



GLONASS

Current Status, Modernization and Use



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Government Policy

The Presidential Decree № 638 of May 17, 2007

On Use of GLONASS (Global Navigation Satellite System) for the Benefit of Social and Economic Development of the Russian Federation

- GLONASS is the **core element of the national PNT infrastructure** ensuring national security and economic development
- PNT infrastructure sustainment and development are Government's function
- GLONASS civil services are **free and unlimited** globally
- **Mandatory use** of GLONASS for government applications and critical industries
- **GLONASS Federal Program** is the instrument for implementing national policy in PNT
- **GLONASS Federal Program 2012-2020**
 - Budget for 9 years secured
 - Most contracts awarded



**Federal GLONASS Program is a basis for
Russian Policy in PNT**



GLONASS Federal Program Goals

- **Improving system performance in terms of accuracy and integrity**
- **Ensuring guaranteed positioning, navigation and timing solutions in restricted visibility, interference and jamming conditions**
- **Enhancing current application efficiency and broadening application domains**

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



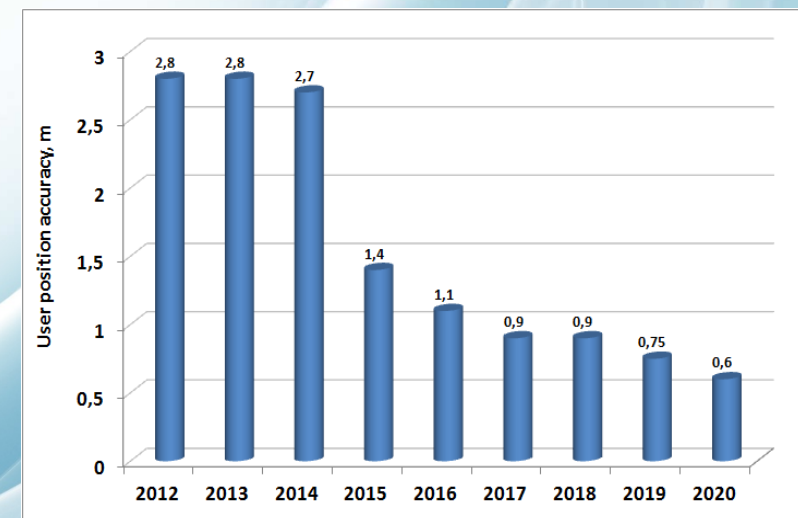
Performance Improvement Plan

❖ Four-fold accuracy improvement

by means of

- ground control segment modernization
- introduction of new onboard atomic frequency standards (2 CAFs + 2 RAFs)
- introduction of advanced satellite control and command, orbit and clock determination technologies based on crosslinks in RF and optical bands
- transition to PZ-90.11 Geodetic System aligned to ITRF with mm level
- synchronization of GLONASS Time Scale with UTC (SU) at less than 2ns while keeping UTC (SU) long-term stability at 10^{-17}

SIS User Positioning Accuracy, m





GLONASS Orbital Constellation Status

(February 9, 2015)

Orbital Constellation and Satellite Status

In total	28
Glonass-M	26
Glonass-K	2
Used for navigation	24
On maintenance	1
Orbital spares	1
On-orbit flight test	2
In commissioning phase	0
Prime Contractor Check	1



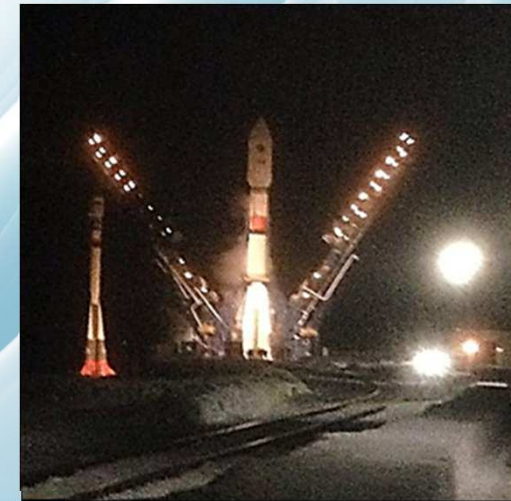
The constellation provides global continuous navigation



Latest Launches and Short-term Sustainment

- 1 Glonass-M (#54) launched March 24, 2014
- 1 Glonass-M (#55) launched June 14, 2014
- 1 Glonass-K launched December 1, 2014
- 2015-2016 – up to 9 Glonass-M launches
- Further launches by Soyuz (1 satellite) or Proton (3 satellites in a batch) launch vehicles will be determined by operational necessity

Glonass-M # 54 launch



Glonass-M



Glonass-K





GLONASS Architecture

Fundamental segment

UTC (SU), Earth Rotation Model and parameters, reference systems

GLONASS Space Complex

MEO orbit constellation
Ground control
Launch facilities

GNSS Augmentations

Space-based systems
-High accuracy
-Integrity
Regional and local differential systems for transport and geodesy

User Segment

Integrated user equipment (communication, inertial sensors and other sources of navigation information)



GLONASS for Civil Use

Transport



Traffic and transportation control

ERA-GLONASS Project



Road accidents emergency response system

Construction



High-rise buildings, bridges, roads construction

Oil & Gas Transportation



Flowrate control

Agriculture



High-accuracy tillage, Fertilization optimization, yield control

Geodesy, Cartography and Land Regulation



Land surveying, cadastral works, land mapping

Power Production



Power networks synchronization

Telecommunications and Data Transfer



Data flows synchronization, capacity growth

Personal Navigation



Positioning, routing

Geosciences



Earth modelling, geodynamics research, earthquakes registration

Multi-GNSS user equipment is used (generally GLONASS/GPS)



International Cooperation

International Cooperation on GNSS

**Provision of
Compatibility and
Interoperability GNSS**

**Promoting Global Use
of GLONASS**

**Pursuing
competitiveness of
GLONASS
Enhancing System
Performance**



Bilateral Cooperation

China

- 13 October 2014 – Signing Memorandum of Understanding
- Committee on Strategic Projects on Satellite Navigation
- Deployment of monitoring stations on mutual basis

Brazil

- Deployment of GLONASS tracking stations

USA

- 9 June 2012 - Renewed Statement of Cooperation between GLONASS and GPS

EU

- Consultations on Agreement on Cooperation in Satellite Navigation



Summary

- **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 is comparable with GPS
 - Full constellation (24 sats) deployed
- **New GLONASS Program (2012 – 2020) approved on March 3, 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 aims at making GLONASS as one of the essential elements of the international GNSS infrastructure for worldwide user benefits**



Thank you!