GLONASS Status

**Central Research Institute of Machine Building,
Information Satellite System - Reshetnev Company,
Russian Federal Space Agency**

ICG WG-A Meeting 23-27 July, 2012 , Olsztyn, Poland

РОСКОСМОС

ЦНИИМАШ
TSNIIMASH

ИАЦ

РЕШЕТНЕВ
ОАО «И С С»

GLONASS Program

New Federal program for GLONASS 2012-2020 have approved

Program Goals:

- **Mass introduction of domestic navigation technologies**
- **Guaranteed provision of navigation services to meet continuously growing requirements of all categories of users**
  - for the national security purposes
  - for social and economic benefit
  - for pursuing leadership in satellite navigation

by means of

- Sustaining
- Further development of GLONASS
  - improvement of performance ,
  - broadening functional capabilities
  - conditions and domains of usage
  - balanced evolution of system's components

Федеральное космическое агентство

Федеральная целевая программа "Поддержание, развитие и использование системы ГЛОНАСС на 2012 - 2020 годы"

Проект Программы разработан ФГУП Центральный НИИ машиностроения по заказу Федерального космического агентства. Государственный контракт № 851-Г003/09 от 16.02.2009 г.

Утверждена постановлением Правительства Российской Федерации 3 марта 2012 г. № 189

- **Program Approved**
- **Budget for 9 years defined**
- **RFPs opened**

Main GLONASS Program Directions

- **Constellation sustainment (24 sats with spares)**
  - Glonass-M launches up to 2014
  - Glonass-K launches since 2015
  - 24 satellites transmitting CDMA signals by 2020
- **GLONASS improvement**
  - Constellation (availability)
  - Accuracy of the core system
  - Augmentations development (accuracy, integrity, availability, assisting technologies…)
  - References improvement (geodesy, time, Earth rotation and attitude data…)
- **User segment development**
  - Governmental applications
  - Chips and chipsets, navigation maps
  - Encouraging commercial applications

GLONASS Segments

GLONASS Space Complex (core)	• Open basic navigation service • Authorized basic navigation service
SDCM Ground based augmentations	• SBAS service • Accuracy improvement • Integrity
Precise Orbit and Clock Determination System	• Post processed data • Real time data
Fundamental Segment	• Geodetic reference system • System time scale steering to UTC • Earth rotation and attitude parameters
User Segment	• Governmentally authorized users • Civil users

GLONASS 2002-2011 Program Results

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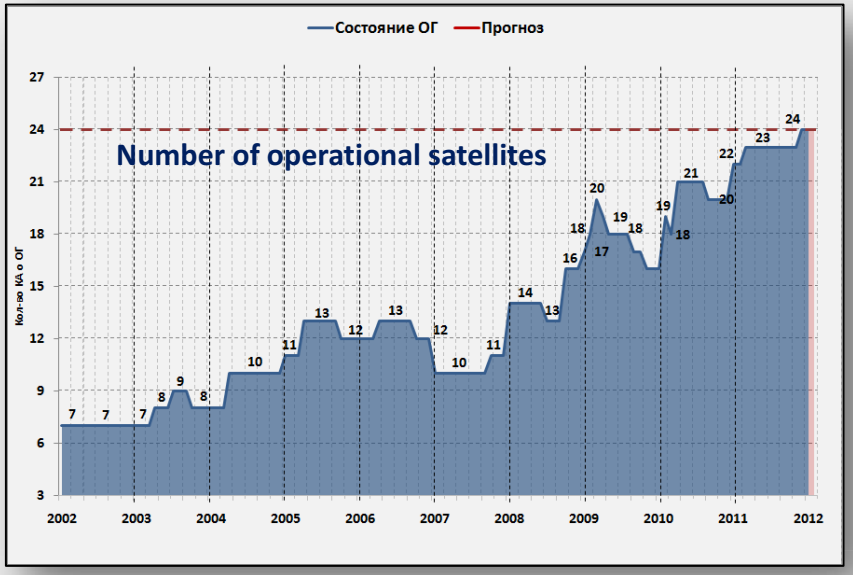
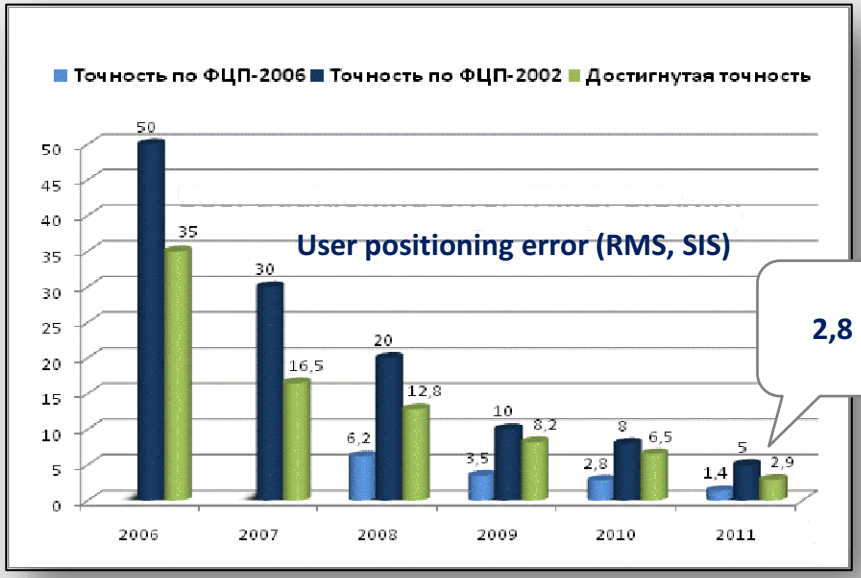
Constellation recovery



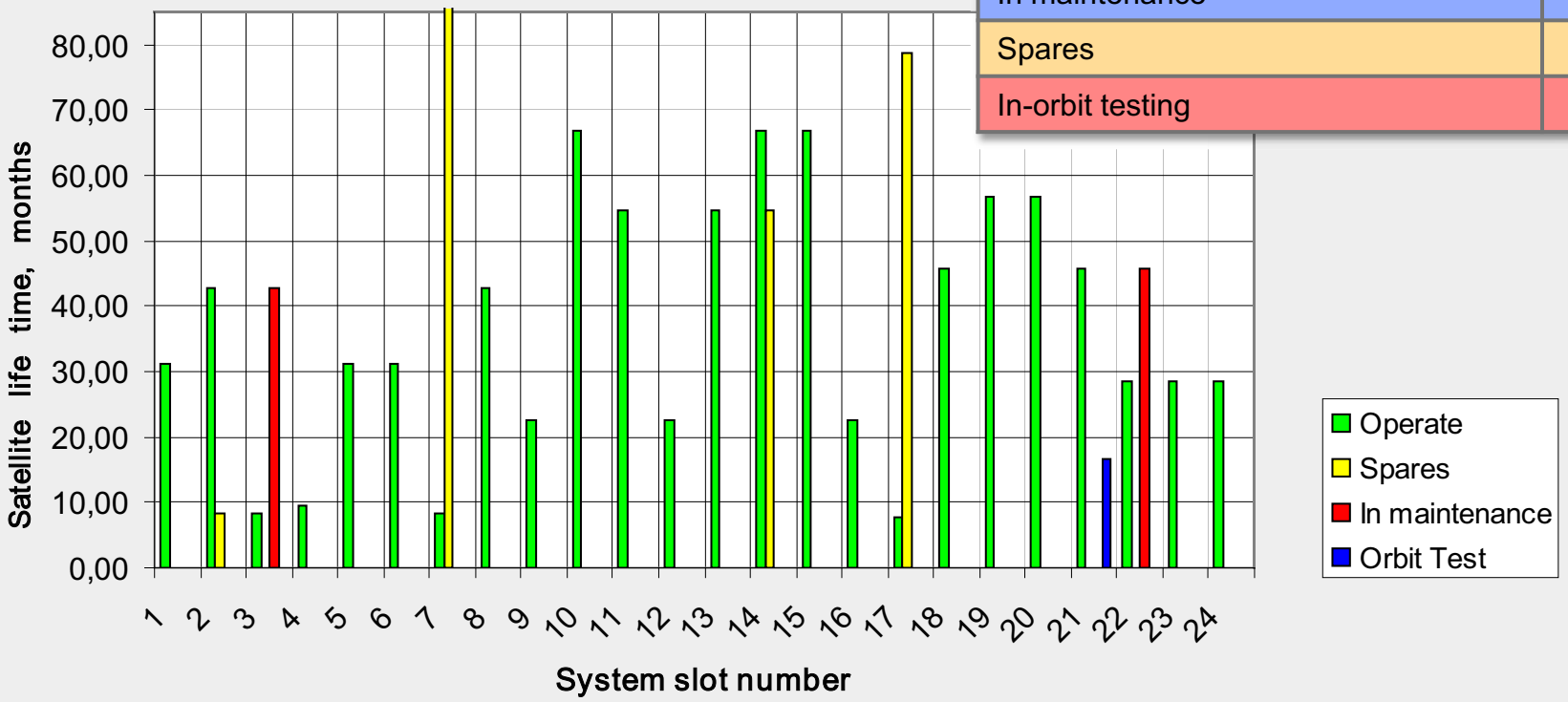
Accuracy improvement



- **GLONASS recovered!**
- **GLONASS recognized worldwide!**
- **Performance is comparable to that of GPS!**
- **Open for cooperation!**

GLONASS Constellation Status 18.07.2012

Total satellites in constellation	31 SV
Operational	24 SV
In commissioning phase	-
In maintenance	2 SV
Spares	4 SV
In-orbit testing	1 SV



GLONASS Performance

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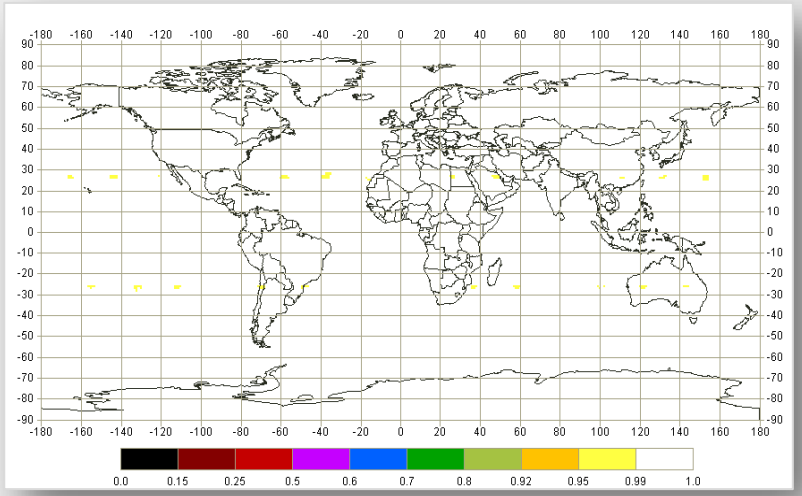
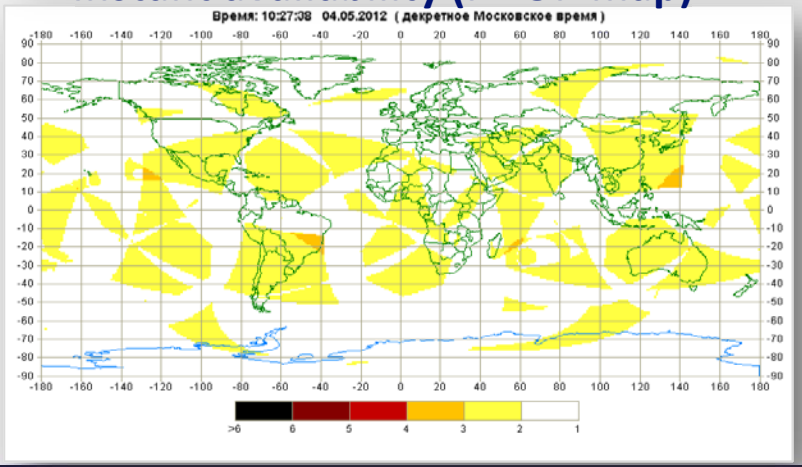
AVAILABILITY

Average availability for a day

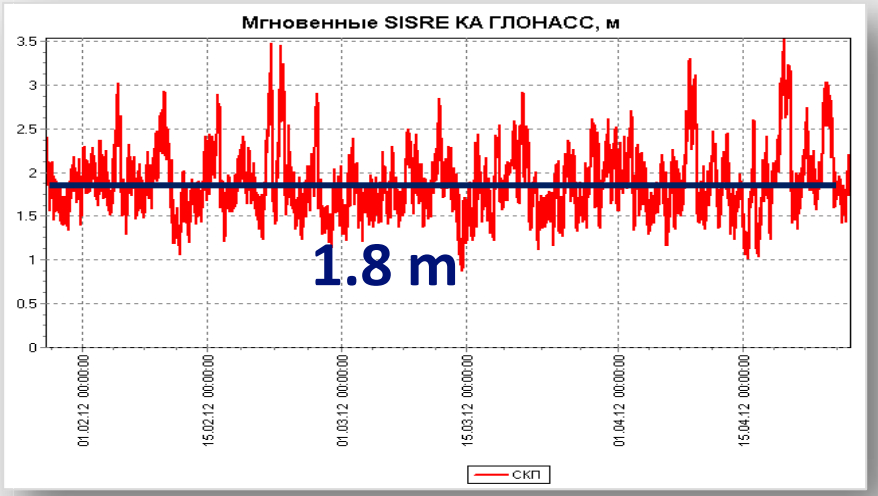


Instant availability (PDOP map)

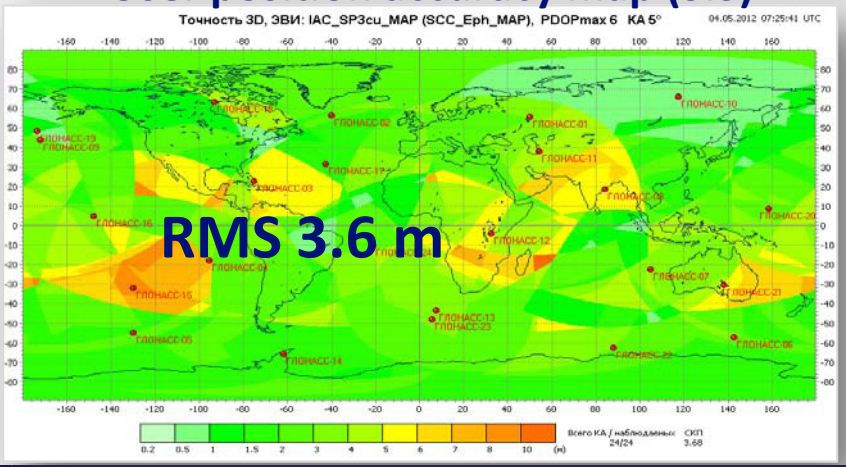


ACCURACY

Instant SISRE, m



User position accuracy map (SIS)



Constellation maintenance

Launches in 2011:

- **26.02.2011 the first GLONASS-K launch (Flight test begins)**
- **03.10.2011 – 1 SV GLONASS-M**
- **04.11.2011 – 3 SV GLONSSS-M**
- **28.11.2011 – 1 SV GLONASS-M**

Next launches:

- **1 GLONASS-K (test) autumn 2012**
- **3 GLONASS-M in ground store and will be launch as necessary**

GLONASS Modernization

РОСКОСМОС

1982 **2003** **2011** **2014**

“Glonass”

- 3 year design life
- Clock stability - $5*10^{-13}$
- Signals: L1SF, L2SF, L1OF, (FDMA)
- Totally launched 81 satellites
- Real operational life time 4.5 years

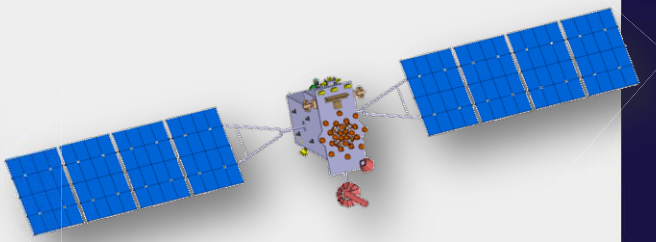
“Glonass-M”

- 7 year design life
- Clock stability $1*10^{-13}$
- Signals: Glonass + L2OF (FDMA)
- Totally launched 28 satellites and going to launch 8 satellite by the end 2012

“Glonass-K1”

- 10 year design life
- Unpressurized
- Expected clock stability ~10…$5*10^{-14}$
- Signals: Glonass-M + L3OC (CDMA) – test
- SAR

“Glonass-K2”



- 10 year design life
- Unpressurized
- Expected clock stability ~5…$1*10^{-14}$
- Signals: Glonass-M + L1OC, L3OC, L1SC, L2SC (CDMA)
- SAR

Directions of GLONASS Signal Modernization

- Improved accuracy of phase and range measurements
- Better interference protection and robustness
- Interoperability with GPS, Galileo and other GNSS

New CDMA signals introduced on Glonass-K

Keeping on transmitting the existing FDMA signals

GLONASS navigation signals modernization

Satellite	FDMA signal		CDMA signal			Status
	L1	L2	L1	L2	L3	
“Glonass-M”	L1OF L1SF	L2OF L2SF	-	-	-	Done
“Glonass-K” I	L1OF L1SF	L2OF L2SF			L3OC	New L3 CDMA signal since 04/2011
“Glonass-K” II	L1OF L1SF	L2OF L2SF	L1OCd L1OCp L1SCd L1SCp	L2OCp L2SCd L2SCp	L3OCd L3OCp	ICD in develop.

System of Differential Correction and Monitoring (SDCM)

POCKOCMOC

Objectives

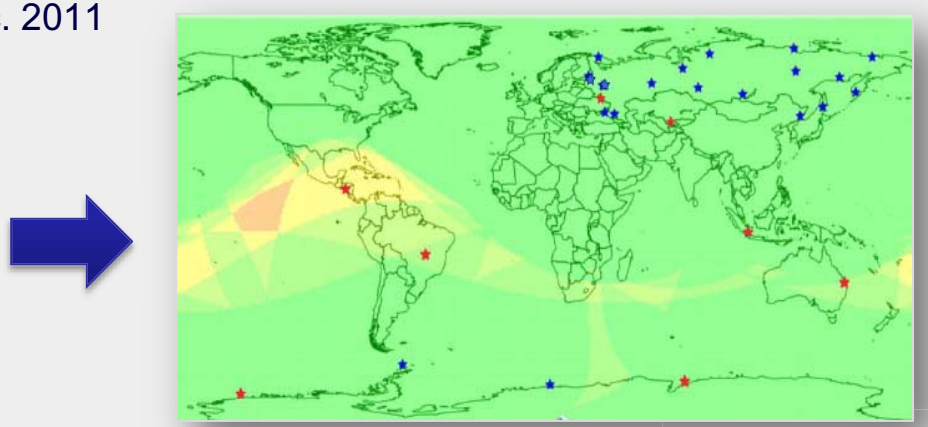
- GNSS monitoring
  - integrity
  - differential corrections
  - orbit and clock data
  - GNSS quality monitoring (GLONASS and GPS)
- Service area – Russian territory

Broadcasting facilities

- 3 (+ 1) GEO sats
  - Luch 5A launched 11 Dec. 2011
  - Luch 5B – Oct. 2012
  - Luch 5V – Mar. 2014
- SiSnet server

Reference stations network

- 19 stations in Russia
  +up to 29 planned stations
- 6-8 stations abroad
  +up to 53 planned stations



Central Processing Facilities

- Main (Moscow)
- Reserve (TBD)

Summary

- First GLONASS Program completed
- GLONASS is full operable and provide global service
- GLONASS open service is free for all users in L1 , L2
- New GLONASS Program (2012 – 2020) approved 3 March 2012
- New CDMA signals have designed and first edition of ICD could be issued to the end of 2012
- International cooperation – to make GLONASS one of key elements of the international GNSS infrastructure for worldwide user benefits

Thank you for your attention!

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