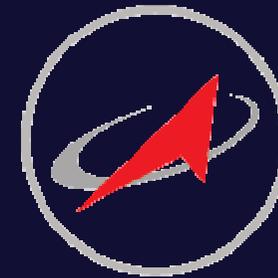


GLONASS Status and Modernization

Sergey Revnivykh

Deputy Director General
Central Research Institute of Machine Building
Head of PNT Center

6th International Committee on GNSS
September 2011



РОСКОСМОС





Content



- GLONASS Overview
- Recent Events
- Modernization Improvements
- GLONASS State Policy
- International Cooperation
- Summary



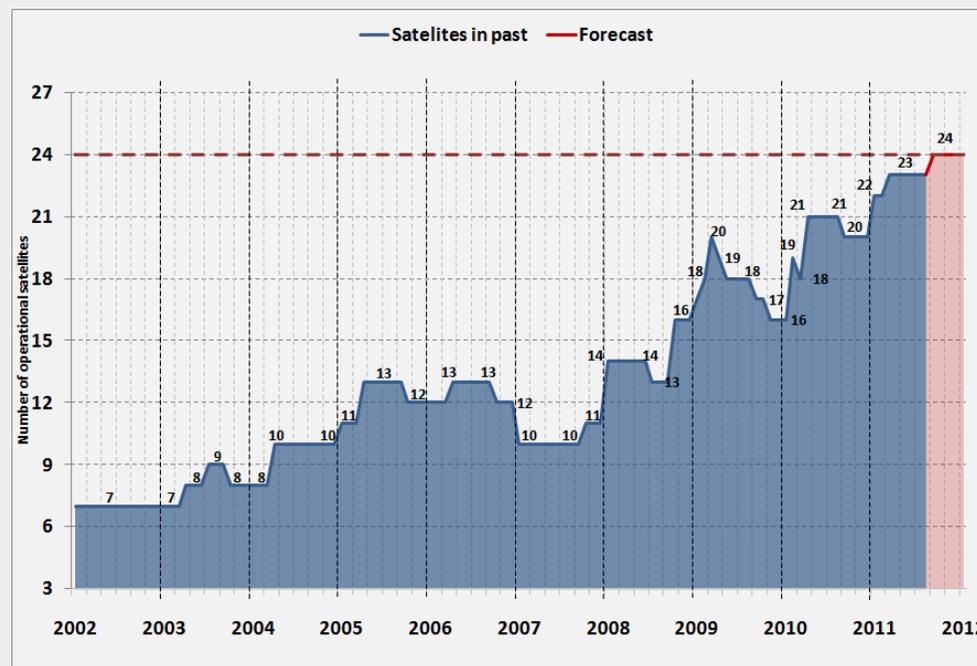
Constellation Status

(03.09.2011)



Total in orbit	27 SV
Operational	23 SV
In maintenance	3 SV
Flight Test	1 SV

Number of operational satellites



The constellation provides:

- Continuous navigation over Russia
- Practically global continuous navigation



Recent Events

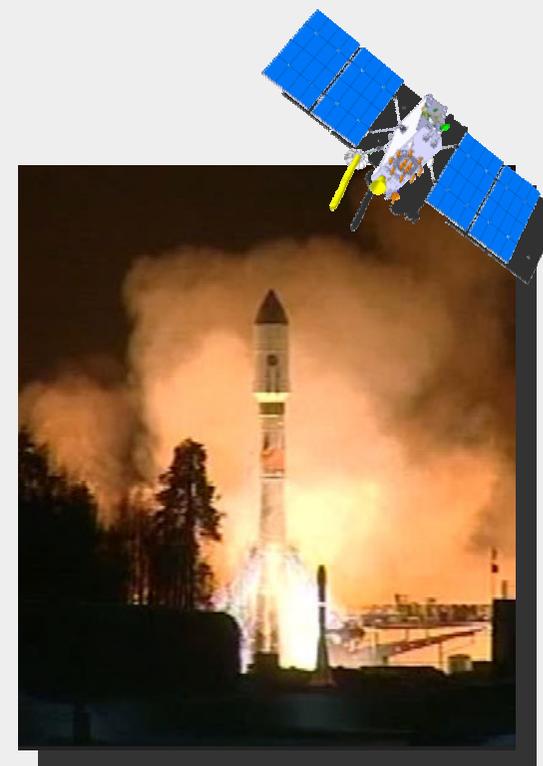


Last launches:

- 26.02.2011 the first GLONASS-K launch

Next Launches:

- 1 GLONASS-M in August
- 3 GLONASS-M in October
- 1 GLONASS-M in November-December
- 1 GLONASS-K 12Л

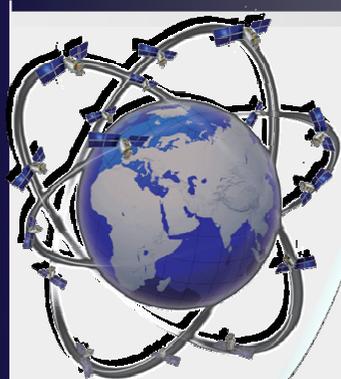


26.02.2011

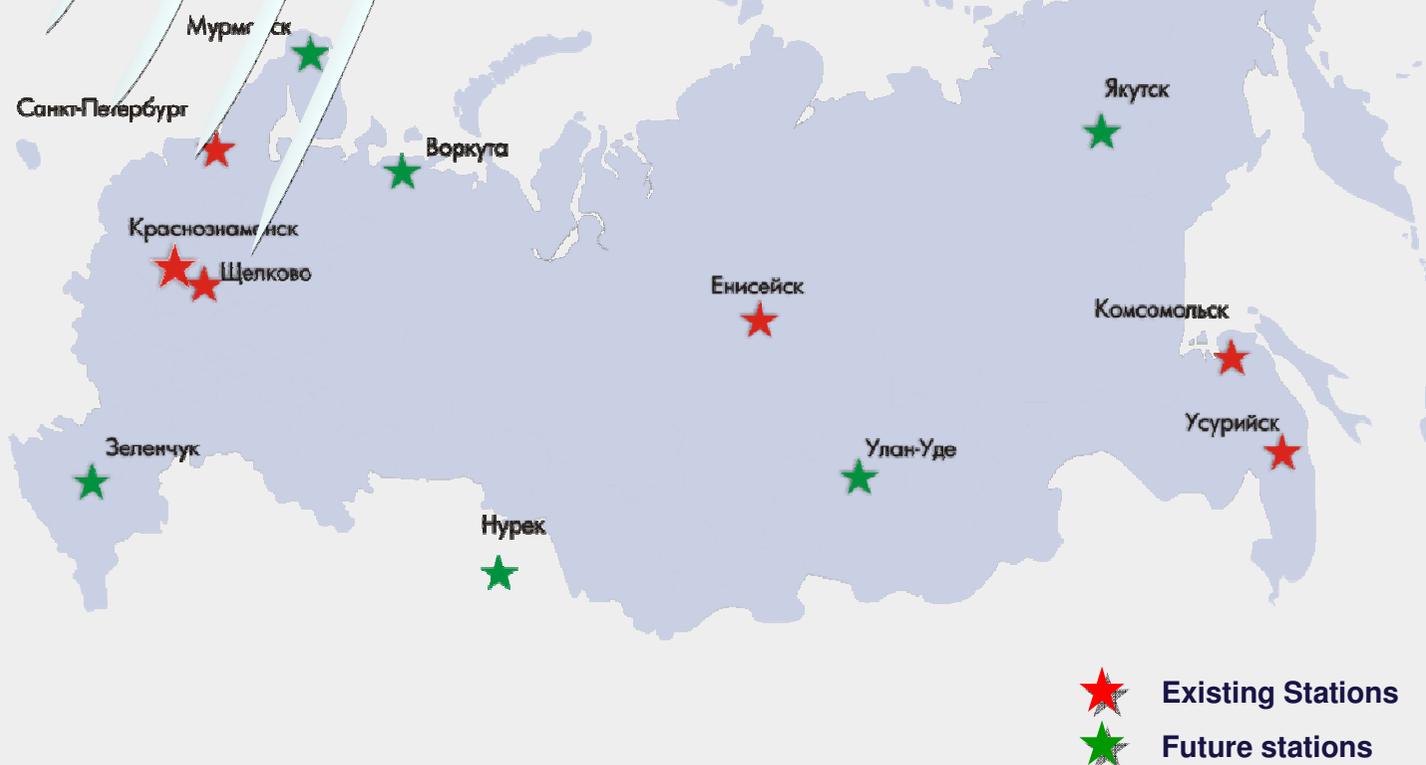
Launch program of 2011 will ensure full constellation deployment and sustainment



GLONASS Control Segment

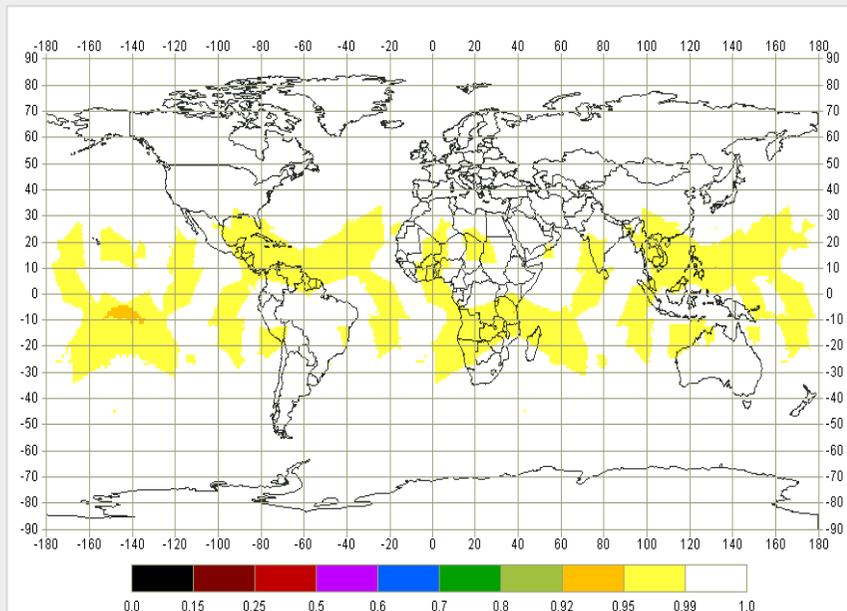


Ground Control Segment

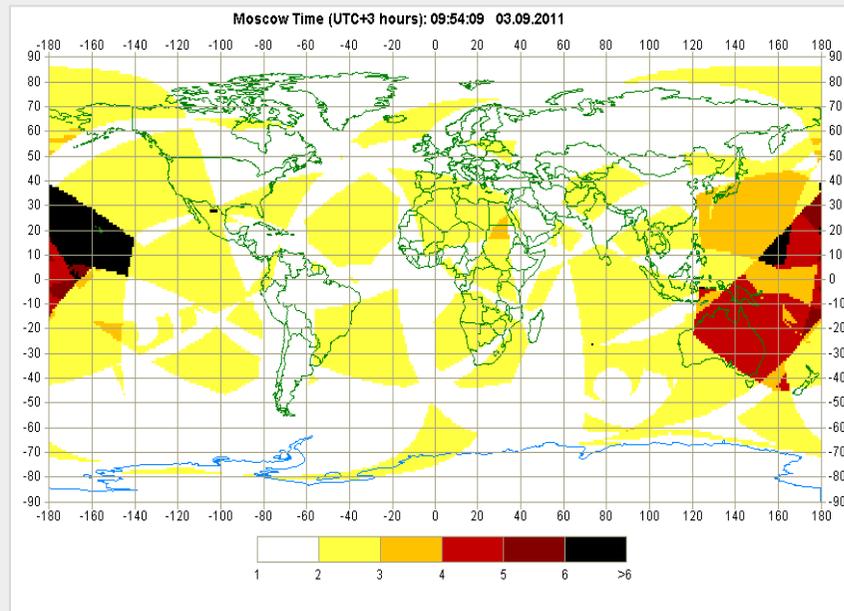




GLONASS Availability (03.09.2011)



Average availability for a day



Instant availability (PDOP)

GLONASS global availability: 99.5% (PDOP<6, γ >5°)

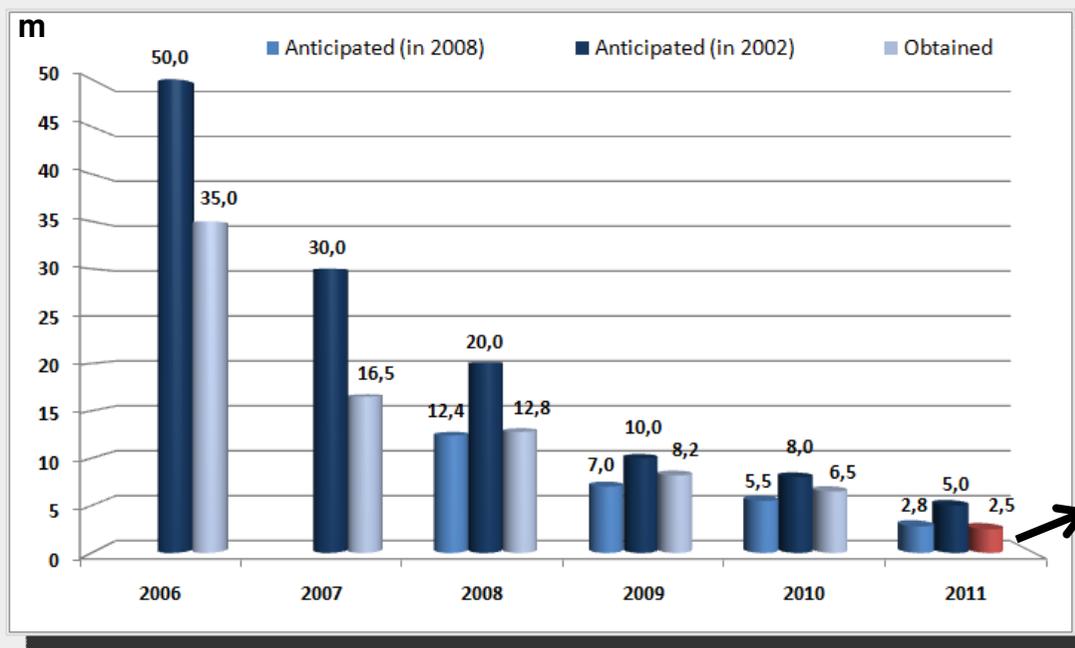


GLONASS Accuracy



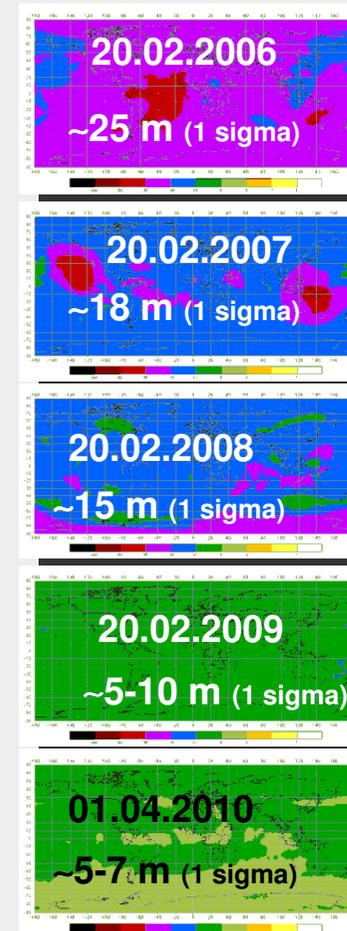
➤ GLONASS accuracy has significantly improved over last five years

➤ Next improvement phase is expected by the end of 2011



GLONASS Accuracy

GLONASS position accuracy map



planned



GLONASS Modernization Plan



1982

2003

2011

2013-2014

“Glonass”



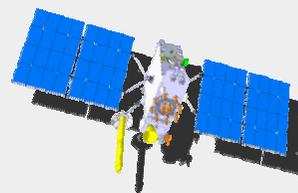
- 3 year design life
- Clock stability - $5 \cdot 10^{-13}$
- Signals: L1SF, L2SF, L1OF, (FDMA)
- Totally launched 81 satellites
- Real operational life time 4.5 years

“Glonass-M”



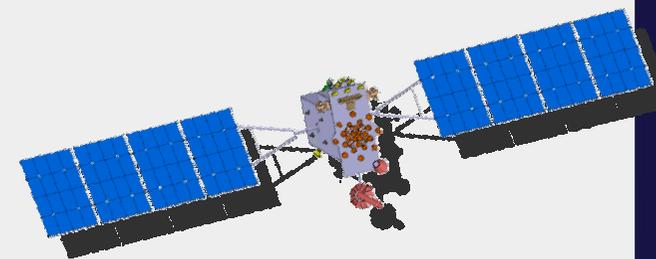
- 7 year design life
- Clock stability $1 \cdot 10^{-13}$
- Signals: Glonass + L2OF (FDMA)
- Totally launched 28 satellites and going to launch 8 satellite by the end 2012

“Glonass-K1”



- 10 year design life
- Unpressurized
- Expected clock stability $\sim 10 \dots 5 \cdot 10^{-14}$
- Signals: Glonass-M + L3OC (CDMA) – test
- SAR

“Glonass-K2”



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

CDMA signals general structure already designed



GLONASS Signals Modernization



“Glonass”

“Glonass-M”

“Glonass-K1”

“Glonass-K2”

“Glonass-KM”

L1	L2	L3	L1, L2	Future	Status
L10F, L1SF	L20F, L2SF	–	–		Done
L10F, L1SF	L20F, L2SF	–	–		Done
L10F, L1SF	L20F, L2SF	L30C test	–		Done
L10F, L1SF	L20F, L2SF	L30C	L10C, L1SC, L2SC		From №3 sat “Glonass-K”
L10F, L1SF	L20F, L2SF	L30C	L10C, L1SC, L2SC	L3SC, L10CM, L20C, L50C	Under development after 2015



FDMA signals



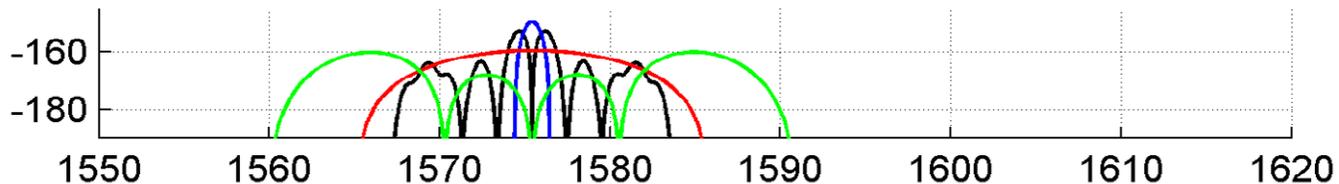
CDMA signals



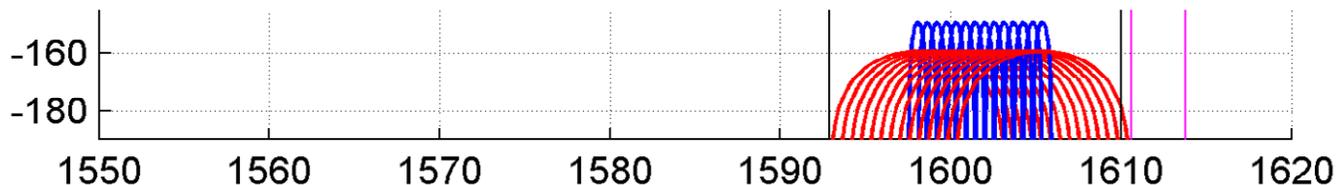
GLONASS Signals L1



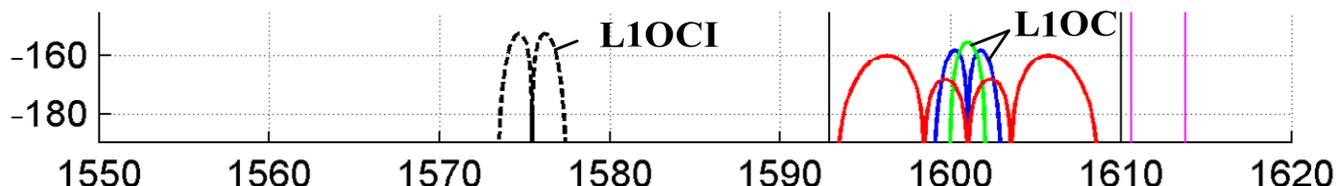
GPS



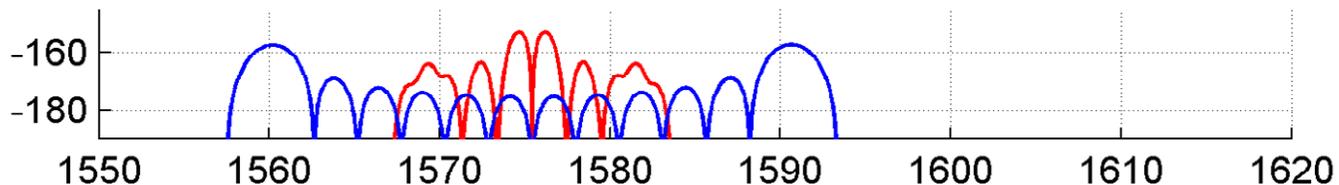
GLONASS
old signals



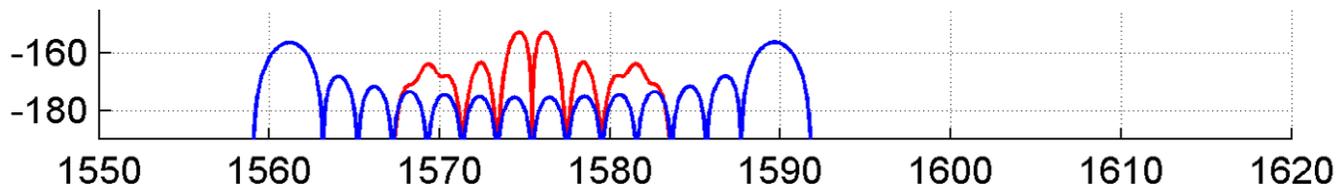
GLONASS
new signals



Galileo



Compass

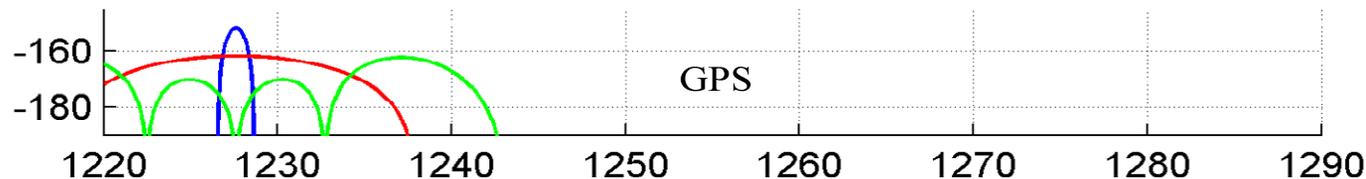




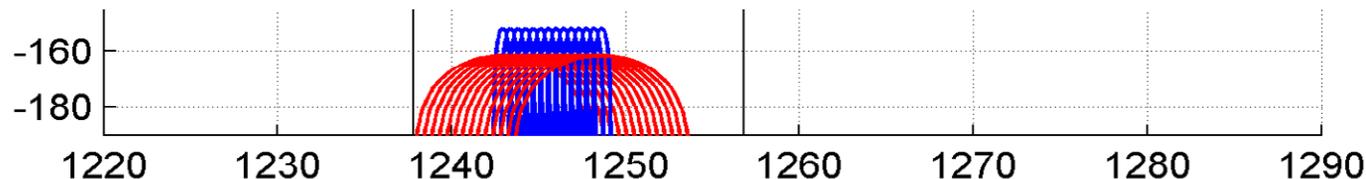
GLONASS Signals L2



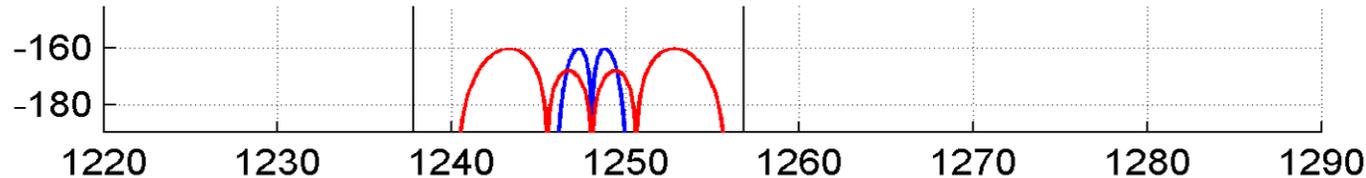
GPS



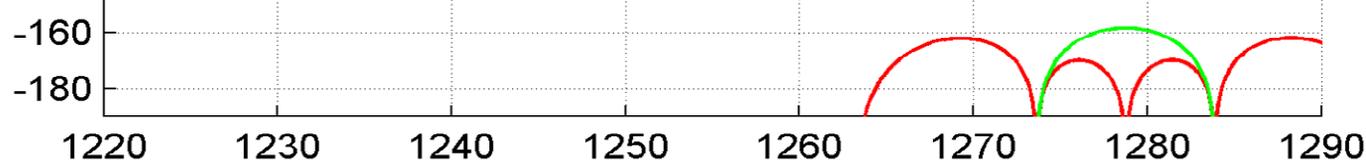
GLONASS
old signals



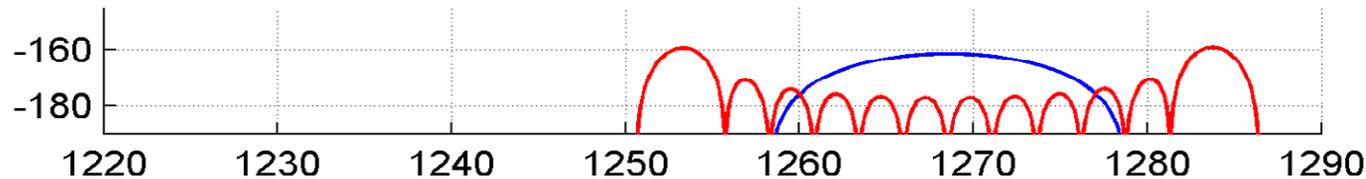
GLONASS
new signals



Galileo



Compass

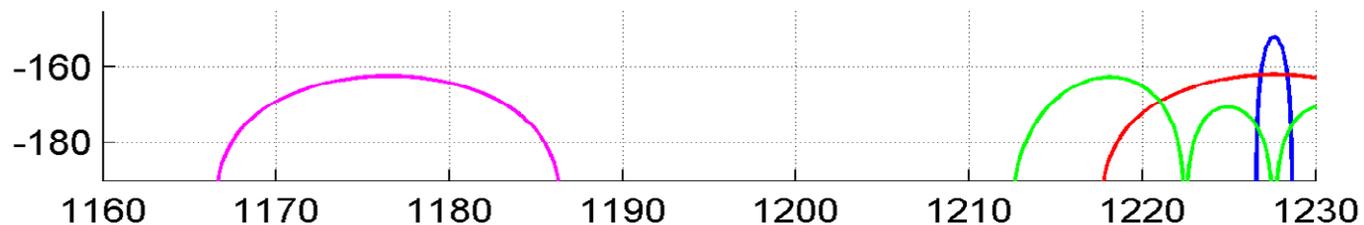




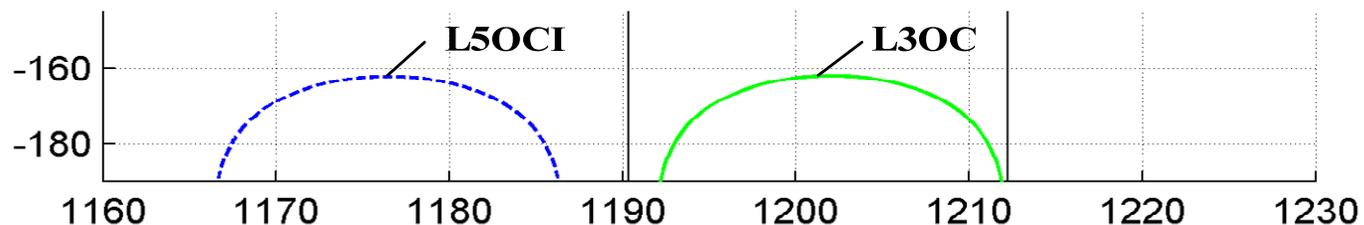
GLONASS Signals L3



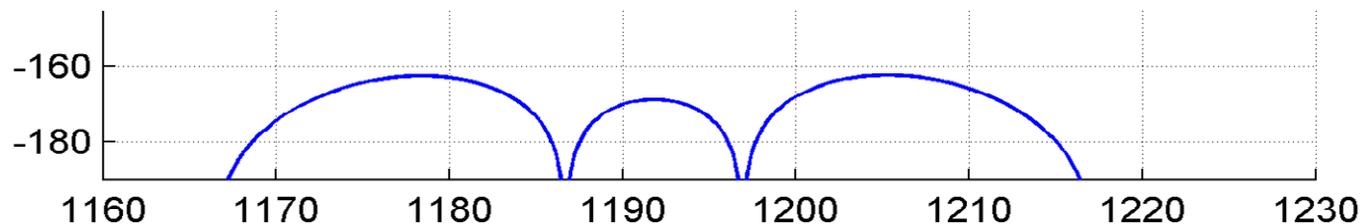
GPS



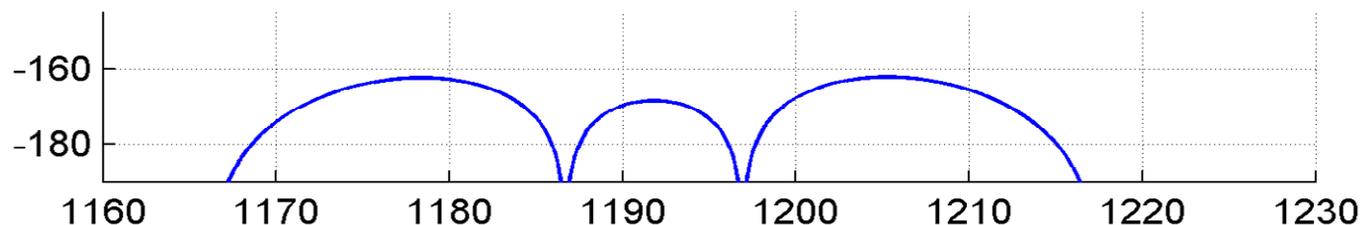
GLONASS new signals



Galileo

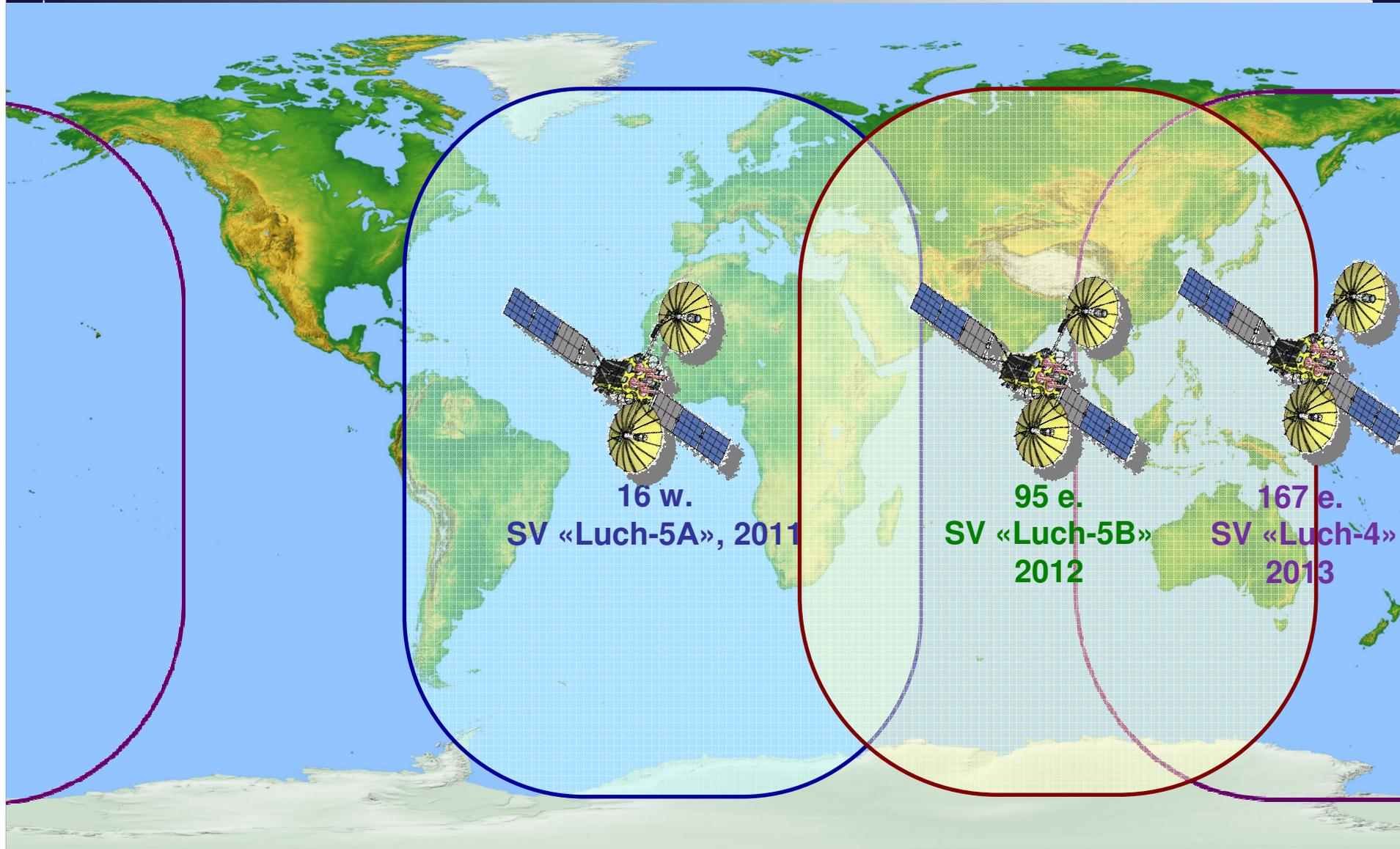


Compass





SDCM Space Segment





SDCM Network

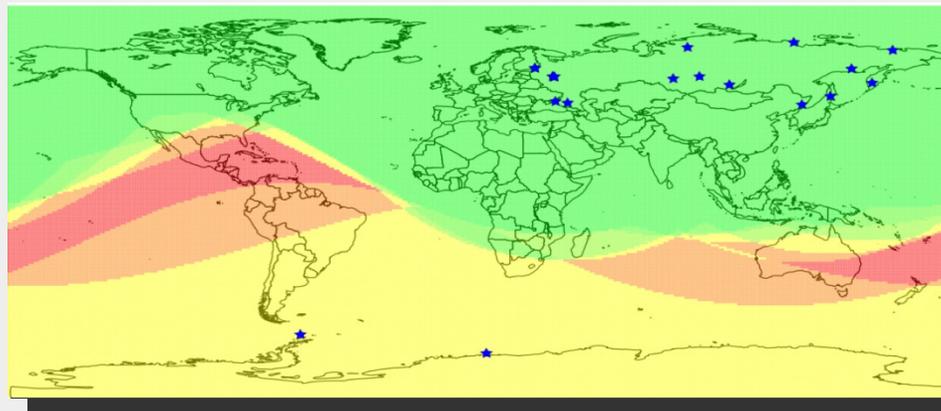


- **Pulkovo** (Leningrad reg)
- **Svetloe** (Leningrad reg)
- **Mendeleevo** (Moscow reg)
- **Gelendzhik** (Krasnodar reg)
- **Kislovodsk** (Stavropol reg)
- **Krasnoyarsk**
- **Norilsk** (Krasnoyarsk reg)
- **Novosibirsk**
- **Irkutsk**
- **Petropavlovsk-Kamchatski**
- **Bilibino** (Chukotka)
- **Tiksi** (Yakutia)
- **Vladivostok**
- **Magadan**
- **Yuzhno-Sakhalinsk**
- **Bellingshausen** (Antarctic)
- **Novolazarevskaya** (Antarctic)

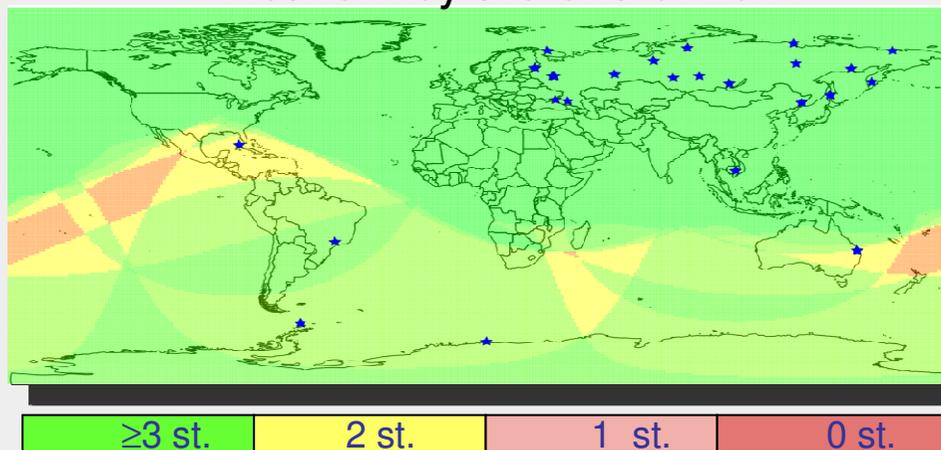
- Lovozero (Murmansk reg)
- Ekaterinburg
- Noyabrsk (Tyumen reg)
- Yakutsk

- 4 more station outside of Russia

Current network



Network by the end of 2011





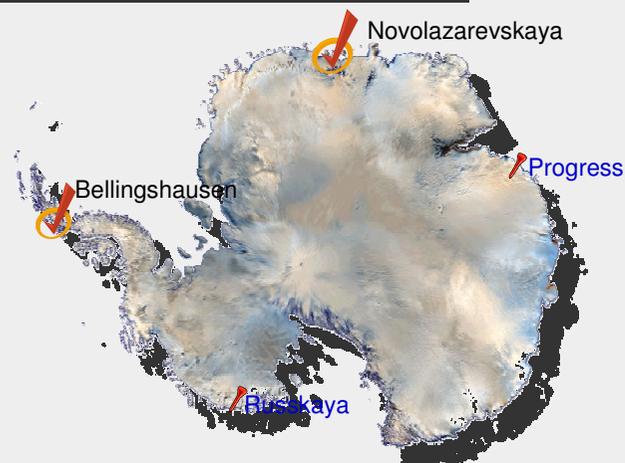
Antarctic SDCM Stations



Station
«Novolazarevskaya»,
December 2010



Station
«Bellingshausen»,
February 2010



1. Voice communication terminal
2. Data defender (VPN)
3. Communication PC
4. Computer
5. Navigation receiver GLONASS/GPS
6. Hydrogen frequency standard
7. Uninterruptible power supply (UPS)



State Policy Basic Principles

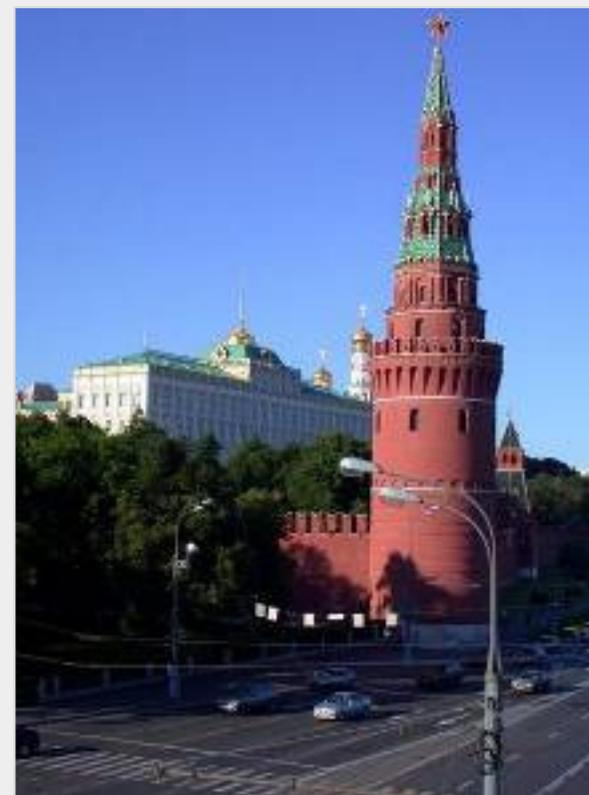


Basic Documents:

- Presidential Decree, May 17, 2007
- GLONASS Federal Program
 - 2002 – 2011
 - 2012 – 2020 (under preparation)

Basic Principles

- GLONASS is a dual use system
 - GLONASS free of charge worldwide
 - GLONASS mandatory use for Russian critical infrastructure and governmental applications
 - Promotion of GLONASS commercial use
 - GNSS compatibility and interoperability



Federal GLONASS Program is a basis for GLONASS State Policy implementation

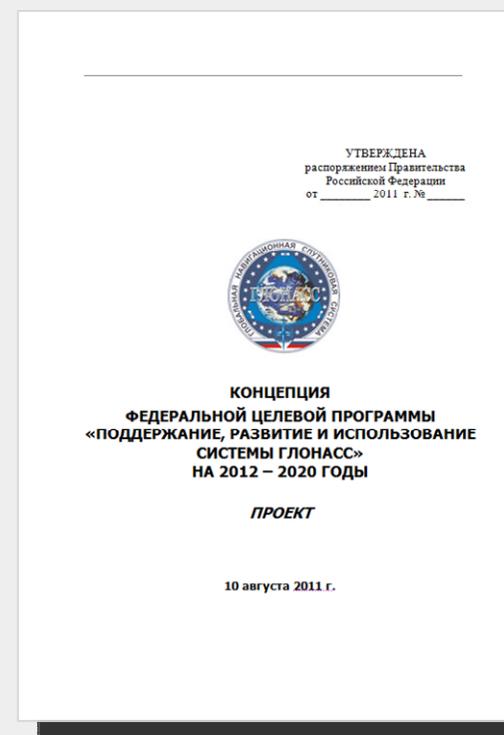


New GLONASS Program Status



- GLONASS Program Concept prepared
- GLONASS Program for 2012 – 2020 to be approved by the end of 2011
- The Program objective is to make the GLONASS service
 - more **available**
 - more **accurate**
 - more **reliable**
 - more **robust**

in the multi GNSS world



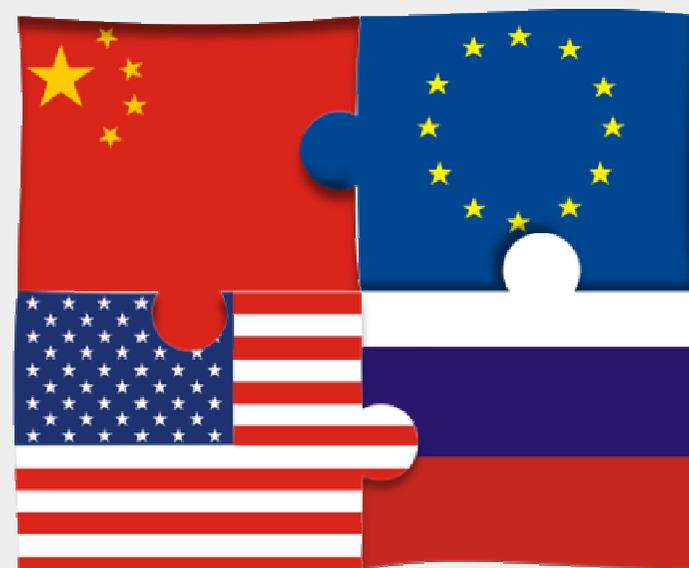
GLONASS Sustainment, Development and Use



International Cooperation



- GLONASS is an element of the global GNSS infrastructure
- Compatibility and Interoperability provision
- Development of common GNSS standards
- Promotion of GLONASS worldwide use for all user benefit





GLONASS Information Service



ФЕДЕРАЛЬНОЕ КОСМИЧЕСКОЕ АГЕНТСТВО
ИНФОРМАЦИОННО-АНАЛИТИЧЕСКИЙ ЦЕНТР

Главная ЦУС ГЛОНАСС ГЛОНАСС GPS Новости Архив Справочник Обратная связь ОБ ИАЦ UTC+4: 11:00:22

Состояние КА ГЛОНАСС

ЭКСПЕРИМЕНТ "СЕВЕРНЫЙ МОРСКОЙ ПУТЬ 2011"

Состав группировки на 03.09.2011г.

Всего в составе ОГ ГЛОНАСС	27 КА
Используются по целевому назначению	23 КА
На этапе ввода в систему	1 КА
Временно выведены на обслуживание	3 КА
Орбитальный резерв	-
На этапе вывода из системы	-

Оценка характеристик ГНС

Новости ГНС

01.09.2011 Запуск навигационного спутника "Глонасс-М" перенесен на первую декаду сентября

22.06.2011 Немецкий прибор ориентации по звездам установят на спутник "Глонасс-М"

05.05.2011 Сигнал на частоте L3 CDMA (ГЛОНАСС-К N701)

31.08.2011 Федеральную целевую программу по созданию системы ГЛОНАСС Роскосмос предлагает осуществлять в рамках гособоронзаказа

28.04.2011 Запланировано проведение работ с КА Глонасс-М N712

18.08.2011 Согласно сообщению Центра Береговой охраны США (Navy 2011062) в рабочую точку RIN30 был переведен и стал использоваться по назначению с 20:43 (UTC) 16.08.11 навигационный КА GPS SVN35 (запущен 30.08.93), находившийся ранее в орбитальном резерве.

Точность местопределения (ГЛОНАСС)

Невьяха
dL: 0.7m
dR: -3.4m
dH: 9.7m
DOP: 1.0
PDOP: 2.1
GDOP: 2.4

Эпоха решения: 06:59:00 03.09.11 UTC

Official website
www.glonass-center.ru
www.glonass-iac.ru

Professional website (authorized access)
stat.glonass-iac.ru
statgps.glonass-iac.ru

Stat - Windows Internet Explorer

http://stat.glonass-iac.ru/

Результаты оценки эфемерид и ЧПТ из навигационных сообщений на интервале уточнения и прогнозирования ЭФИ ИАЦ

КВНД: интервал прогноза 2 - 6 часов. Обновление каждые 5 минут.

Мгновенные SISRE КА ГЛОНАСС, м

Мгновенные SISRE приложены к использованию КА ГЛОНАСС. Шаг данных: 5 минут. Интервал построения графиков: 12 часов.

Интернет | Защищенный режим: вкл. 75% 203 02.03.2011



Summary



- GLONASS Program is high priority of the Russian Government policy
- GLONASS open service is free for all users
- GLONASS Program is in a progress, objective to be achieved by 2011
- GLONASS improvement is a major objective:
 - Performance to be comparable with GPS by the end of 2011
 - Full constellation (24 sats) by the end of 2011
- GLONASS will continue
 - Keep the GLONASS traditional frequency bands
 - Transmit existing FDMA signals
 - Introduce new CDMA signals
- New GLONASS Program (2012 – 2020) is under development to be adopted by the end of 2011
 - State commitments for major performance
 - GLONASS sustainment, development, use
- International cooperation – make GLONASS as one of key elements of the international GNSS for worldwide use



Thank you for your attention!

RUSSIAN FEDERAL SPACE AGENCY
CENTRAL RESEARCH INSTITUTE of MACHINE BUILDING
INFORMATION and ANALYSIS CENTER for POSITIONING,
NAVIGATION and TIMING

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Head of IAC PNT

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Mobile Phone: +7 (916) 240-69-96
e-mail: sergey.revnivykh@glonass-iac.ru
<http://glonass-iac.ru>

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РОСКОСМОС

