«Current state and prospects of development of commercial application GLONASS/GNSS in the Russian Federation»

United Nations
SYMPOSIUM TO STRENGTHEN THE PARTNERSHIP WITH INDUSTRY COMMERCIAL APPLICATIONS OF GLOBAL NAVIGATION SATELLITE SYSTEMS
17 February 2014. Andrey Kupriyanov “GLONASS/GNSS Forum Association”
GLONASS/GNSS Forum

Designers of the GLONASS system

Customer of services and user’s equipment

Designers of navigation equipment, VTS, on base of GLONASS/GNSS systems

Universities and Scientific Institutions

Service providers

The association includes about 80 enterprises, growth for the year 10%
State Policy Basic Principles

- GLONASS is a part of the critical state PNT infrastructure providing national security and economy development
- Creating, developing and sustaining the PNT infrastructure is a State responsibility
- No direct user fees for civil GLONASS services
- Open, free access to GLONASS information necessary to develop and build user equipment
- GLONASS use in combination with other GNSS to increase reliability of navigation
- Mandatory GLONASS use for Governmental and critical applications
- International cooperation on GNSS compatibility and interoperability and worldwide use

Federal GLONASS Program is a basis for GLONASS sustainment, development and use
GLONASS Architecture

Constellation

Orbit constellation:
- 24 SV + spare (3 planes by 8 satellites)

Orbit parameters:
- Circular, H = 19,100 km, i = 64.8°
- Revolution: 11h 15 min

Two types of signal:
- Standard (open)
- Special (authorized)

Launchers

Proton-M
Soyuz-2

Baykonur
Plesetsk

Ground Control Segment

Existing Stations
Future stations

Users

Signal:
- 15–100 km in Space
- Standard (open)
Major principles of the GLONASS-2020 Concept

Sustainment, Development, Use

- **Sustainment**
  - *State commitments* on performance (constellation, availability, accuracy, reliability)
  - Launch program until 2020 with spares on-orbit and on the ground

- **Development**
  - Constellation improvement
  - New signals implementation
  - Accuracy and availability improvement
  - Interference protection improvement
  - New capabilities implementation
  - Service area extension

- **Use**
  - Governmental use support
  - Private activity encouraging
  - Make GLONASS as worldwide utility
Extended PNT Architecture of Russia

- Precise Ephemeris and Clock System
- Earth Attitude and Rotation System
- GLONASS Space Complex
- Wide Area Augmentation SDCM
- Time Reference System UTC (SU)
- Regional Augmentations
- Certification Standardisation
- Inertial navigation
- Geodesy Reference and Maps
- Special User Equipment
- Civil Users Equipment
- Synergy of performance and requirements
<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
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</thead>
<tbody>
<tr>
<td>Transport (≈50%)</td>
<td>Geodesy, cartography, hydrography, land management</td>
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<tr>
<td>Inventory, management of territories</td>
<td>Monitoring of natural and technogenic processes</td>
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<td>Trade</td>
<td>Power industries</td>
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<td>Public health</td>
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<td>Agriculture</td>
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<td>Science</td>
<td>Communication</td>
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<td>Sports, tourism</td>
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<td>Social services</td>
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INTRODUCTION OF THE GLONASS TECHNOLOGIES ON TRANSPORT

- Monitoring municipal, special transports
- Traffic Monitoring, overcharge
- Control of modes of working and rest of drivers
Safe bus

- Introduction of monitoring systems and traffic management and "Safe Bus" information services as an effective solution to urban transport problems.
- The terminals installed in municipal buses, in real time will provide dispatchers with full information on the speed of vehicles and the movement direction. Each "safe bus" is equipped with surveillance cameras, sensors of the number of passengers, indicators of smoke and the button of an emergency call for immediate communication with the dispatcher in an emergency.
In 2013 the number GLONASS, GLONASS/GPS equipped vehicles were more than 2 million.
The potential market in 2013 (estimated) amounted to more than 46 million vehicles. The CAGR (average annual growth rate) was 3.5%.

- **Cars**: 85.7%
- **Trucks**: 12.4%
- **Buses**: 2.0%
PROJECT "ERA-GLONASS"

Integrated safety on roads
4000 safed annually

Mass markets of the equipment and services GLONASS
Transport 2015 – 120 billion rubles

The Russian product with a high export potential

Modernization of transport infrastructure
Integration of systems based on "ERA-GLONASS"

Multiplier of innovative sector
Microelectronics, telecommunications, information and navigation technologies

Transition to high-precision coordinate positioning

"ERA-GLONASS" creates "scale effect" for the GLONASS technologies: at first in the Russian market – more than 40 million units of motor transport, further – on world
State “ERA-GLONASS” system: the main criterion – reliability

Radio covering of federal highways *:
- MTS 82%
- MegaFon 75%
- Beeline 73%
- MVNO > 90%

Automatic emergency call
SMS – reserve data link
Scheme of communication is full MVNO
Largest zone of radio coverage
united pool of numbers
Subscriber priority call (eCall flag)
Voice-to-voice communication with an operator
Reserve communication channel (option) – personal satellite communication link
duplication and reservation of elements
testing during vehicle inspection
Standard technical policy: common cartographic projection, common communications protocols
technical solutions for infrastructure
“ERA-GLONASS” system infrastructure

1. Navigation and information platform
2. Data transmission system
3. MVNO communication network

St. Petersburg, Novosibirsk, Ufa, Moscow, Khabarovsk, Stavropol, Rostov-on-Don, Ekaterinburg.

navigation and information center 1 level

navigation and information center 2 level

Regional navigation information center

MTS, MegaFon, Beeline, GMSC, SMSC, HLR/ALC, GPRS, in-band modem, multiservice platform.

Voice, 112.
Synchronization of communications networks
Intelligent Transport Systems

- System of identifying and collecting payments
- ACS of the transport systems of the RF
- Intermodal transport
- System management traffic signals
- Control system of movement of transport vehicles
- Information system on vehicles
- System of data processing of incidents
- Traffic center
- Telematic devices and systems
- Information systems provide road users
- System of receiving and processing information

- Loop method
- Determination of location
- Image recognition
- Ultrasound determination
- Sea ports
- Airports
- Iron road
- Visual data
- Internet
- Information about vehicles
- Automatic
- Funds telephone communication
- Car navigation
- Management of Traffic lights
- Information on bus stops
- Forced control vehicles
- Data proposing about collisions
- Traffic control of vehicles
The next level of mass service – precision positioning

The development of ground infrastructure of high-precision navigation system
Three major segments of GNSS:
- Space segment
- User segment
- Applications
Since the late 80s the Russian Federation has begun to apply commercial satellite equipment and technology. At the first stage it was receivers with code measurements for maritime and ground navigation, survey. Meritime and aviation application were under IMO and ICAO requirements and regulations.

Commercial application of precision technology and equipment were first of all in survey, cadastre, land and ground infrastructure inventory. The major sector of application were oil&gas, survey and mining. The methods of field applications were static, pseudo kinematic.
The next step was Development, improvement of technology equipment for commercial application
- RTK-kinematics in real time, kinematics with moving base base stations, transmission of differential corrections

Development of commercial (regional, local) reference networks for various applications based on GLONASS/GNSS
Future direction of commercial high-precision applications of GLONASS / GNSS technology and equipment:

- monitoring of ground infrastructures, oil and gas pipelines, geophysical survey and other work on the continental shelf

- machine control - road construction with centimeter accuracy, using technology and real-time reference stations, digital maps
GLONASS/GNSS monitoring systems of buildings, bridges, dams - Precision control system using local reference systems, data transmission systems, software analysis for decision making.
Increasing informational content, coordinate and time providing rolling stock

High-precision monitoring of objects of transport infrastructure, keeping and creating united digital cartographical basis
Schematic diagram and basic directions of the GLONASS/GPS data use in railroad
Precision agriculture. Mining.

- RTK is the main open cut mining GNSS technology.
- Precision steering systems can now run on commercial networks, precision steering systems can now run on commercial networks.
Areas of application of GLONASS

- Positioning of power lines masts;
- Monitoring of hydroelectric power stations;
- Control of transport mobile means of emergency services in real time;
- Tracing of power lines by means of geo information systems and technologies of aerial photography;
- Synchronization with help of technologies of satellite navigation.
The navigation market, both in Russia and elsewhere, is on the rise, which gives plenty of opportunities to start and develop a new business.

An annual growth of this market in Russia is estimated to be 20%. It demands hundreds of thousands of pieces of GLONASS and GPS equipment every year. Moreover, experts expect a twentyfold increase by 2020 due to the adoption of relevant legislation.

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<th>GIS Survey Cadastre</th>
<th>Agriculture</th>
<th>Passenger travel</th>
<th>Oil and gas industry</th>
<th>Intern. forwarding</th>
<th>Machine control</th>
<th>Special vehicles</th>
<th>Construction</th>
<th>Housing, public utilities</th>
<th>Air transport</th>
<th>Hazardous cargo</th>
<th>Sea and river transport</th>
<th>Leasing, Insurance Consumer market</th>
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![Chart showing 20-fold increase from 0.3 billion euros in 2012 to 3 billion euros in 2015, expecting 7 billion euros in 2020.]
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Satellite Navigation Forum-2014

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