal framework**
Legal framework has been established for implementation of GLONASS technologies
Refinement of regulatory and legal framework will accelerate the development of navigation information systems sector and adoption of GLONASS technologies

**Globalization of GLONASS technologies**
Russian companies actively promote GLONASS technologies on international market
GLONASS-based systems, equipment and services, tested and proven in Russia, are offered for export
GLONASS/GPS technologies should be used for modernization of transport system and transportation security

**Size of the problem:**
damage from road accidents - 2.5% GDP, 27,953 people died

**Systems in interest of safety**

- State system «ERA-GLONASS»
  - after 12.2013 - 40 mio vehicles
- Monitoring system of dangerous, bulky and heavy-weight cargo transportation
  - after 2013 - 150 thousand vehicles
- Control and dispatch systems (regional, urban)
- Drivers’ schedule of work and rest control system (digital tachographs)
  - after 2013 - 900 thousand vehicles
- Police patrol /EMERCOM monitoring and control systems
  - after 2015 - 5 mio vehicles
- Heavy truck tolling system
  - since 2011 - 200 thousand vehicles
- Intelligent transport systems and transport streams
  - after 2014 - 1.5 mio vehicles

**Systems in interest of effectiveness**

13 megapolis, 19 cities with a population more than 500 thousand people

Basic requirements to the systems: federal or regional scale, combination with each other and with federal safety systems and international systems
Commercial potential: prepared service platform and the most popular navigation device

**ERA-GLONASS**

- **Safety and security on the roads**
  - **Social effect:** 4 thousand saved lives annually
  - **Testing:** since 12/2011
  - **Operation:** after 12/2013

- **State service consumers:** Drivers and passengers

- **Tolling systems**
  - **Fair recovery of damages**
  - **Economic effect:** Replenishment of Federal and regional road funds
  - **Testing:** since 12/2012
  - **Operation:** after 07/2014

- **State service consumers (1st stage):** 1.5 mio trucks (> 12 tonnes)

- **Insurance telematics**
  - **Social effect:** Road discipline growth
  - **Testing:** since 9/2012
  - **In the market:** after 6/2013

- **Commercial service consumers:** cars’ owners

- **Services for car drivers**
  - **Ease and comfort on the road**
  - **Economic effect:** new big market
  - **Testing:** after 10/2012
  - **In the market:** after 8/2013

- **Commercial service consumers:** cars’ owners

**Key and necessary market growth condition – functional expansion of «ERA-GLONASS» terminal**
Industry solutions

Precision farming

Agriculture with GNSS:
- 10% annual income increase
- 52% fuel cost reduction
- 67% labor cost reduction

Control systems for mining equipment

- > 12% increase of traffic volume
- 8% fuel consumption reduction
- 50% downtime reduction

High-precision integrated sensors

- Observation and control of forest fire danger
- Forest crime monitoring
- Identification of areas of low, medium and high forest pathology threat

Signal-searching device with self-contained power supply

- Signal-searching device sends signals on a user’s mobile phone or to the dispatch center while attempting to open the property or to take away the device.
Most mobile devices already have functions of satellite navigation

Tourist navigator with a satellite communication channel

Navigation helmet for bikers

Photo and video cameras

Ski sunglasses

Navigation gadget for golf playing

Baggage tracker

Tracker for animals

Navigation tracker for sport shoes

Coming soon «Google glasses»

New navigation gadgets and based on them services – new opportunities for people
Satellite navigation for children and handicapped people

Navigation services provide additional safety and improvement of quality of life of the least socially protected groups

**Satellite navigation for children and handicapped people**

**Navigation for wheelchair users**

**I know how to get there!**

**Children, sick and elderly relatives monitoring**

**We ALWAYS know where our family and friends are!**

**Voice and tactile navigation for visually impaired people**

**Ease of movement!**

**Children, sick and elderly relatives monitoring**

**We ALWAYS know where our family and friends are!**

**Telemedicine**

(patient’s monitoring)

**Help will come on time!**

**Navigation services provide additional safety and improvement of quality of life of the least socially protected groups**
Effects on domestic GLONASS technology market

Demand for GLONASS-based equipment

GLONASS-based projects and programs create a multiplicative effect on growth in Russian innovation sector, and contribute to greater efficiency in various sections of national and regional economy.
Transportation monitoring and dispatch system

Challenges:
- Lack of a transportation dispatch system
- Absence of an elaborated common regulatory framework
- Limited cross-border cargo tracking capabilities
- Insufficient level of integration in development and operations management of the transportation system
- Lack of consistent, unified standards for document workflow
- Lax collaboration among different types of carriers

Unrealized benefits:
- Faster delivery times
- Lower transportation expenses
- Fare optimization
- Safekeeping of cargo
- Predictability
- Operational efficiency
- Fuel economy
- Environmental sustainability
Primary effects from development of navigation systems

**Transportation service purchasers (cargo owners):**
- Effective control over the freight transportation process
- Continuous monitoring of freight location
- Prompt response in critical situations
- Objective information on compliance with transportation contract terms

**Transportation companies and individual haulers:**
- Automation of planning and control of shift assignments
- Efficient utilization of freight transport
- Enhanced transportation route safety
- Objective control of compliance with transportation contract terms

**Dispatch services:**
- Continuous monitoring of vehicle location with electronic map display capability
- Automatic control of routes and timetables
- Prompt correction of deviations from transportation timetables
- Real-time communication with drivers
- Automated reporting of timetable performance and transportation volumes
Control over completion of road freight transportation assignments using GNSS

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Transportation planning</td>
</tr>
<tr>
<td>2</td>
<td>Monitoring rail transportation</td>
</tr>
<tr>
<td>3</td>
<td>Monitoring sea freight transportation</td>
</tr>
<tr>
<td>4</td>
<td>Monitoring freight terminal performance</td>
</tr>
<tr>
<td>5</td>
<td>Tracking cargo pickup by roadway transport</td>
</tr>
<tr>
<td>6</td>
<td>Ensuring roadway freight transportation safety</td>
</tr>
<tr>
<td>7</td>
<td>Control over completion of road freight transportation assignments</td>
</tr>
<tr>
<td>8</td>
<td>Freight transportation analysis and reporting</td>
</tr>
</tbody>
</table>

Reception, processing, and storage of telematics data from navigation communication equipment

Integration with road transportation companies’ telematics platforms

Road freight transportation planning

Monitoring road freight transportation vehicles

Operational control over vehicles

Analysis of road freight transportation vehicle performance
Cumulative effectiveness

- Transportation transparency
- Faster freight movement
- Efficient tracking
- Enhanced transportation safety
- Capability to clearly delimit responsibility for delays
- Simplicity of customs processing
- Accompanying operational services
- Integration with marine, seaport, and railway systems
<table>
<thead>
<tr>
<th>Implementation mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishment of an international coordination consul</td>
</tr>
<tr>
<td>Signing of a framework cooperation agreement</td>
</tr>
<tr>
<td>Preparation of internationally coordinated design specification, taking into account requests and interests of all potential participants</td>
</tr>
<tr>
<td>Drafting of international formats for approval and operational regulation of monitoring &amp; logistics platform</td>
</tr>
<tr>
<td>Defining implementation, investment, and control mechanisms</td>
</tr>
</tbody>
</table>
Navigation systems implementation challenges

- **Various navigation systems:**
  - Utilize different standards
  - Differences in navigation data exchange protocols
  - Differences in data composition and structure
- **Various navigation equipment manufacturers:**
  - Differences in design
  - Differences in functionality
  - Differences in reliability
- **Large number of transportation companies (corporate navigation systems) – quantity transforms into quality**

Standardization of utilized navigation technologies is a key factor for assuring operability of the navigation system for optimized logistics.
GLONASS Program is among priorities of the Russian Government policy

GLONASS open service is free for all users

GLONASS Program (2002-2011) completed, goal achieved
- Performance are comparable with GPS
- Full constellation (24 sats) deployed

New GLONASS Program (2012 – 2020) approved 3 March 2012
- Government commitments for major performance characteristics
- GLONASS sustainment, development, use

GLONASS will continue
- Keep the GLONASS traditional frequency bands
- Transmit existing FDMA signals
- Introduce new CDMA signals

International cooperation – make GLONASS as one of key elements of the international GNSS infrastructure for worldwide user benefits
Thank you for your attention!

24 Mishina St., Bldg.1
127083 Moscow, Russia
Tel.: +7 495 988 21-10
Fax: +7 495 988 21-09
e-mail: nugaevaom@nis-glonass.com
http://www.nis-glonass.com