



GLONASS Current Status and Plans

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- **GLONASS Government Policy**
- **GLONASS Program 2012-2020**
- **GLONASS Constellation Status**
- **Recent Events and Constellation Sustainment**



- **Modernization Plans**
- **Augmentations**
- **International Cooperation**
- **Summary**

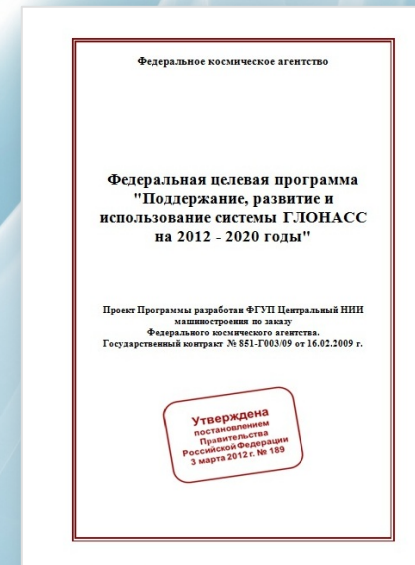


Government Policy

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



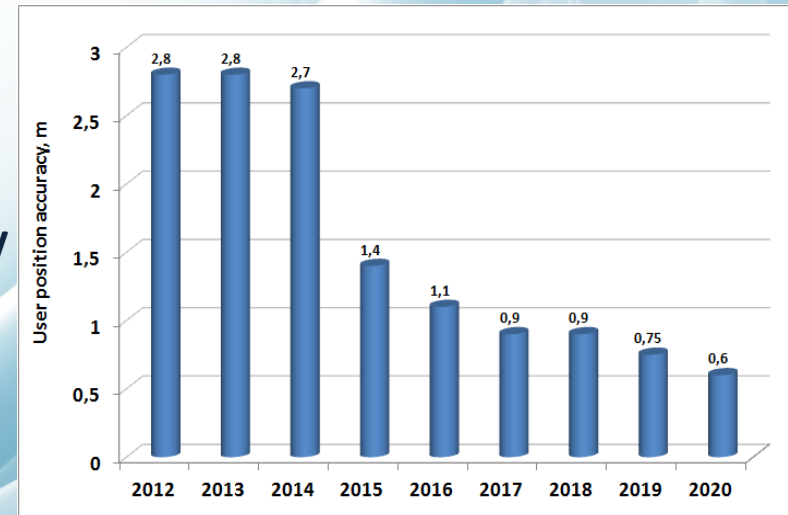
Performance Improvement Plan

❖ 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



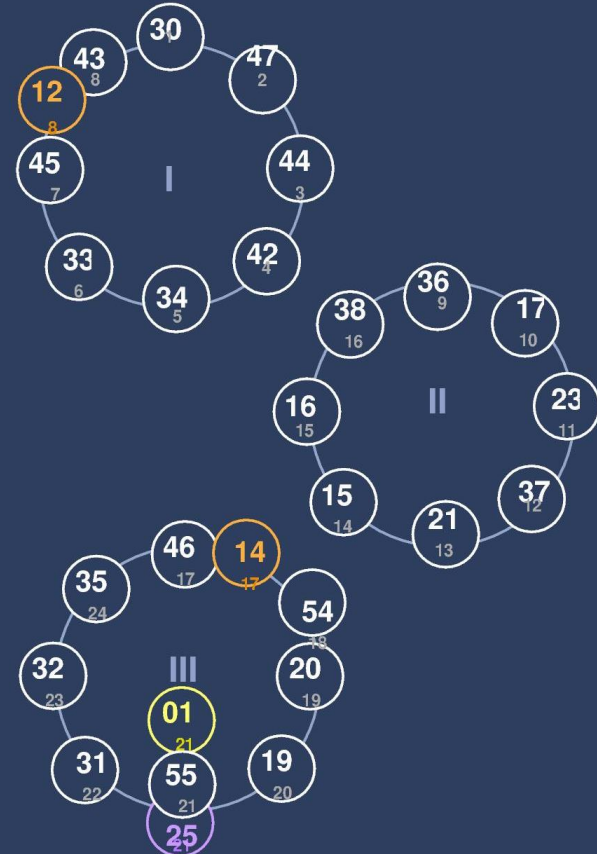


GLONASS Orbital Constellation Status

(28 November 2014, 00:00)

Orbital Constellation and Satellite Status

In total	28
Glonass-M	27
Glonass-K	1
Used for navigation	24
On maintenance	0
Orbital spares	2
In-orbit flight test	1
In commissioning phase	0
Prime Contractor Check	1



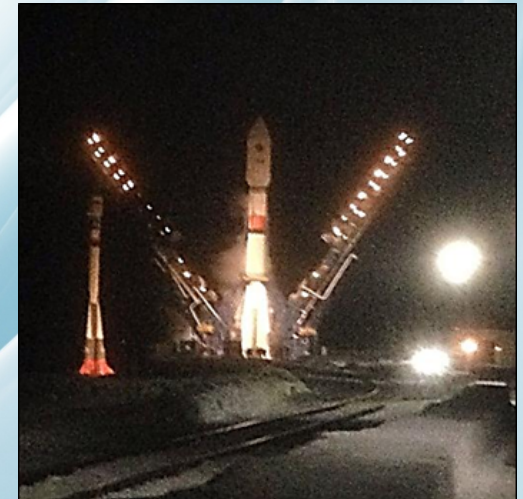
The constellation provides global continuous navigation



Latest Launches and Short-term Sustainment

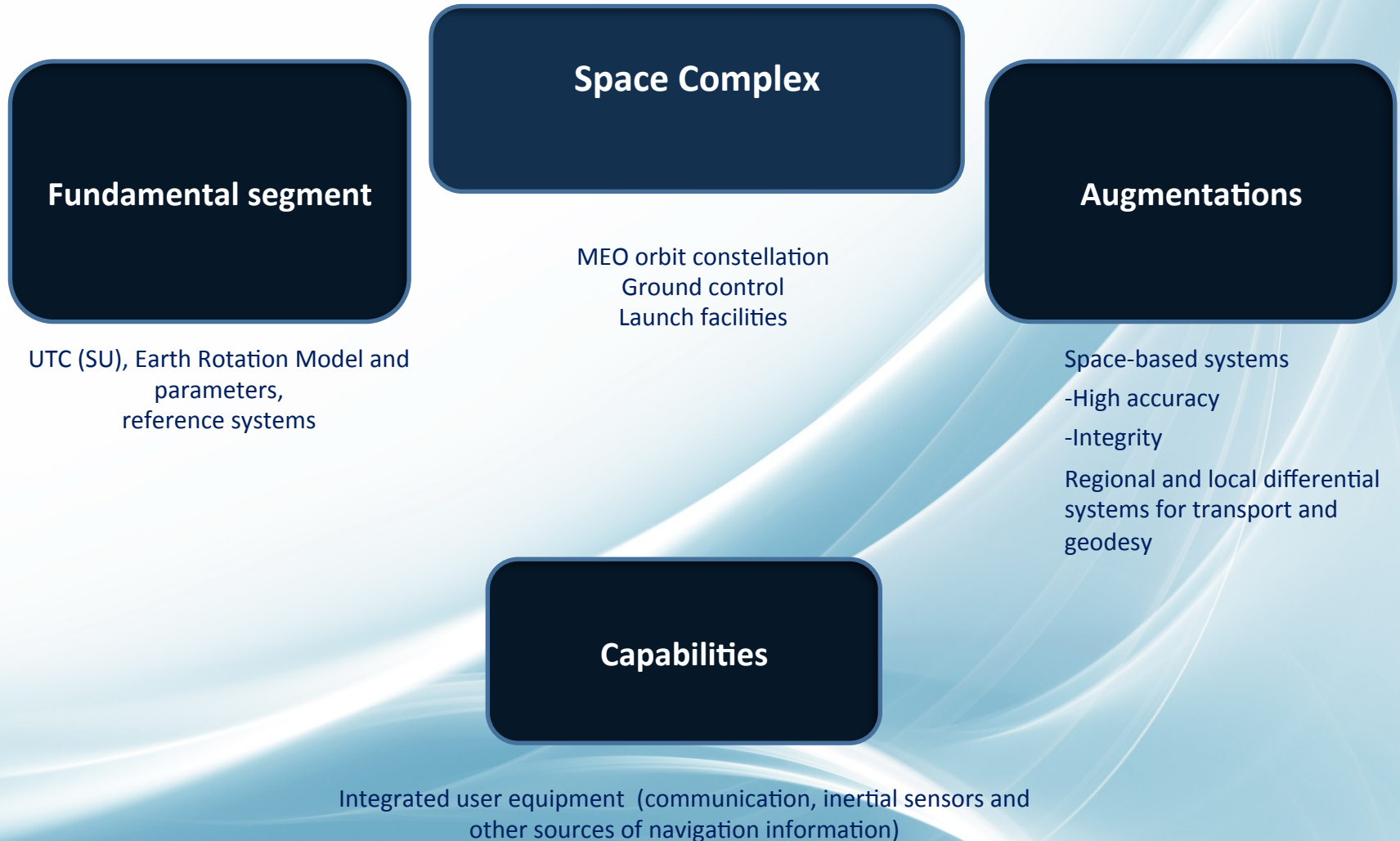
- **1 Glonass-M (#54) launched March 24, 2014**
- **1 Glonass-M (#55) launched June 14, 2014**
- **2015-2016 – up to 9 Glonass-M launches**
- **Further launches by Soyuz or Proton will be determined by operational necessity**
 - **triple launch planned for the beginning of 2015**
- **1 Glonass-K in ground storage to be launched in the end of 2014**

Glonass-M # 54 launch





GLONASS Architecture





Space Segment Modernization



Glonass-M





Glonass-K

- increase of guaranteed life-time
- evolution of satellite service systems
- more stable on-board clocks
- new control, command and ODTS technologies
- introduction of SAR payload
- new signals

Phased build-up of capabilities



GLONASS Signal Implementation Plan

Satellite	FDMA Signals		CDMA Signals		
	L1	L2	L1	L2	L3
 Glennass-M	L1OF L1SF	L2OF L2SF	-	-	L3OC (2014+) 7 SVs
 Glennass-K	L1OF L1SF	L2OF L2SF			L3OC
Modernized Glennass-K	L1OF L1SF	L2OF L2SF	L1OC L1SC	L2OC L2SC	L3OC

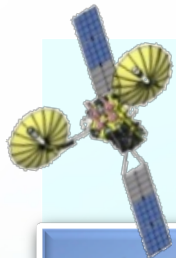
System of Differential Correction and Monitoring (SDCM)



Objectives

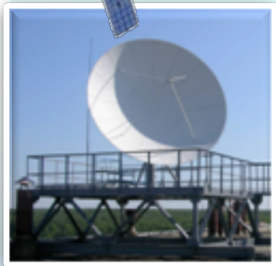
- SBAS L1 full coverage over Russian territory by 2016
- SBAS L1 dual coverage and L5 service in the central part of Russia by 2018
- SDCM SBAS service certification by 2019
- Precise point positioning service through signals from GEO in GLONASS bands

System Architecture



Broadcasting channels

- ✓ 3 L1 GEO
- ✓ 1 L1/L5 GEO
- ✓ SiSnet server



RIMS network

- ✓ 46 stations in Russia
- ✓ up to 8 stations abroad



Processing Facilities

- ✓ Main (Moscow)
- ✓ 2 Regional

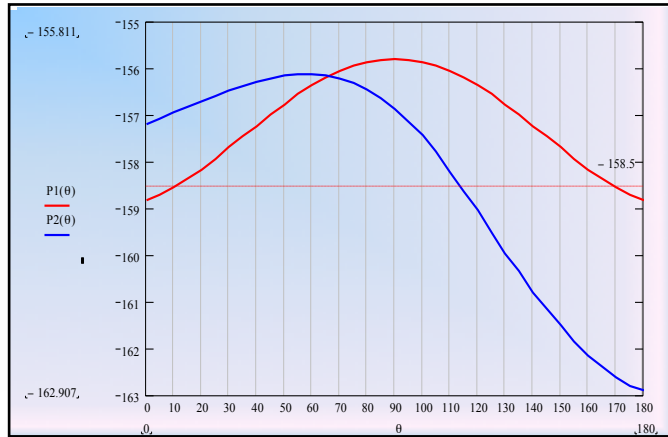


Constellation Status

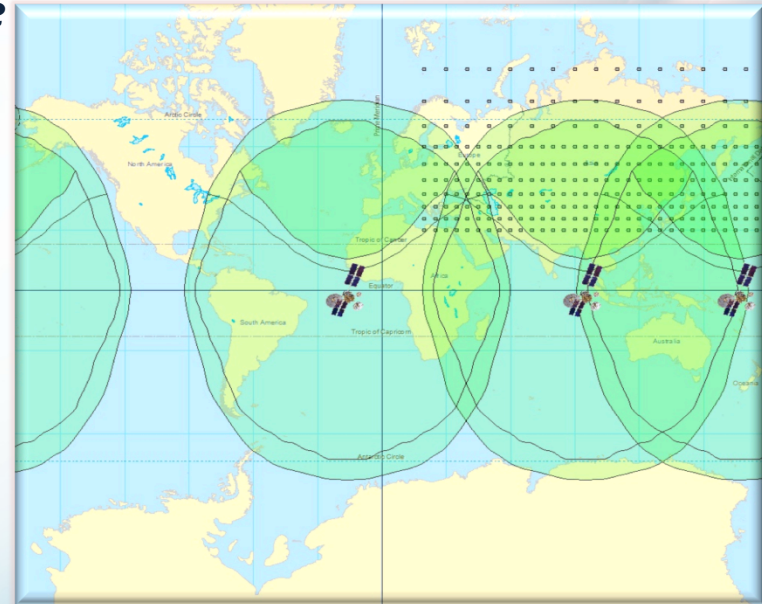
- Luch-5A launched at 16° W on December 11, 2011
- Luch-5B launched at 167° E on November 3, 2012
- Luch-5V launched at 95° E on April 28, 2014



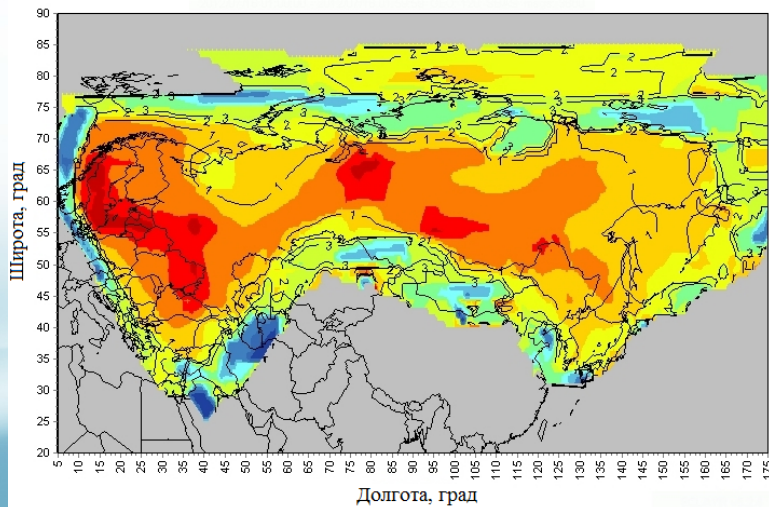
Coverage



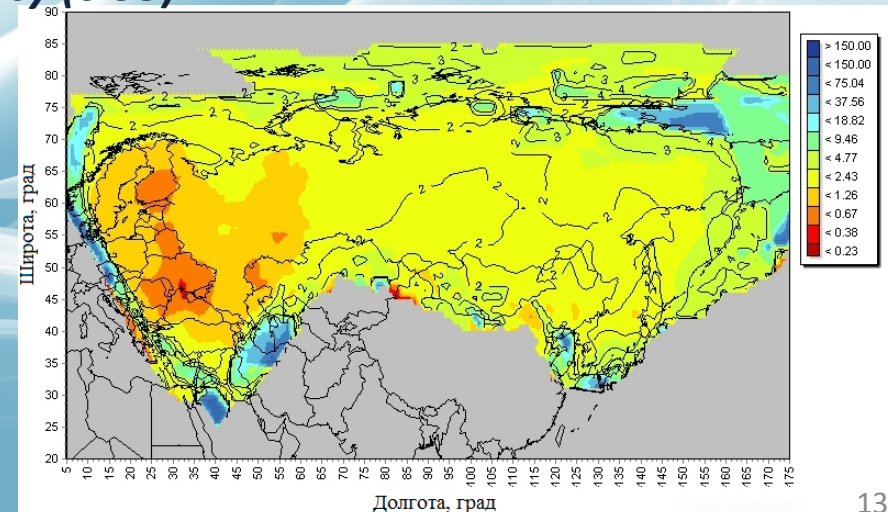
- Q - elevation angle
- P1 (Q) - SDCM signal level at the surface (direct beam)
- P2 (Q) - SDCM signal level at the surface (7 deg to the north)



Accuracy (0.95)



Plane



Height



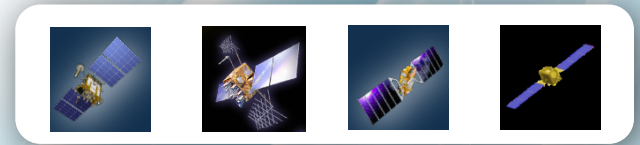
Global Precise Positioning System Architecture

BROADCASTING FACILITY

Objectives:

- Global Precise Point Positioning service (real time)
- Precise Orbit and Clock generation (real-time and post-processed)

GNSS CONSTELLATION



GLOBAL MONITORING NETWORK





International Cooperation

International Cooperation on GNSS

**Provision of
Compatibility and
Interoperability of
GLONASS with other
GNSS**

**Promoting Global Use
of GLONASS**

**Pursuing
competitiveness of
GLONASS
Enhancing System
Performance**



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



- **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 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 aims at making GLONASS one of the essential elements of the international GNSS infrastructure for worldwide user benefits**



Thank you for your attention!