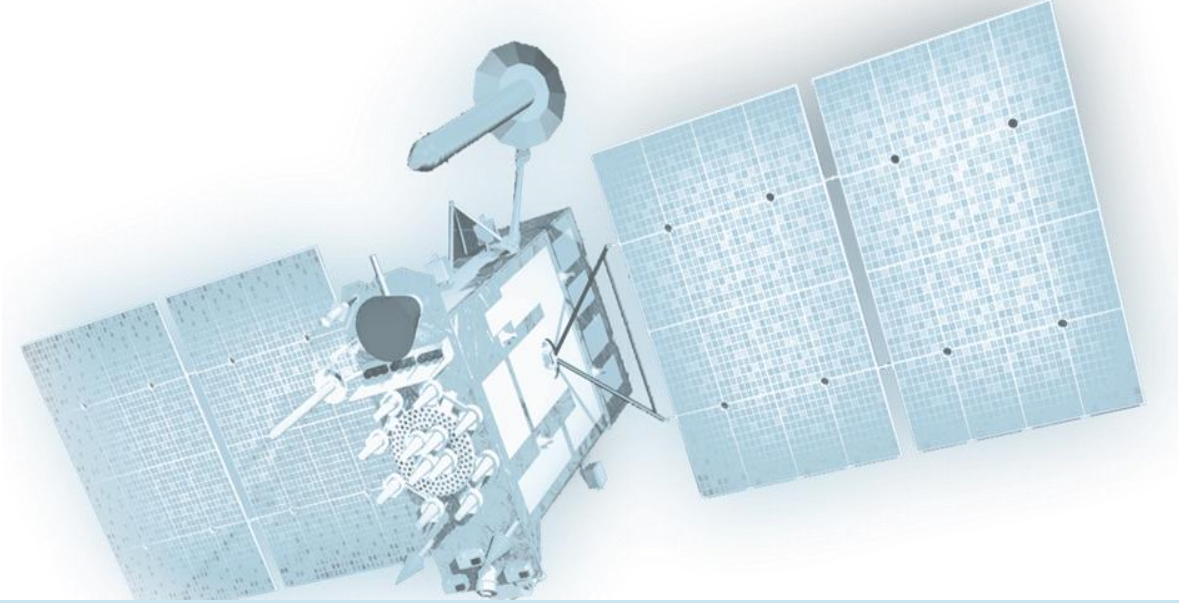


GLONASS User Information Center of Roscosmos

Information and Analysis Center for Positioning, Navigation and Timing
Central Research Institute of Machine Building
Roscosmos State Corporation

11th Meeting of the International Committee on GNSS
Working Group - C
8 November 2016
Sochi, Russian Federation

GLONASS USER INFORMATION CENTER

SCOPE

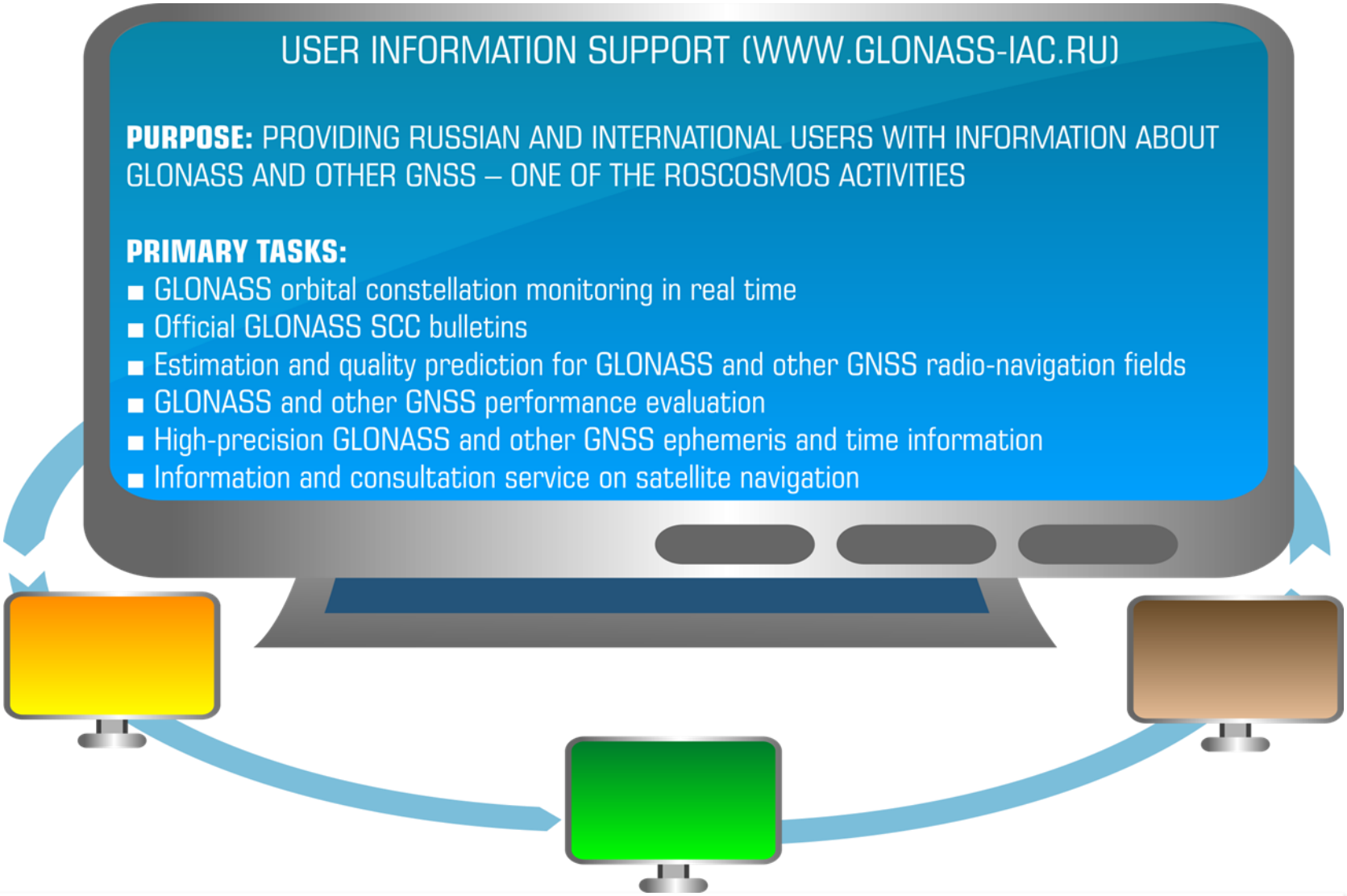
- Based on the facilities of the Information and Analysis Center for PNT established in 1995 in The Central Research Institute of Machine Building (TsNIImash)

- Provides information and methodological support of GLONASS civil users for the purpose of economic and social development of the Russian State, international cooperation and scientific research

COMPOSITION of the User Information Center:

- User Information Support System (www.glonass-iac.ru Web Portal)
- Mobile Instrumentation and Diagnostics Laboratory (MIDL)

USER INFORMATION SUPPORT SYSTEM



WWW.GLONASS-IAC.RU

CURRENT STATUS OF GLONASS AND GPS CONSTELLATIONS

GLONASS CONSTELLATION STATUS AT 18.10.2016 BASED ON BOTH THE ALMANAC ANALYSIS AND NAVIGATION MESSAGES RECEIVED AT 09:00 18.10.16 (UTC) IN IAC PNT TSNIIMASH

Orb. slot	Orb. pl.	RF chnl	# GC	Launched	Operation begins	Operation ends	Life-time (months)	Satellite health status		Comments
								In almanac	In ephemeris (UTC)	
1	1	01	730	14.12.09	30.01.10		82.2	+	+ 09:11 18.10.16	In operation
2	1	-4	747	26.04.13	04.07.13		41.8	+	+ 09:11 18.10.16	In operation
3	1	05	744	04.11.11	08.12.11		59.5	+	+ 09:11 18.10.16	In operation
4	1	06	742	02.10.11	25.10.11		60.6	+	+ 09:11 18.10.16	In operation
5	1	01	734	14.12.09	10.01.10		82.2	+	+ 09:11 18.10.16	In operation
6	1	-4	733	14.12.09	24.01.10		82.2	+	+ 09:11 18.10.16	In operation
7	1	05	745	04.11.11	18.12.11		59.5	+	+ 09:11 18.10.16	In operation
8	1	06	743	04.11.11	20.09.12		59.5	+	+ 09:11 18.10.16	In operation
9	2	-6	702	01.12.14	15.02.16		22.6	+	+ 09:11 18.10.16	In operation
10	2	-7	717	25.12.06	03.04.07		117.9	+	+ 09:11 18.10.16	In operation
11	2	00	753	29.05.16	27.06.16		4.7	+	+ 09:11 18.10.16	In operation
12	2	-1	737	02.09.10	12.10.10		73.6	+	+ 09:11 18.10.16	In operation
13	2	-2	721	25.12.07	08.02.08		105.9	+	+ 09:11 18.10.16	In operation
14	2	-7	715	25.12.06	03.04.07		117.9	+	+ 09:11 18.10.16	In operation
15	2	00	716	25.12.06	12.10.07		117.9	+	+ 09:11 18.10.16	In operation
16	2	-1	736	02.09.10	04.10.10		73.6	+	+ 09:11 18.10.16	In operation
17	3	04	751	07.02.16	28.02.16		8.4	+	+ 09:11 18.10.16	In operation
18	3	-3	754	24.03.14	14.04.14		30.9	+	+ 09:11 18.10.16	In operation
19	3	03	720	26.10.07	25.11.07		107.8	+	+ 09:11 18.10.16	In operation
20	3	02	719	26.10.07	27.11.07		107.8	+	+ 09:11 18.10.16	In operation
21	3	04	755	14.06.14	03.08.14		28.2	+	+ 09:11 18.10.16	In operation
22	3	-3	731	02.03.10	28.03.10		79.6	+	+ 09:11 18.10.16	In operation
23	3	03	732	02.03.10	28.03.10		79.6	+	+ 09:11 18.10.16	In operation
24	3	02	735	02.03.10	28.03.10		79.6	+	+ 09:11 18.10.16	In operation
11	2		723	25.12.07	22.01.08	24.06.16	105.9			Spares
17	3		714	25.12.05	31.08.06	24.02.16	129.9			Spares
20	3	-5	701	26.02.11			67.8			Flight Tests

GPS CONSTELLATION STATUS FOR 18.10.16 UNDER THE ANALYSIS OF THE ALMANAC ACCEPTED IN IAC

Plane	Slot	PRN	NORAD	Type SC	Launch date	Input date	Outage date	Life-time (months)	Notes
A	2	31	29486	IIR-M	25.09.06	13.10.06		120.3	
	4	7	32711	IIR-M	15.03.08	24.03.08		102.9	
	5	24	38833	II-F	04.10.12	14.11.12		47.1	
	6	30	39533	II-F	21.02.14	30.05.14		28.7	
B	1	16	27663	II-R	29.01.03	18.02.03		164.1	
	2	25	36585	II-F	28.05.10	27.08.10		73.8	
	3	28	26407	II-R	16.07.00	17.08.00		194.2	
	4	12	29601	IIR-M	17.11.06	13.12.06		118.3	
	5	26	40534	II-F	25.03.15	20.04.15		18.0	
	6		34661	IIR-M	24.03.09				
C	1	29	32384	IIR-M	20.12.07	02.01.08		105.6	
	2	27	39166	II-F	15.05.13	21.06.13		39.9	
	3	19	28190	II-R	20.03.04	05.04.04		150.5	
	4	17	28874	IIR-M	26.09.05	13.11.05		131.2	
	5	8	40730	II-F	15.07.15	12.08.15		14.2	
D	1	2	28474	II-R	06.11.04	22.11.04		142.9	
	2	1	37753	II-F	16.07.11	14.10.11		60.2	
	3	21	27704	II-R	31.03.03	12.04.03		162.3	
	5	11	25933	II-R	07.10.99	03.01.00		201.6	
	6	6	39741	II-F	17.05.14	10.06.14		28.3	
E	1	20	26360	II-R	11.05.00	01.06.00		196.7	
	2	22	28129	II-R	21.12.03	12.01.04		153.3	
	3	5	35752	IIR-M	17.08.09	27.08.09		85.8	
	4	18	26690	II-R	30.01.01	15.02.01		188.2	
	6	10	41019	II-F	30.10.15	09.12.15		10.3	
	1	3	40294	II-F	29.10.14	12.12.14		22.2	
F	1	14	26605	II-R	10.11.00	10.12.00		190.4	
	2	15	32260	IIR-M	17.10.07	31.10.07		107.7	
	3	13	24876	II-R	23.07.97	31.01.98		224.7	
	4	23	28361	II-R	23.06.04	09.07.04		147.4	
	5	32	41328	II-F	05.02.16	09.03.16		7.3	
	6	9	40105	II-F	02.08.14	17.09.14		25.1	

WWW.GLONASS-IAC.RU PRODUCTS 2 (6)

- **GLONASS NEWS. INFORMATION NOTIFICATIONS TO GLONASS USERS**

22.07.2016 ACCORDING TO GLONASS SYSTEM CONTROL CENTRE, THE SC GLONASS-K #737 (ORBITAL SLOT 12) WILL BE SET UNUSABLE DUE TO THE SCHEDULED WORKS FROM 21.07.2016 17:30(MT) TILL 15.08.2016 00:00(MT)

14.07.2016 ACCORDING TO THE MONITORING IAC, A PLANNED MAINTENANCE WITH SC GLONASS-M #737 (ORBITAL SLOT 12) SUCCESSFULLY COMPLETED, THE SC IS USED FOR THE INTENDED PURPOSE

12.07.2016 ACCORDING TO GLONASS SYSTEM CONTROL CENTRE ALL WORKS WITH SC GLONASS-M #725 (ORBITAL SLOT № 21), WHICH WAS ON THE CHIEFS DESIGNERS TESTS, WERE STOPPED FROM 07.07.2016 . THE SC WAS REMOVED FROM GLONASS CONSTELLATION

04.07.2016 ACCORDING TO THE MONITORING IAC SC GLONASS-M #737 (ORBITAL SLOT 12) SET UNUSABLE DUE TO THE SCHEDULED WORKS FROM 04.07.2016 03:52 (MT)

27.06.2016 ACCORDING TO THE MONITORING IAC SC GLONASS-M #753 (ORBITAL SLOT 11) INCLUDED INTO GLONASS OPERATIONAL CONSTELLATION

24.06.2016 ACCORDING TO GLONASS SYSTEM CONTROL CENTRE SC GLONASS-M #753 (ORBITAL SLOT № 11) IS SCHEDULED TO BE OPERATION ON 27.06.2016 12:00 (MT)

24.06.2016 ACCORDING TO GLONASS SYSTEM CONTROL CENTRE, THE GLONASS-M #723 (ORBITAL SLOT 11) WAS SET TO SPARES FROM 09:34(MT) 24.06.2016

24.06.2016 ACCORDING TO THE MONITORING IAC SC GLONASS-M #723 (ORBITAL SLOT 11) SET UNUSABLE DUE TO THE SCHEDULED WORKS FROM 24.06.2016 09:28 (MT)

24.06.2016 ACCORDING TO THE MONITORING IAC, A PLANNED MAINTENANCE WITH SC GLONASS-M #717 (ORBITAL SLOT 10) SUCCESSFULLY COMPLETED, THE SC IS USED FOR THE INTENDED PURPOSE

22.06.2016 ACCORDING TO GLONASS SYSTEM CONTROL CENTRE, THE SC GLONASS-M #717 (ORBITAL SLOT 10) SET UNUSABLE DUE TO THE SCHEDULED WORKS FROM 21.06.2016 13:03 (MT)

08.06.2016 ACCORDING TO GLONASS SYSTEM CONTROL CENTRE ALL WORKS WITH SC GLONASS-M #738 (ORBITAL SLOT № 16), WHICH WAS ON THE CHIEFS DESIGNERS TESTS, WERE STOPPED FROM 20:10 (MT) 06.06.2016 . THE SC WAS REMOVED FROM GLONASS CONSTELLATION

GLONASS OBSERVABILITY ESTIMATION SERVICE

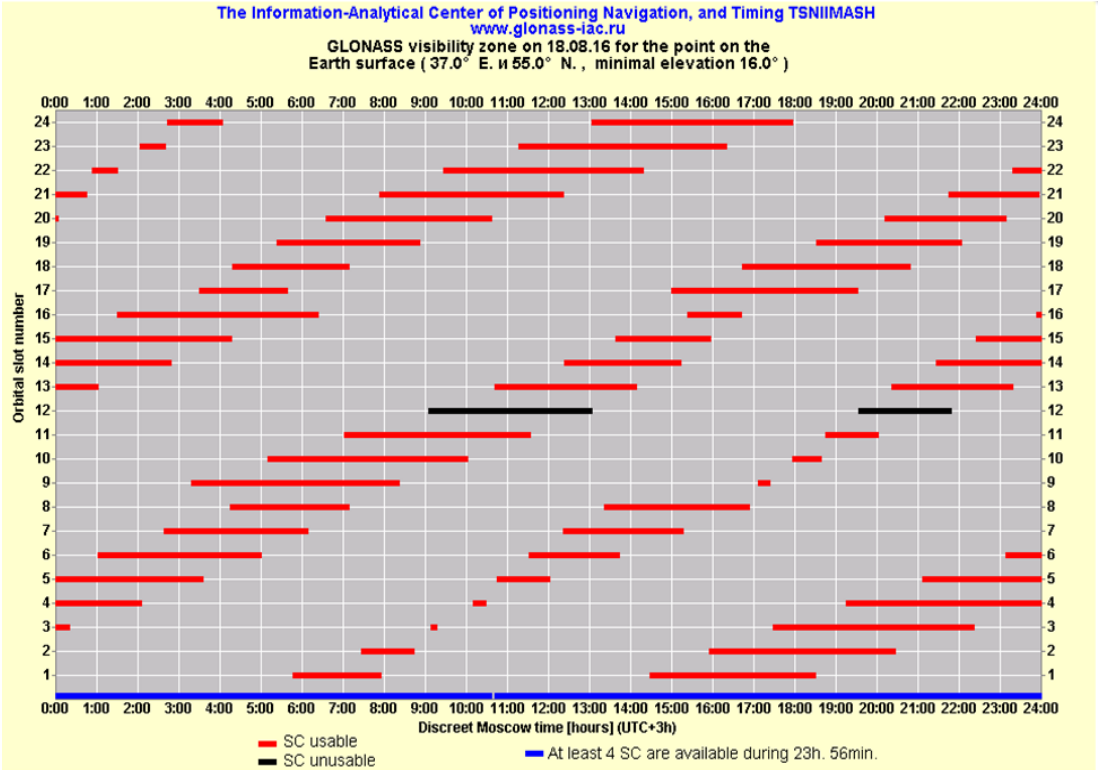
Latitude: N.

Longitude: E.

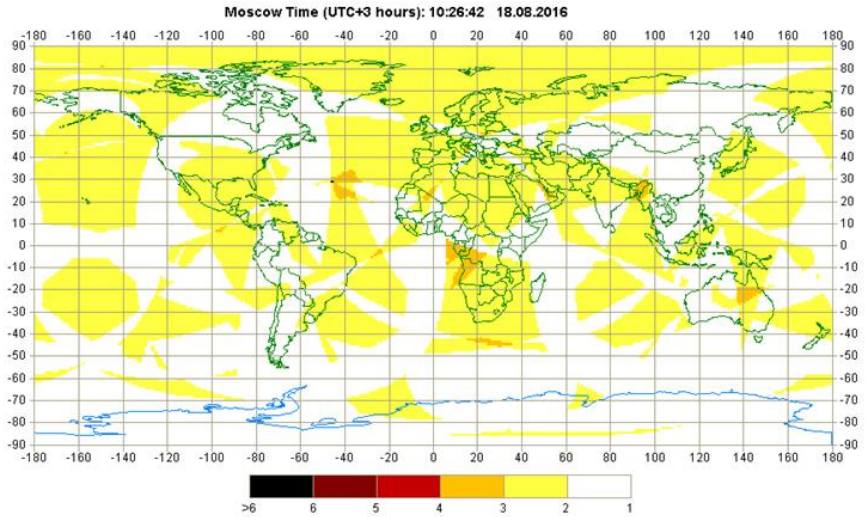
Elevation:

Date (DD.MM.YYYY): 19.08.2016

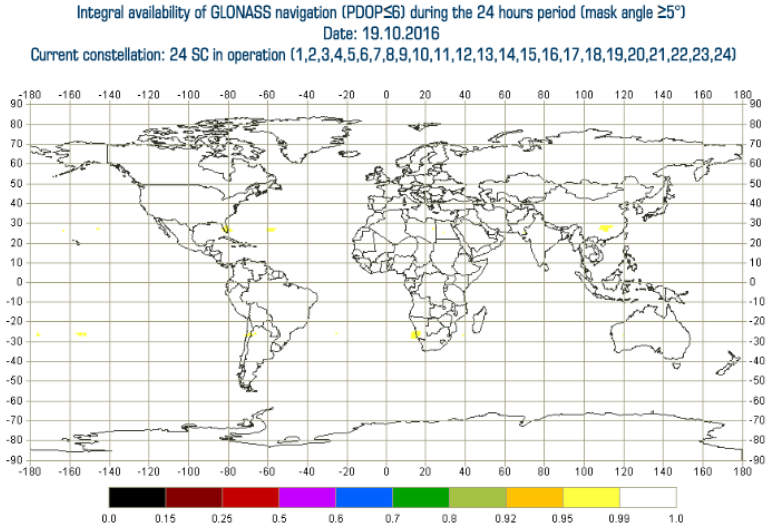
Calculate clear



- **GLONASS AVAILABILITY DATA**



I. Current PDOP over the Earth's Surface



II. Integral GLONASS PDOP Availability (PDOP≤6) over 24-hour interval (elevation angle ≥ 5°)

NAVIGATION DATA ARCHIVE (FTP-SERVER: ftp.glonass-iac.ru)

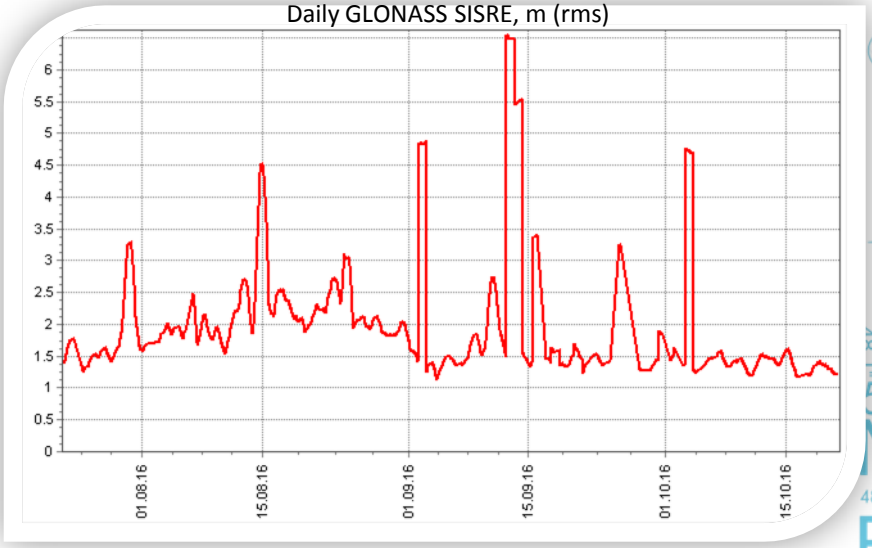
- daily GLONASS and GPS almanacs
- retrospective data on GLONASS and GPS constellation status
- information on daily usability of navigation satellites derived from ephemeris data and almanacs
- merged daily GLONASS and GPS ephemeris files in RINEX format
- GLONASS and GPS ephemeris and clock data
- Information and Analysis Center Bulletins
- description of formats

Information and Analysis Center for PNT operates the set of software and hardware tools used for:

- collecting and processing precision radio frequency and laser ranging data
- determination and analysis of satellite ephemeris and clock parameters
- real time and posteriori GNSS performance monitoring based on processed data from the global reference network

ASSESMENT OF GLONASS AND GPS PERFORMANCE

- implemented through regular service mode
- based on internally processed data from the global reference network
- results updated at intervals from 5 min to 1 day
- aimed at advanced users qualified in analysis of satellite navigation systems performance
- available through a special IAC technological web-site: www.stat.glonass-iac.ru
- access granted upon preregistration



Technological Web-site contains:

- ✓ detailed estimation of orbit and clock data for all GLONASS and GPS satellites over the last month, over the last 3 days (postprocessing), and in near real time mode
- ✓ results of accuracy estimation for the IAC posteriori and predictive orbit and clock data used for GNSS performance analysis, also as compared to that performed by foreign centers of analysis
- ✓ results of user positioning accuracy estimation based on various measurements (one and single and dual-frequency, code and phase smoothed) with the use of on-board (standard) and postprocessed orbit and clock data
- ✓ systematic errors estimation results for code measurements of commonly used surveying receivers
- ✓ results of estimating parameters contributing to the potential user positioning accuracy of GLONASS and GPS

Every section has its own "Description" tab which contains description of the data and calculation methods.

MOBILE INSTRUMENTATION AND DIAGNOSTICS LABORATORY (MIDL)

- designed and developed by Information and Analysis Center for PNT
- approved by the Order of the Federal Agency on Technical Regulation and Metrology of 1 Aug 2011 as a measuring facility
- regularly tested and calibrated
- patented

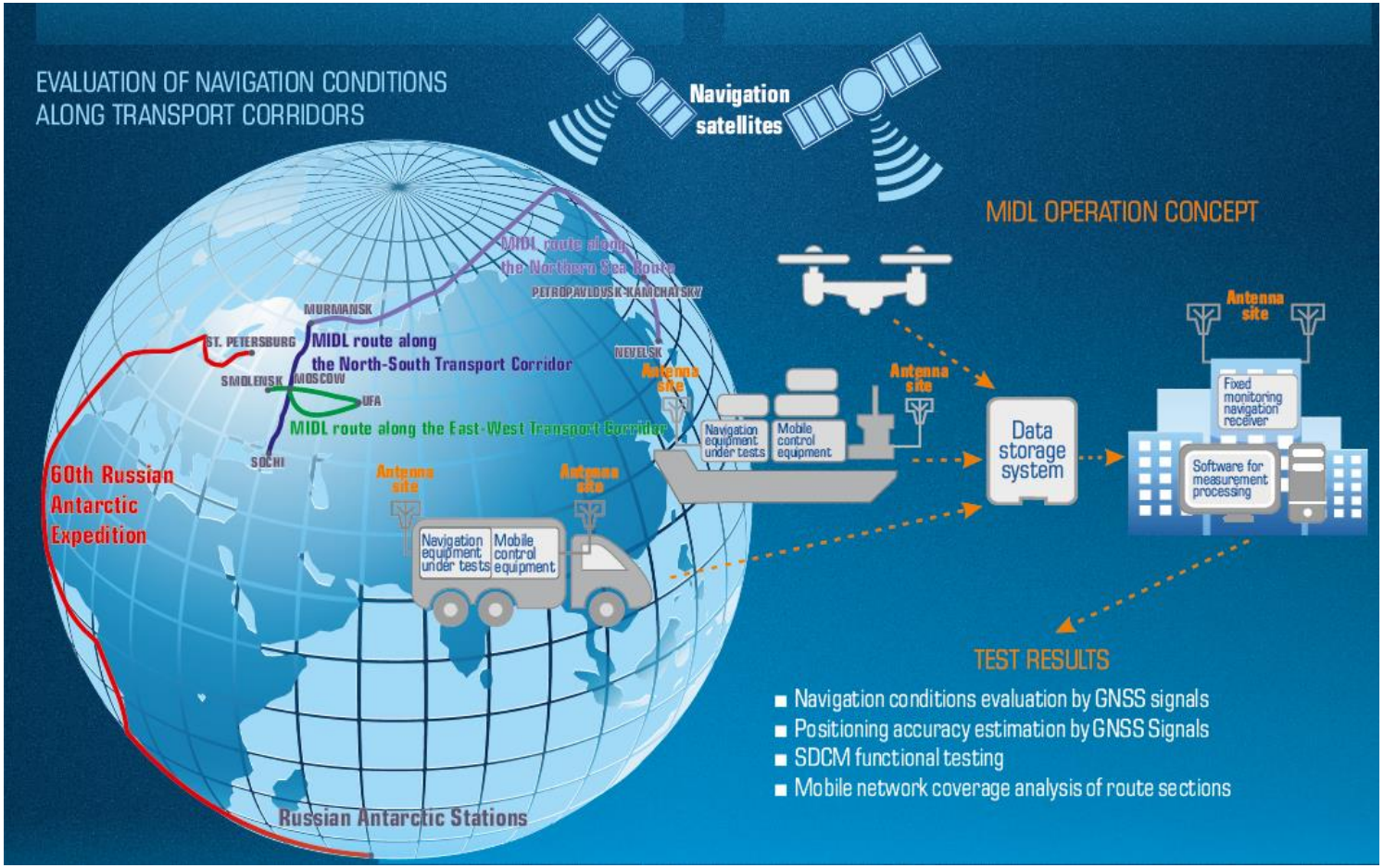
Purpose:

- Independent in-field user equipment testing to assess its operational performance on the fly in the real operational environments like urban or industrial

Applications:

- Comparative testing of receivers/navigation modules in various operational scenarios
- Assessment of local receiver performance in real operational conditions
- Generating high-precision reference trajectories
- Monitoring and assessment of radionavigation environment:
  - GLONASS and GPS performance
  - Interference environment

MIDL OPERATION



Stationary segment

- used as a reference station to collect measurements to be processed together with the measurements from mobile segment

Mobile segment

- collects data from mobile reference equipment and receivers under tests
- can be mounted on a car, a vessel or an aerial vehicle

With increasing distances to the stationary segment, data from other nearer reference stations can be used

WAY FORWARD

- Including Beidou and Galileo into the product line of User Information Support System
- Hardware and software modernization
- Expanding information product line
- Modernization of MIDL to include interference detection capabilities, 3D terrain imaging and others

Thanks for attention!

Information and Analysis Center for PNT
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