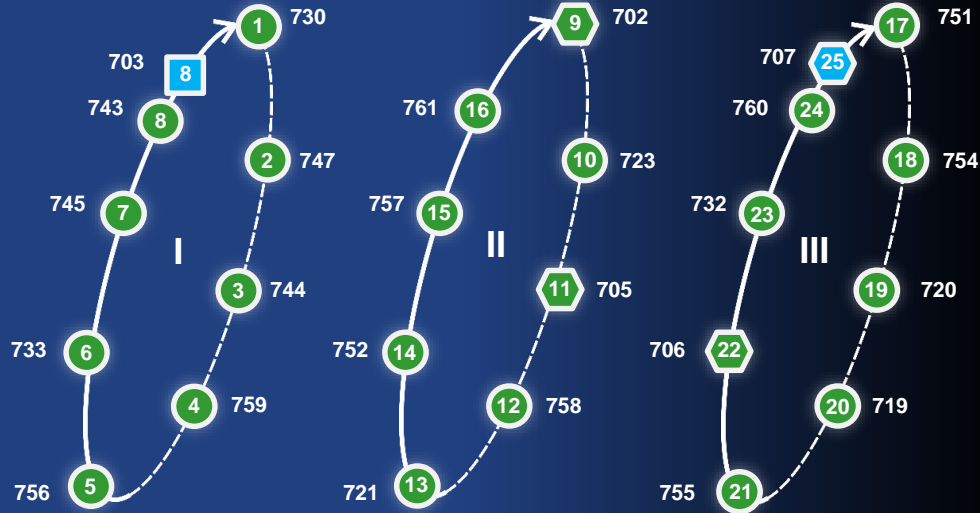# GLONASS STATUS

ROSCOSMOS STATE SPACE CORPORATION

IVAN REVNIYKH

February 13, 2024
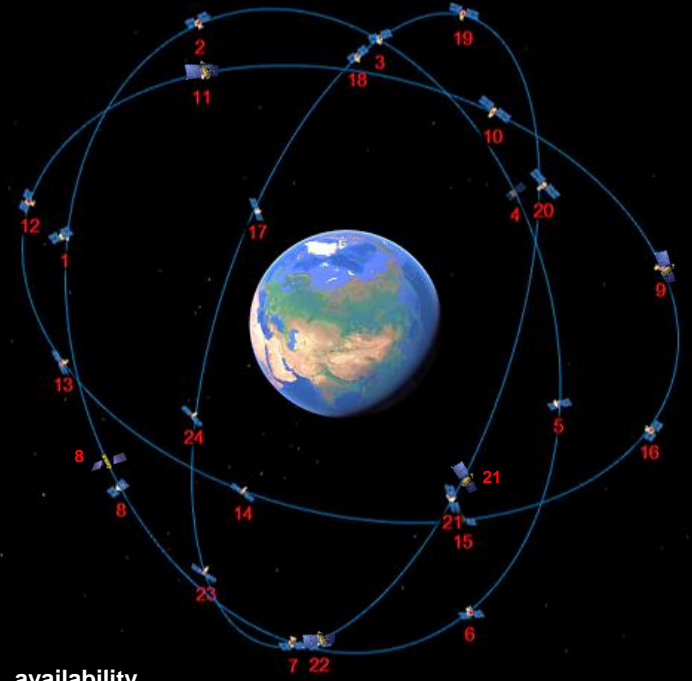
GLONASS SPACE SEGMENT STATUS

updated 12.02.2024

I

730	1
703	8
743	8
747	2
745	7
744	3
733	6
759	4
756	5

II

702	9
761	16
723	10
757	15
705	11
752	14
758	12
721	13

III

751	17
707	25
760	24
754	18
732	23
720	19
706	22
719	20
755	21

∑ **26 MEO satellites**

24 operational   **2** commissioning

○ GLONASS-M batch   21
⬡ GLONASS-K batch   4
▢ GLONASS-K2 batch   1

availability

99,99%

The constellation provides continuous global PNT service

GLONASS CIVIL SERVICES

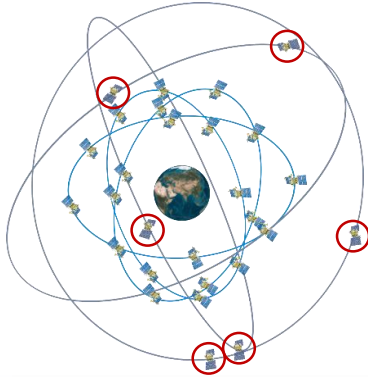| Basic Service	Service of Improved Reliability and Accuracy	Relative Navigation Service	High-Accuracy Service
Infrastructure			
GLONASS	• System for Differential Correction and Monitoring/SDCM (SBAS) • GBAS stations	Distributed network of base RTK-stations	System for High-Precision Definition of Ephemeris and Clock Corrections based on the analogue of PPP technology
Status			
Operational	Pre-operational (SBAS) Operational (GBAS)	Operational	Operational
Service Area			
Global (including up to 2000 km altitude of space volume)	Russia	Local service areas in Russia	Russia
Broadcast Channels			
24 GLONASS satellites • L1OF, L2OF open signals • L1OC, L2OC, L3OC open signals as pre-operational	• 2 LUCH GEO relay satellites (L1) • SISNET (access via Internet) • ground HF & UHF radio channels of GBAS stations (coverage radius up to 200 km)	• ground radio channels of base stations (coverage radius up to 30 km) • Internet (access to post-processing information)	Internet, including mobile communications
Provided information			
• Ephemeris and timing information • Global ionospheric model (L1OC, L3OC)	• Real-time corrections for GLONASS & GPS • Integrity information • Ionospheric corrections (VTEC)	Assistive real-time and post-processing OSR information (precise station coordinates, code and phase observations)	Precise absolute orbit & clock (SSR) real-time and post-processing corrections for all GNSS

The launch of GLONASS-K2 satellite in August 2023
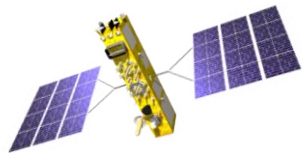
The first GLONASS-K2 satellite was successfully launched on August 7, 2023

|	GLONASS-M	GLONASS-K	GLONASS-K2
The number of satellites	21	4	1
Inter-Satellite Links	-	+	+
Clocks	Cs	Cs, Rb	H-maser, Cs, Rb
Open FDMA L1OF & L2OF	21	4	1
Open CDMA signal L3OC	7	4	1
Open CDMA L1OC & L2OC	-	-	1
COSPAS-SARSAT payload	-	3	1
Laser Retroreflectors	21	4	1

HIGH-ORBIT GLONASS SPACE COMPLEX

Planned Architecture

At least 6 satellites in inclined geosynchronous orbits in 3 orbital planes

Orbit altitudes	34 000 – 38 000 km
Orbital inclination	64.8°
Semi-major axis	42 164.142 km
Orbital period	86 164 s
Eccentricity	0.072

Ground tracks of satellites
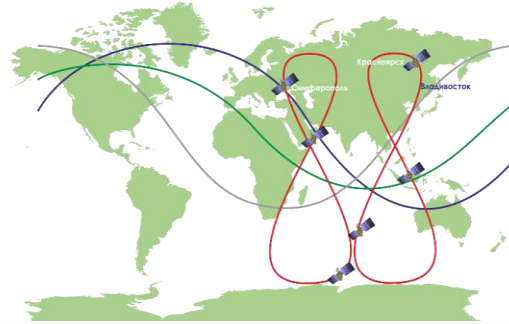
Launch vehicles: Soyuz-2 family
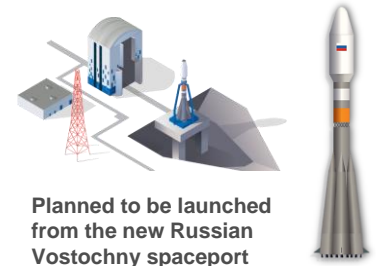
Planned to be launched from the new Russian Vostochny spaceport

Contribution to GLONASS Services

- Contribution to the provision of GLONASS Basic (PNT) Service by the broadcast of L1OC & L2OC open signals as a complement to GLONASS MEO constellation for better satellite (signal) geometry
- Contribution to the provision of GLONASS High-Accuracy Service by the broadcast of L3SVI open signal transmitting PPP corrections for all GNSS and integrity service information

Planned Results

Enhanced availability in difficult conditions for signal reception (elevation > 25°) by 15%

Extended coverage zone and increased availability of GLONASS High-Accuracy Service

Increased availability in high latitudes, including Artic region

More reliable GLONASS High-Accuracy Service due to integrity

Improved PDOP leads to 25% accuracy improvement in the Eastern hemisphere
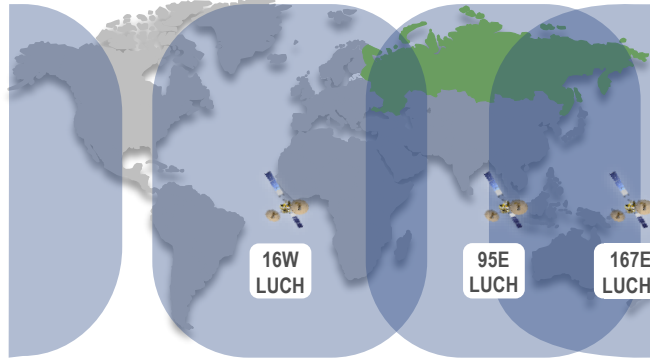
Ionospheric activity compensation in high latitudes with global ionospheric model in L1OC
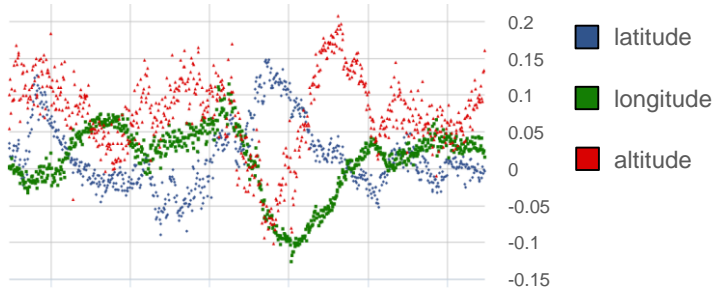
GLONASS HIGH-ACCURACY SERVICE

Expected GLONASS L3SVI signal (1202.025 MHz) coverage based on LUCH GEO relay satellites

GLONASS High-Accuracy Service accuracy (m)


- latitude
- longitude
- altitude

Static accuracy in 3 dimensions based on GLONASS + GPS + GLONASS High-Accuracy Service real-time solution is within 25 cm

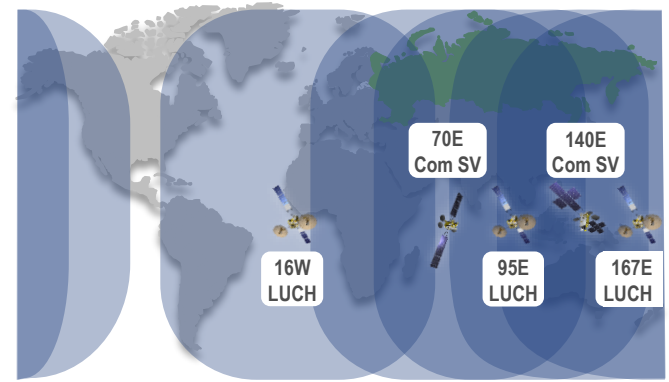*(NPK SPP assessments, January 10-11, 2024)*

Current Status	Further Development
Infrastructure	
59 measurement stations of Roscosmos network	80 measurement stations of Roscosmos network
Corrections	
Absolute real-time & post-processing orbit & clock corrections for all GNSS	• Absolute real-time & post-processing orbit & clock corrections for all GNSS • Code & phase biases + yaw-attitude models • Ionospheric & tropospheric models (for users in Russia and surrounding territories)
Service Area	
Russia	Limitedly global (all continents except North America and Antarctica)
Broadcast Channels	
Internet, including mobile communications (corrections for all GNSS)	• Internet (corrections for all GNSS) • L3SVI signal broadcast by 3 new LUCH GEO relay & 2 other GEO satellites (corrections for GLONASS & GPS) • L3SVI signal broadcast by High-Orbit GLONASS satellites (corrections for all GNSS + integrity information)
Message Format	
RTCM	Analogue of CSSR (for L3SVI signal) and RTCM
Service Integrity	
Not available	Provided

SDCM has successfully passed the preliminary certification tests in accordance with the requirements for typical approach operations with vertical guidance (APV-I and APV-II) and is pre-operational now

**Approximate current L1 signal coverage zone based on LUCH GEO relay satellites**
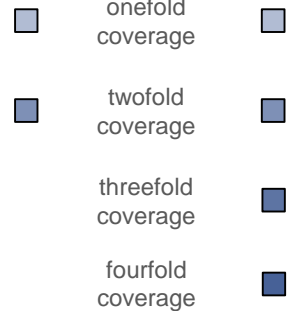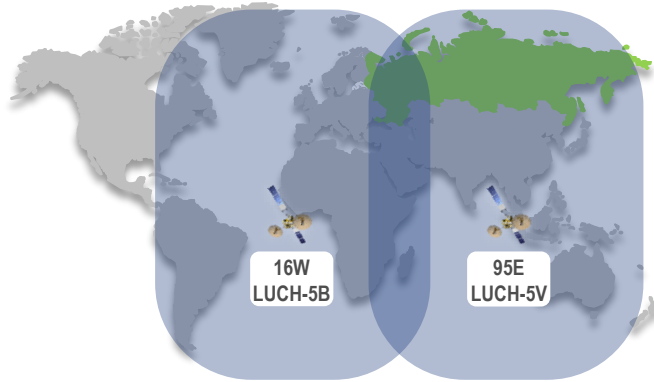
Approximate future L1/L5 signals coverage zone based on new LUCH GEO relay & other GEO satellites

onefold coverage

twofold coverage

threefold coverage

fourfold coverage

16W LUCH-5B

95E LUCH-5V

70E Com SV

140E Com SV

16W LUCH

95E LUCH

167E LUCH

Information provided in the service area of SDCM

Current Status	Further Development
• Real-time corrections for all GLONASS satellites and almost all GPS satellites based on single-frequency measurements • Integrity information for GLONASS & GPS satellites with alert time within 6 s • Ionospheric corrections	• Real-time corrections for the satellites of all GNSS based on dual-frequency measurements (L1/L5 DFMC SBAS) and single-frequency measurements (L1 SBAS) • Integrity information for the satellites of all GNSS with alert time within 6 s • Ionospheric corrections (for L1 SBAS) • L1/L5 signal authentication

The Russian System for GLONASS Performance Monitoring and Verification is continuously collecting global observation data for real-time GLONASS characteristics assessment to confirm their correspondence to the guaranteed levels defined in GLONASS Open Service Performance Standard (edition 2.2) and ensure that GLONASS domestic and foreign civil users are provided with Basic (PNT) Service of proper quality
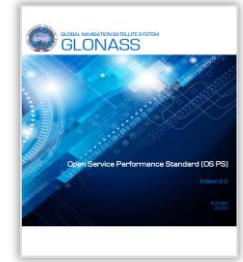
Applied User Center of Roscosmos State Space Corporation based on Information and Analysis Center for Positioning, Navigation and Timing is providing continuous online information support to GLONASS domestic and foreign civil users in accordance with the principle of transparency

Assessed characteristics of GLONASS and other GNSS

Updated GLONASS constellation status, health and almanac
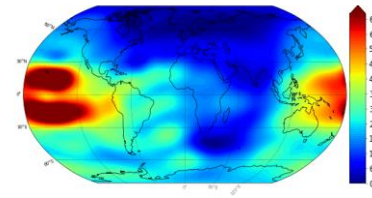
Notice Advisory to GLONASS Users

Links to GLONASS formal documents (Interface Control Documents and Open Service Performance Standard)

Global ionospheric map by IAC PNT and results of experiments on GNSS monitoring & assessment

https://www.glonass-iac.ru

Global ionospheric map
by IAC PNT
(for 08.01.2024 in TECu)

Web-site is available in Russian, Chinese, English, German & Spanish languages

DEPARTMENT OF AUTOMATIC SPACE COMPLEXES, NAVIGATION AND EARTH OBSERVATION SYSTEMS

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