



Developments of the Glonass system and Glonass Service Interface

**JOINT MEETING OF ACTION TEAM ON GNSS
AND GNSS EXPERTS OF UN/USA REGIONAL WORKSHOPS
AND INTERNATIONAL MEETING 2001-2002
8-12 December 2003, Vienna, Austria**

Sergey Revnivykh
Mission Control Center
Russian Aviation and Space Agency
sergey.revnivykh@mcc.rsa.ru



GLONASS Policy



- ❑ THE DECREE OF THE GOVERNMENT OF THE RUSSIAN FEDERATION (March 7, 1995 No 237)
 - **GLONASS system is opened for civil use**
- ❑ THE DECREE OF THE PRESIDENT OF THE RUSSIAN FEDERATION (February 18, 1999 No. 38-rp)
 - **GLONASS is a dual use system**
- ❑ DECLARATION OF THE GOVERNMENT OF THE RUSSIAN FEDERATION (29 March 1999)
 - **GLONASS is opened for international cooperation**
- ❑ THE DECREE OF THE GOVERNMENT OF THE RUSSIAN FEDERATION (August 20, 2001 No 587)
 - **Federal GLONASS Program has been approved for 2002 - 2011**



Federal GLONASS Program



**Approved by the Russian Government in August, 2001 for 10 years.
Coordinated by Russian Aviation and Space Agency**

Program Directions:

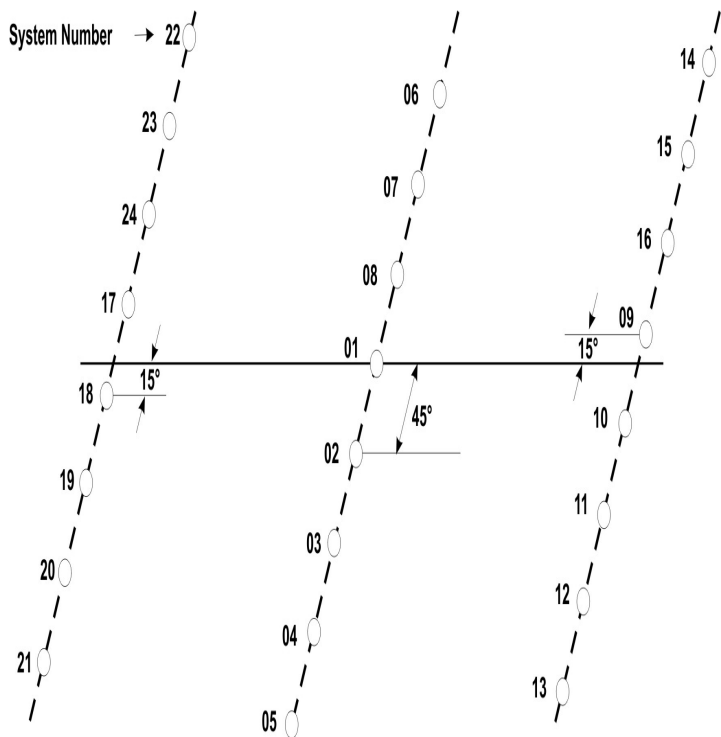
- ↪ **Sustainment and development of GLONASS system:**
 - Minimal operation capability (18 satellites) by 2007
 - Full operation capability (24 satellites) by 2010
- ↪ **Development and production preparation of the GNSS user equipment for civil and special users**
 - Combined GNSS receivers
 - Integrated systems based on SatNav techniques
 - Components manufacture
- ↪ **Navigation technology introduction in the transport infrastructure**
- ↪ **Geodesy system modernization**



GLONASS Architecture



Orbit: circular, H=19100 km
Revolution time: 11 h 15 min 44 sec
Inclination: 64,8°





GLONASS Status



Block 32. Launch in Dec. 2003



Glonass-M № 11JI
Life-time 7 years

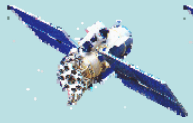


Glonass № 94
Life-time 3 years

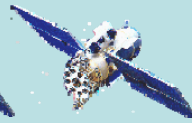


Glonass № 95
Life-time 3 years


Block 33. Launch in 2004



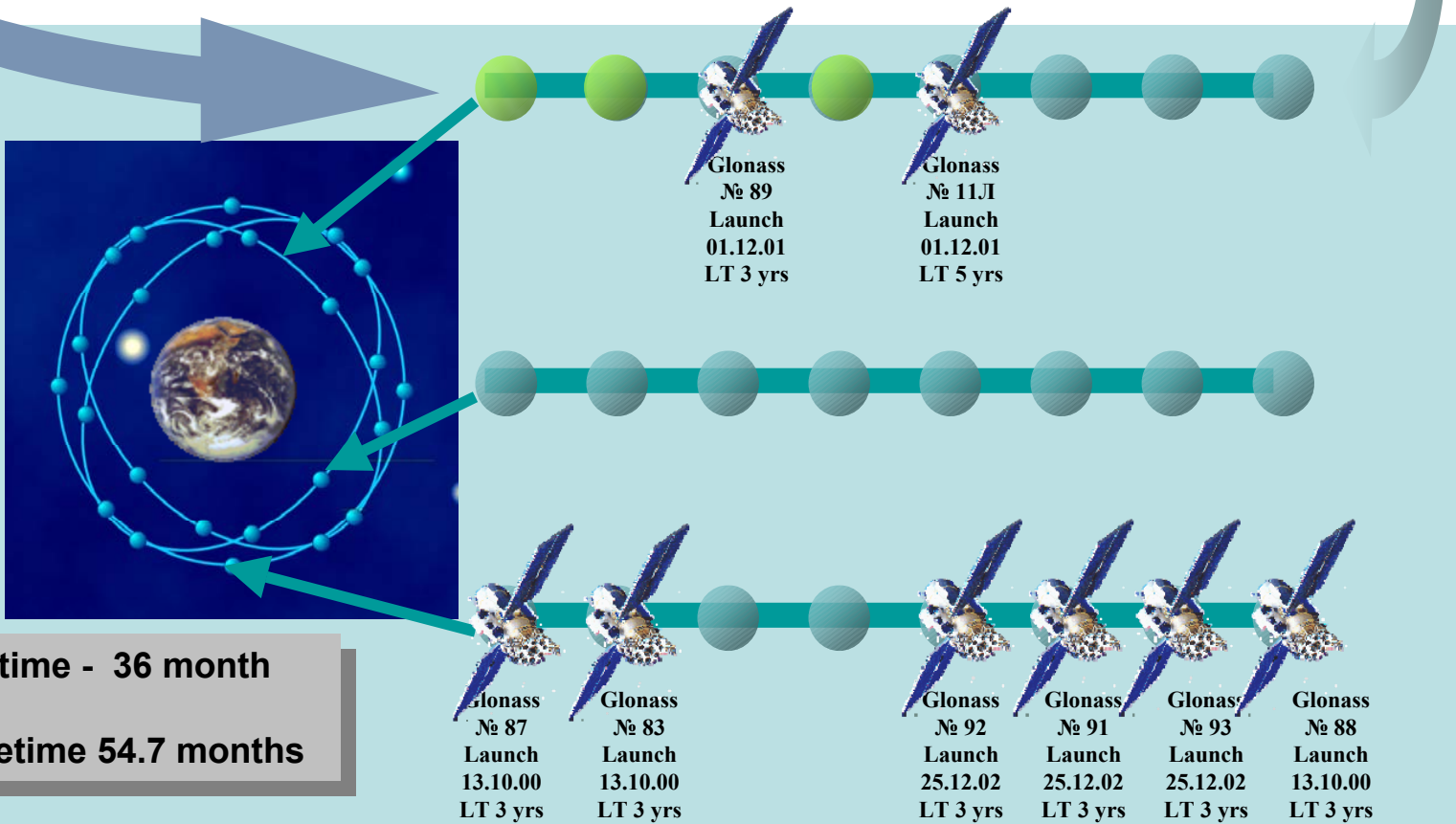
Glonass № 96
Life-time 3 years



Glonass № 97
Life-time 3 years



Glonass-M № 12JI
Life-time 7 years



Guaranteed lifetime - 36 month

Mean actual lifetime 54.7 months



GLONASS Modernization Goals



↪ For Users

- More robust navigation against interference, compensation of ionosphere delays due to new civil signals
- Higher accuracy, availability, integrity, reliability
- Supplementary functions (SAR, integrity and differential correction broadcasting)

↪ For Customers

- Operational cost reduction due to enhanced life-time of new satellites and ground control segment modernization

↪ For International Cooperation

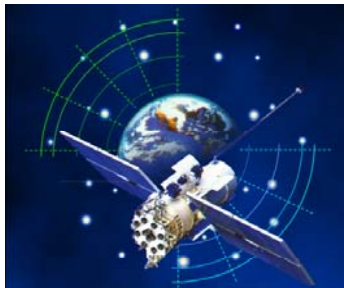
- Compatibility and interoperability of GLONASS, GPS, GALILEO and augmentations



GLONASS Modernization



GLONASS 1982-2007



Developer NPO PM
Producer PO "Polyot"
Total launched 77 SV
Ordered 5 SV
In orbit 8 SV
Clock $5 \cdot 10^{-13}$
Life-time 4.5 yrs

GLONASS-M 2003-2013



Developer NPO PM
Development completion
Ordered 3 SV
To be ordered another 8
Clock $1 \cdot 10^{-13}$
Life-time 7 years
2nd civil signal

GLONASS-K 2006-2022



Developer NPO PM
D&D phase
To be ordered up to 27 SV
Life-time more 10 ys
3rd civil signal

GLONASS-KM 2015-2035

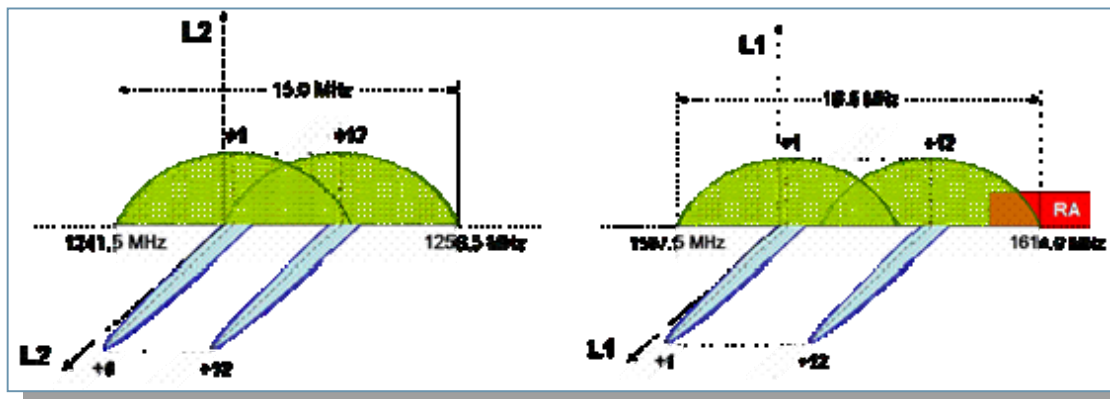


Requirement definition
since 2002 r.

Ground control segment modernization
Navigation (OD\$TS) system modernization
Integrity monitoring segment implementation
System certification for safety of life applications

Nuclear tests agreements monitoring
Search and Rescue service implementation
Supplementary functions (TBD)

before 2005:



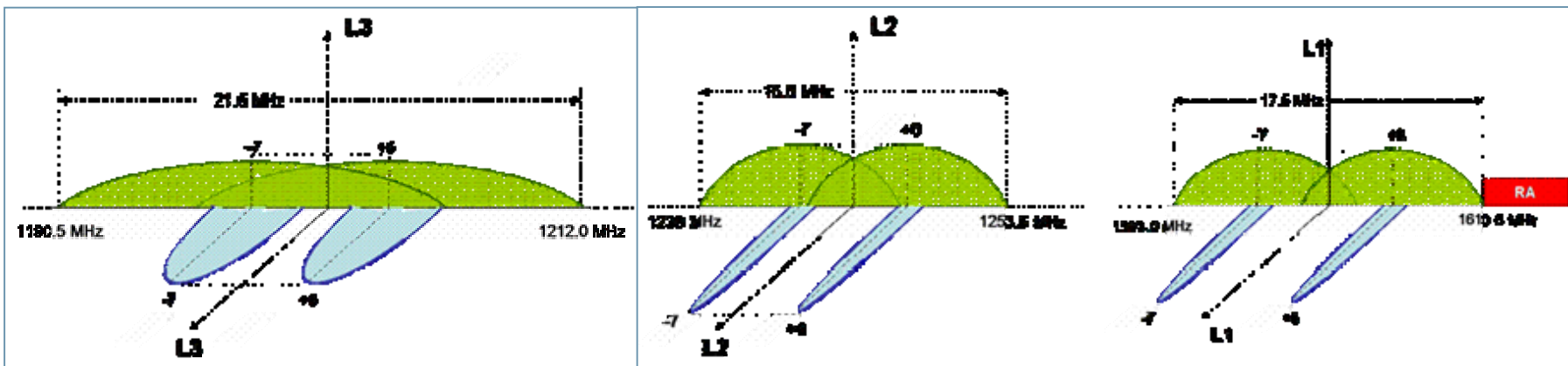
$$f_{k1} = f_{01} + k \cdot \Delta f_1$$

$$f_{k2} = f_{02} + k \cdot \Delta f_2$$

$$f_{01} = 1602 \text{ MHz}; \Delta f_1 = 562,5 \text{ kHz}$$

$$f_{02} = 1246 \text{ MHz}; \Delta f_2 = 437,5 \text{ kHz}$$

after 2005:





New GLONASS Services for Civil Users



- ↪ **Second civil signal at L2 frequency band since GLONASS-M in 2003 for higher accuracy**
- ↪ **Third civil signal at L3(L5) frequency band since GLONASS-K in 2006 for higher reliability and accuracy, especially for safety-of-life applications**
- ↪ **GNSS Integrity information in the third civil signal (GLONASS-K) – reliability of navigation service**
- ↪ **Global differential ephemeris and time corrections in the third civil signal (GLONASS-K) – sub meter real time accuracy for mobile users**
- ↪ **Search and Rescue service (extension of COSPAS/SARSAT service) – shortening time of precise positioning and rescue for people in distress**

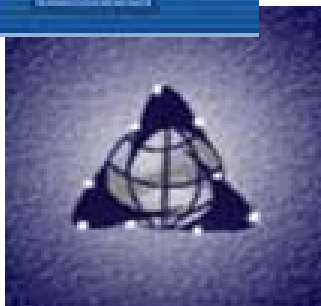


Glonass Service Interface



Ministry of Defense, Russian Federation
Coordination Scientific Information Center
www.glonass-center.ru (Russian and English)

General GLONASS information



Russian Aviation and Space Agency
Central Research Institute, Mission Control Center
Information Analytical Center
www.mcc.rsa.ru/main_iac.htm (Russian and *English*)

GNSS Performance and Application



Russian Aviation and Space Agency
Russian Research Institute of Space Device Engineering
Multifunctional Navigation Information Center
www.mnic.rniikp.ru is under development

GNSS Application and User Equipment



Russian Aviation and Space Agency
Scientific Industry Corporation of Applied Mechanics
www.npopm.ru (Russian)

GLONASS Satellite Data



Coordinational Scientific Information Center



www.glonass-center.ru

The mission of the **Coordinational Scientific Information Center** is to plan, manage and coordinate the activities on civil-military interface for GLONASS use

Information at site:

- About CSIC
- General GLONASS
- Constellation status
- Time data
- Documents
- Publications
- Archive
- GLONASS history

The screenshots illustrate the website's structure and content. The main page features a navigation menu with tabs for 'GENERAL', 'TIME DATA', 'DOCUMENTS', 'PUBLICATIONS', and 'CSIC'. A prominent section titled 'COORDINATION SCIENTIFIC INFORMATION CENTER' describes the center's mission: 'The mission of the Coordinational Scientific Information Center is to plan, manage and coordinate the activities on civil-military interface for GLONASS use'. This mission is supported by three key areas: 'use of civil-military space systems (navigation)', 'realization of Russian and international scientific and technical programs', and 'conversional use of military space facilities'. A 'GENERAL GLONASS' section provides detailed information about the satellite constellation, including a table of satellite status.

Index	Name	Freq.	Launch	Intro	Status	Outage date
1091	1701	12	01.12.2003	04.01.2004	operating	
1092	1702	12	01.12.2003	01.04.2004	operating	
1093	1704	09	01.12.2003	04.01.2004	operating	
1094	1706	08	01.12.2003	01.04.2004	operating	04.01.2004
1095	1708	08	01.12.2003	01.04.2004	operating	14.07.2003
1096	1710	08	01.12.2003	01.04.2004	operating	
1097	1712	08	01.12.2003	01.04.2004	operating	
1098	1714	08	01.12.2003	01.04.2004	operating	
1099	1716	08	01.12.2003	01.04.2004	operating	
1100	1718	08	01.12.2003	01.04.2004	operating	
1101	1720	08	01.12.2003	01.04.2004	operating	
1102	1722	08	01.12.2003	01.04.2004	operating	
1103	1724	08	01.12.2003	01.04.2004	operating	



Information Analytical Center

Mission Control Center



www.mcc.rsa.ru/main_iac.htm

Information at site:

- ❑ About IAC
- ❑ General GNSS, documents, GNSS application
- ❑ GNSS performance status
- ❑ Ephemeris and Time data analysis
- ❑ GNSS performance prediction
- ❑ GNSS News
- ❑ Laser Center

Main products :

- ↪ GLONASS/GPS integrity data (real-time, monthly bulletin)
- ↪ Precise GLONASS orbits based on SLR and one-way data
- ↪ Earth Rotation Parameters based on SLR data
- ↪ SLR world network performance
- ↪ PZ-90-GLONASS / ITRF transformation parameters



www.mnic.rniikp.ru is under development

Founded in 2002

Main tasks

- Realization of a common governmental policy in the field of coordinate-time provision of users
- Coordination of works in connection with development of perspective systems intended to provide the users with coordinate-time data
- Establishment and evolution of the market of navigation technologies and services in Russia
- Integration with international systems and services



Main Trends of Activity

- Realization of a common modern navigation provision of users in Russia.
- Rendering the services of the GLONASS functional augmentation.
- Participation in creating the state Land Cadastre and a system of geodetic provision in Russian Federation
- Coordination of the interoperability with foreign and domestic navigation-information centers and services



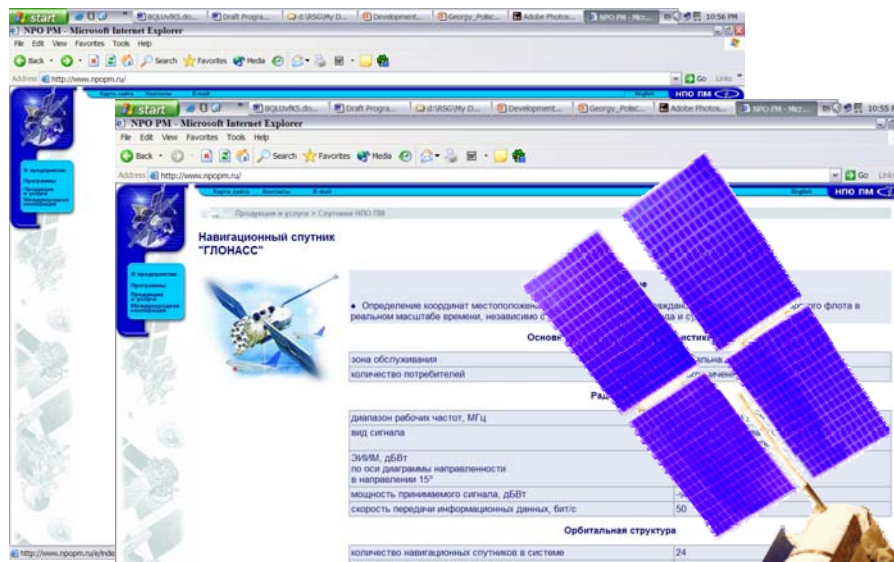
Scientific Industry Corporation of Applied Mechanics



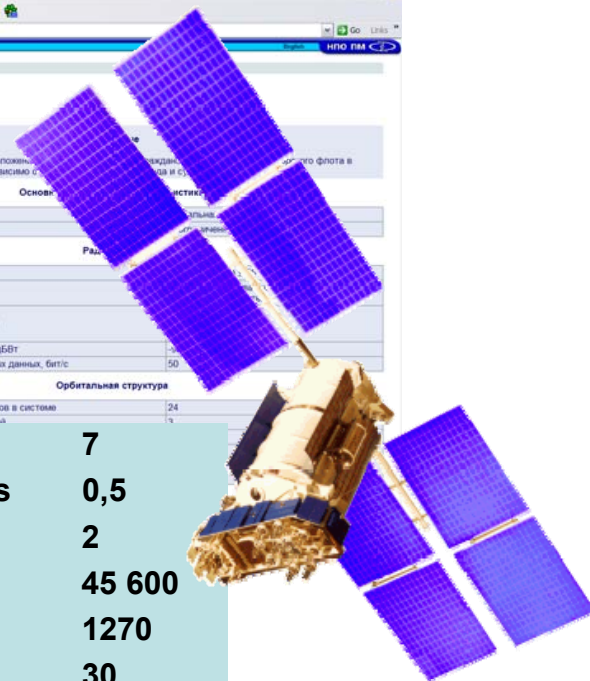
www.npopm.ru

Information at site:

- About NPO PM
- Programs
 - **GLONASS**
- Products and services
 - Satellite platforms
 - ↪ **GLONASS**
- International Cooperation



Satellite lifetime, years	7
Earth pointing accuracy, degrees	0,5
Sun pointing accuracy, degrees	2
Total thrust impulse, N*s	45 600
Power, Watts	1270
Solar arrays area, m ²	30
Satellite mass, kg	1415
Payload:	
- mass, kg	260
- power, Watts	650



Thank you for attention!!!

