



## **GLONASS Policy, Status and Evolution**

**Denis Lyskov  
Deputy Head  
Russian Federal Space Agency (Roscosmos)**

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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 civil services **are free and unlimited globally**
- GLONASS is used as **a basis for the National PNT System**
- **GLONASS Federal Program** approved and adopted in March 2012 to support implementation of the National PNT Policy
  - Budget for 9 years secured
  - 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**



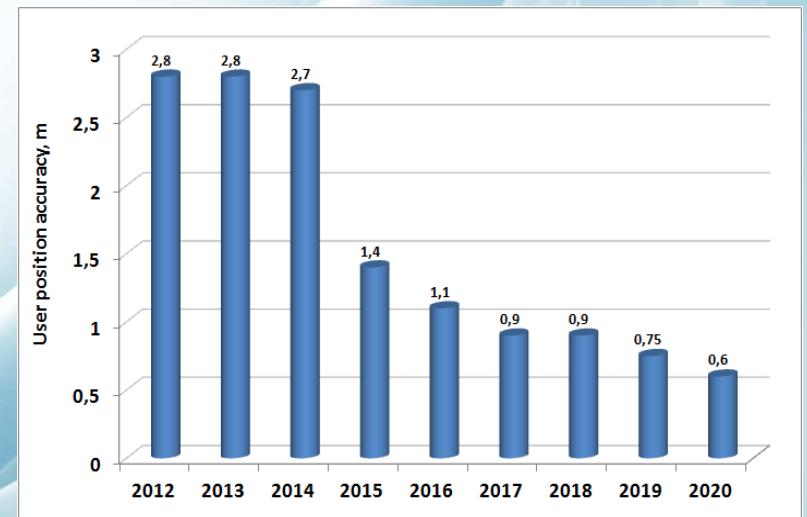
# Performance Improvement Plan

## ❖ 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



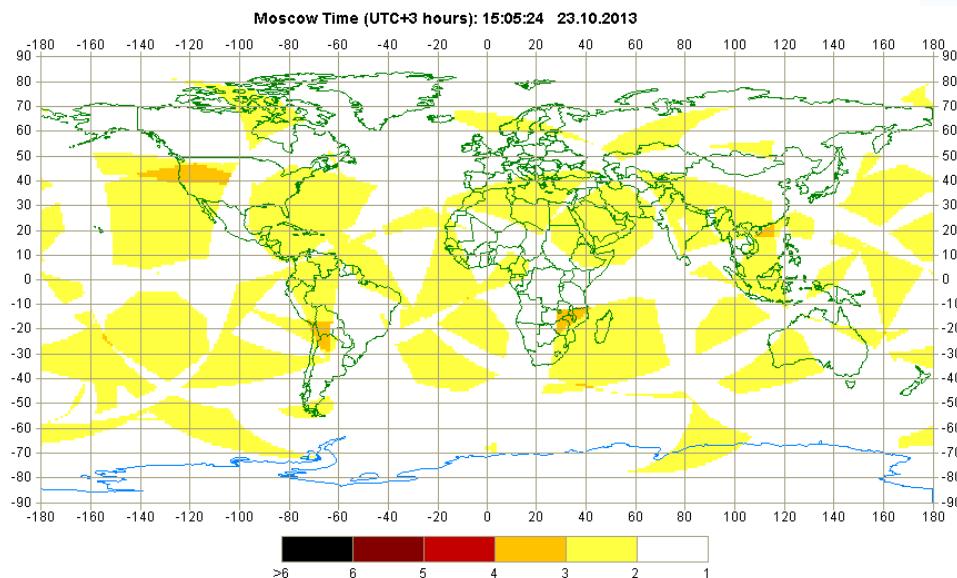


# GLONASS Constellation Status

(23/10/2013)

GLONASS constellation status, 23.10.2013

Total satellites in constellation	28 SC
Operational	24 SC
In commissioning phase	-
In maintenance	-
Spares	3 SC
In flight tests phase	1 SC



GLONASS Orbital Planes Status

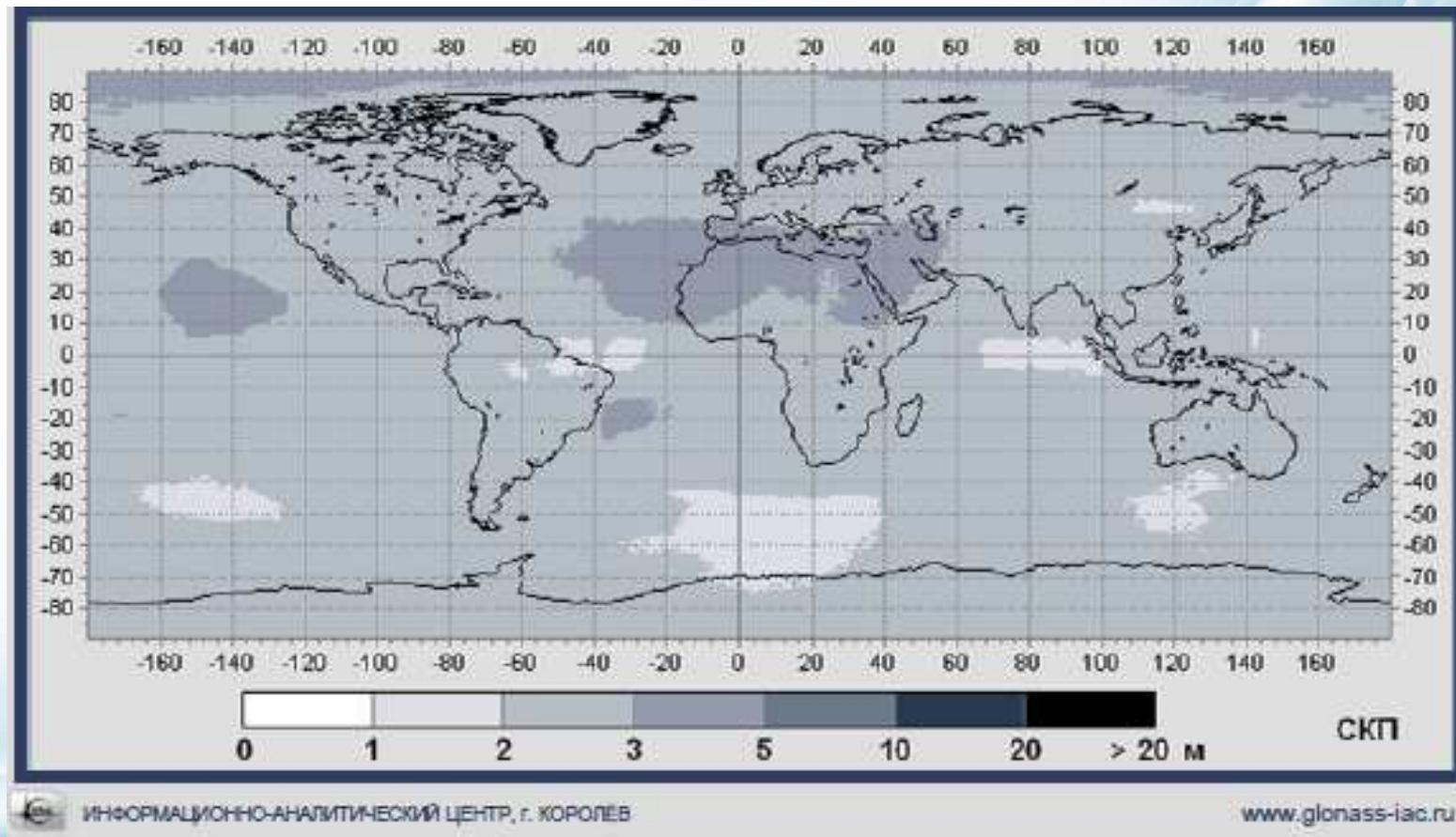


The constellation provides global continuous navigation

# Positioning Accuracy (23/10/2013)



SIS User Positioning Accuracy – 2.5 m globally, 2.4 m over Russia (RMS)





## Latest Launches and Short-term Sustainment

- 1 Glonass-M #47 launched 26 April 2013
- 3 Glonass-M lost 2 July 2013
- 2 Glonass-M (#51, #52) are in storage
- 3 Glonass-M (##53-55) under manufacturing
- Launches by Soyuz or Proton will be determined by operational necessity
- 1 Glonass-K in ground storage to be launched in the 2nd half of 2014

Glonass-M #47 launch



**Launch schedule restructured to make up for the loss of satellites**



# GLONASS Architecture

## Ground-based Augmentations

- Regional and local differential systems for transport, geodesy
- Assisted systems
- Pseudolites

## GLONASS MEO Space Complex (incl. Ground Control)

## Supporting Systems

UTC (SU), Earth Rotation Model and parameters, reference systems, maps, precise orbits and clocks

## Space-based Augmentations

- SDCM (SBAS)
- Global Precise Point Positioning System
- Regional Navigation System (GEO and HEO based) – under feasibility study

## Special User Capabilities

## Civil User Capabilities (including commercial)

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



# Space Segment Modernization

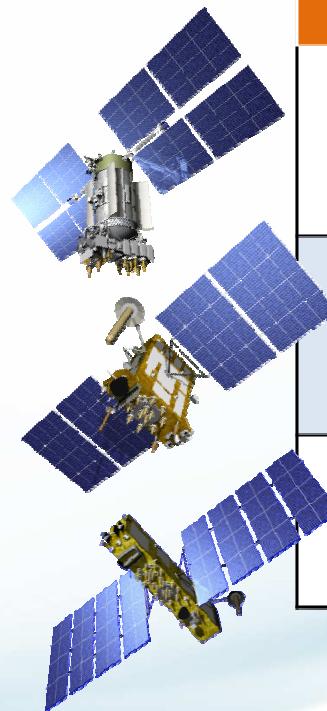


- increase of guaranteed life-time
- evolution of satellite service systems
- more stable on-board clock
- new control, command and OD&TS technologies
- introduction of SAR payload
- new signals

Phased build-up of capabilities



# GLONASS Signal Implementation Plan



Satellite	FDMA Signals		CDMA Signals		
	L1	L2	L1	L2	L3
Glonass-M	L1OF L1SF	L2OF L2SF	-	-	L3OC (2014+)
Glonass-K1	L1OF L1SF	L2OF L2SF			L3OC
Glonass-K2	L1OF L1SF	L2OF L2SF	L1OC L1SC	L2OC L2SC	L3OC

**L3OC ICD to be finalized by the end of 2013**



# 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 for LPV-200 by 2019
- Precise point positioning service by signals from GEO in L1/L3 GLONASS bands by 2020

## 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



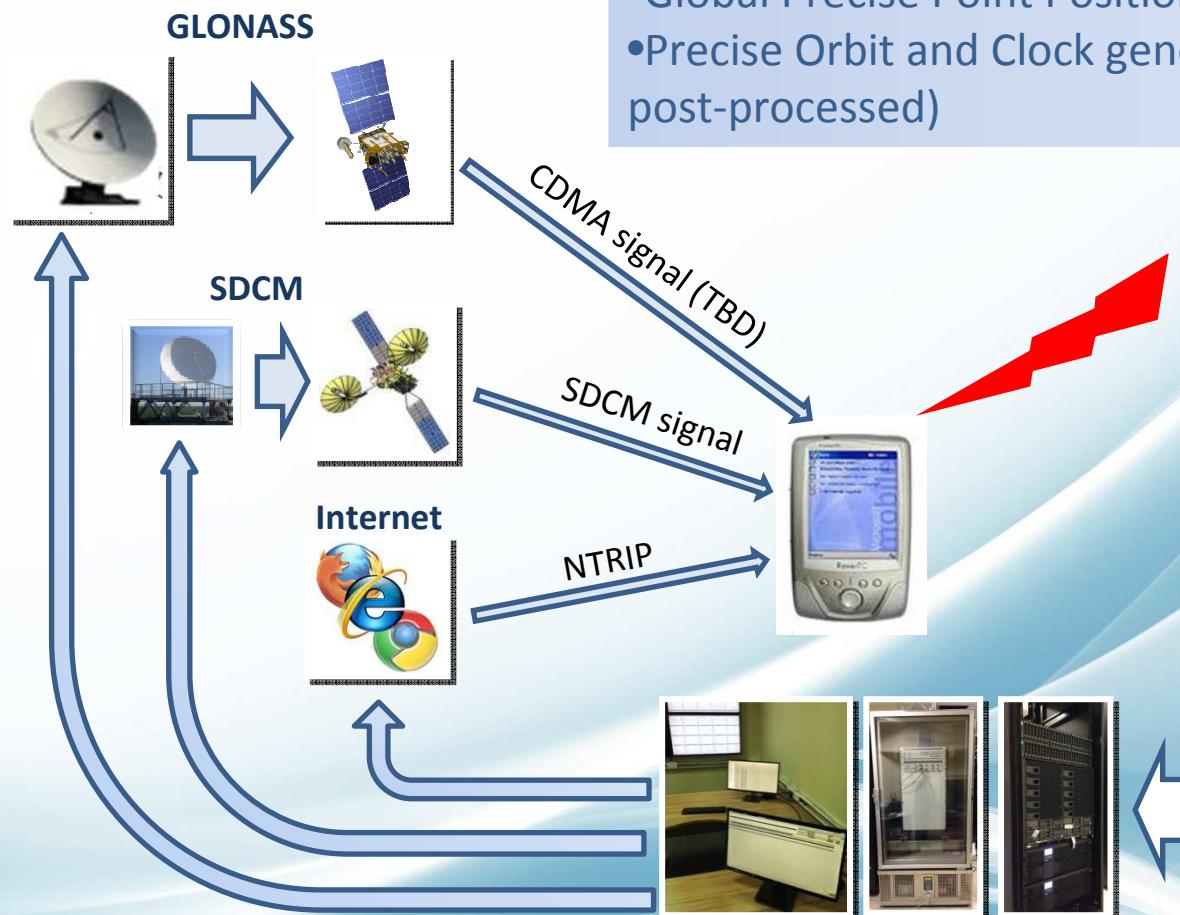
## Constellation Status

- Luch-5A launched at 16° W on 11 December 2011
- Luch-5B launched at 167° E on 3 November 2012
- Luch-5V to be launched at 95° E in Q1 2014



# 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

## DATA PROCESSING

- ~~Master~~ Center
- Back-Up Center



# 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**



# Participation in and contribution to ICG

- Participation in yearly ICG Meetings (since 2006)
- Hosting the ICG-4 Meeting in Saint-Petersburg in September 2009
- Plans to host UN Workshop on the Applications of GNSS in May 2014 in Krasnoyarsk
- Plans to host ICG- in 2016
- Russia –active participant of ICG and its working groups
- Russia co-chairs the ICG Working Group A on Compatibility and Interoperability





## USA

- 9 June 2012 - Renewed Statement of Cooperation between GLONASS and GPS
- Resuming activities of the Working Group on GPS-GLONASS Cooperation

## EU

- Consultations on Agreement on Cooperation in Satellite Navigation
- May 2013 EC-Roscosmos bilateral discussions - finalizing Joint Statement on Russia – EU Cooperation in GNSS

## China

- Russia-China Working Group on Space Cooperation
- Including GNSS Signal Monitoring in the Space Cooperation Program for 2013-2017
- Discussion of monitoring stations deployment on mutual basis



# 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 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



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# Thank you for your attention!

**Denis Lyskov  
Deputy Head  
Russian Federal Space Agency (Roscosmos)**