



Federal Space Agency



GLONASS Status Update

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 (Presented at FIG 2006 by Matt Higgins, Chair FIG Commission 5)

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State Policy Principles


- ❑ GLONASS is a strategic element of the national security issue
- ❑ GLONASS is a dual-use system
- ❑ No direct user fees for civil GLONASS service
- ❑ Open access to the GLONASS civil signal structure for user equipment manufacture, applications development and value-added services
- ❑ Combine GLONASS/GPS receivers development and manufacture
- ❑ Compatibility and interoperability of GLONASS with GPS and future GALILEO
- ❑ Development of the GNSS global market
- ❑ Since 2006 binding equipment of Russian users by GLONASS or combine GLONASS/GPS receivers

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New Presidential Initiatives



- ❑ Directive issued at January 18, 2006
 - ↳ To ensure GLONASS minimum operational capability (constellation of 18 NSV) by the end of 2007
 - ↳ To ensure GLONASS full operational capability (constellation of 24 NSV) by the end of 2009
 - ↳ To ensure GLONASS performance comparable with that of GPS and GALILEO by 2010
- ❑ Directive issued at April 19, 2006
 - ↳ To ensure the navigation equipment mass production: encourage the industry in the manufacture renovation
 - ↳ Mass market development



Federal GLONASS Program Update

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Basic Document for GLONASS Development

- ❑ Federal GLONASS Program for 2002-2011.
 - ↳ Approved by the Government Resolution at 20 August 2001, #587
- ❑ The Program Update
 - ↳ Program update approved by the Government Resolution at July 14 2006, # 423
- ❑ Decisions of the Governmental Military Industry Commission
 - ↳ Held at August 30, 2006
 - ↳ Full support of the GLONASS Program Update
 - ↳ Priorities highlighted – GLONASS Mission Requirement Update (to be developed)

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GLONASS Mission Extension

➢ Encouraging the GLONASS competitiveness
 ➢ Encouraging the worldwide GLONASS application

GLONASS fundamentals

- VLBI "Quasar-KVO"
- UTC (SU)
- Geodesy Reference

GLONASS Covered by existing Requirements

- Constellation
- Ground Control Segment
- Launch Means
- Special Complexes

System of Differential Corrections and Monitoring

Regional and Local Augmentations



End-User Application Systems

User Equipment

GLONASS covered by the existing Mission Requirements
 GLONASS Extension with Mission Requirement Update

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Federal GLONASS Program Directions

- ❑ Sustainment and development of GLONASS system (Roscosmos, MOD):
 - ↳ Minimal operation capability (18 satellites) by 2008
 - ↳ Full operation capability (24 satellites) by 2010-2011
- ❑ Development and production preparation of the GNSS user equipment for civil and governmental users (Agency of Industry, MOD)
 - ↳ Combined GNSS receivers
 - ↳ Integrated systems based on GNSS techniques
 - ↳ Components manufacture
- ❑ Navigation technology introduction in the transport infrastructure (Transport Agencies of MOT)
- ❑ Geodesy system modernization (Mapping Agency of MOT)

Federal GLONASS Mission Oriented Program – directly funded from the Federal Budget with annual adjustment

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GLONASS Program Update Directions

- Speed up of the constellation deployment
- GLONASS performance (accuracy first) comparable with GPS
- Multi-system receivers and end-user systems development
- Manufacture renovation for mass production of the user equipment
- Pilot projects implementation
- GNSS equipment combination with ground based radio-navigation systems (Chayka/Loran-C like)
- Non-classified navigation maps production (100 m and 50 m scale)
- Legal basis establishing for mass application of GNSS techniques
- Communication system modernization

Requirements of 2001:

- Full constellation in 2011
- Standard Performance

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GLONASS Mass Applications Conditions

- Full operational **GLONASS constellation with sustained performances** at the level comparable with GPS and future Galileo
- Competitive user equipment manufacture** in Russia available for different kinds of users
- Legal basis establishing** for satellite navigation application regulation at the public and private economy domains
- Satellite navigation mass service infrastructure implementation including service providers
- Compatibility and Interoperability** of GLONASS with the existing and future GNSS systems and augmentations

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GLONASS Status

Orbital constellation status at 25.09.2010

In the Constellation now: 16 SV
 operational: 13 SV
 to be decommissioned soon: 1 SV
 maintenance: 2 SV
 within life-time: 9 SV

Block 35 Launch: December 2010

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GLONASS Service Modernization

- Second civil signal at L2 frequency band **since GLONASS-M in 2003** for higher accuracy: 4 satellites in 2006
- Third civil signal at L3 frequency band since **GLONASS-K in 2008** for higher reliability and accuracy, especially for safety-of-life applications
- GNSS Integrity information in the third civil signal (GLONASS-K, tbc) – reliability of navigation service
- Global differential ephemeris and time corrections in the third civil signal (GLONASS-K, tbc) – 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

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GLONASS Deployment Program Update

GLONASS deployment program

number of operational satellites (in thousands)

GLONASS Program implementation (first edition)

GLONASS deployment based on the GLONASS Program Update

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Number of GLONASS satellites with civil signals

MSV

L1

GLONASS M
GLONASS K

L1+L2

GLONASS K
L1+L2+L3

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GLONASS Performance Modernization Plan

- ❑ Satellite modernization
 - ↳ Clock stability improvement
 - ↳ Dynamic model improvement (attitude accuracy, eclipse passing algorithm)
- ❑ Receiving monitoring stations (RMS) network extension
 - ↳ Space Force network (3 stations)
 - ↳ Roscosmos network (9-12 stations)
 - ↳ Rosstandart network (3 stations at the UTC(SU) sites)
 - ↳ Cooperation with International GNSS Service and foreign agencies
- ❑ GLONASS time keeping system modernization
 - ↳ New system clocks with high stability (2 distributed clocks)
 - ↳ Synchronization system modernization
- ❑ Geodesy system refinement in direction to ITRF : PZ-90.02
- ❑ OD&TS software modernization based on one-way code and phase data processing

13

Navigation Maps Development for Mass Market

I: Navigation maps development based on the digital topography maps update (scale 1: 100 000, 2006 – 2007)

II: Navigation maps development based on the digital topography maps update (scale 1: 100 000, 2008 – 2009)

14

International Cooperation Directions

- ❑ GLONASS compatibility and interoperability with existing and future GNSS systems and augmentations
- ❑ Promotion of GLONASS applications on the world market
- ❑ Strategic partners involvement for GLONASS development

Partners

- ↳ USA
- ↳ European Union, ESA
- ↳ India
- ↳ Kazakhstan
- ↳ International Organizations

15

GLONASS Interface

- ❑ **Informational Analytical Center of PNT service** (PNT service department of the Mission Control Center of the Central Research Institute of Machine Building) since August 15 has been formally assigned by the Federal Space Agency as the GLONASS official information portal for users
 - ↳ Daily brief bulletins for GLONASS and GPS status based on the global data available (IGS network, SDGM network)
 - ↳ GLONASS Control Center (Space Force) information
 - ↳ NAGU generation
 - ↳ NOTAM generation (to be soon)
 - ↳ Monthly bulletin with deep analysis of GLONASS performance
 - ↳ GLONASS news
 - ↳ GLONASS ICD

IAC PNT is now acting as positive feed-back in the GLONASS control segment

www.glonass-ianc.rsa.ru

16

GLONASS Performance Improvement for 2005-2006

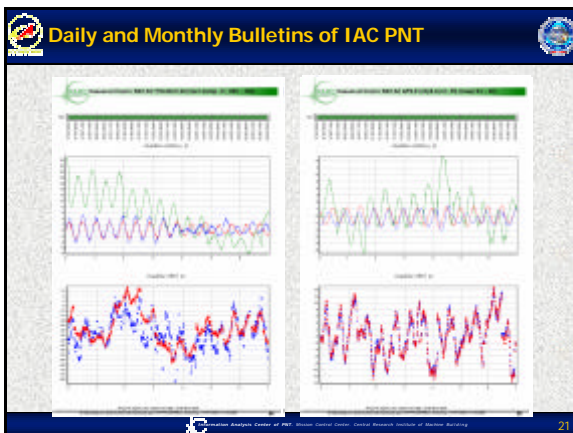
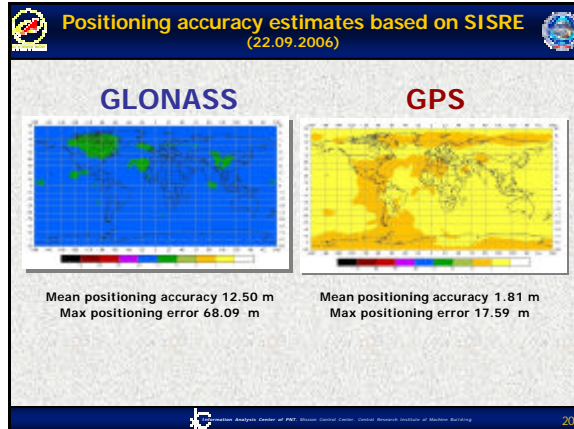
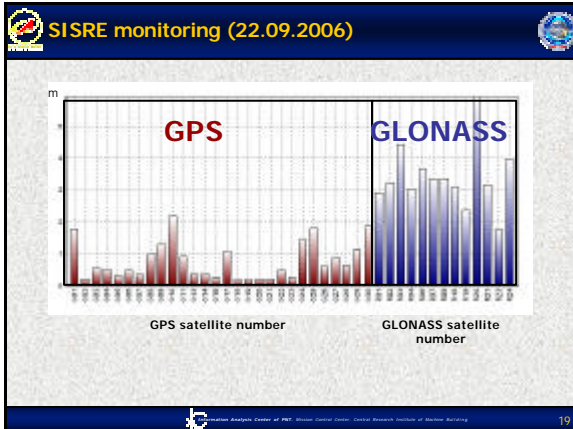
SISRE, ?

17

GLONASS service positioning accuracy (SIS only)

High errors due to on-board clocks problems of GLO #18 and #22 detected by IAC PNT

18



- ### Summary
- ❑ Positioning, Time and Navigation is a component of the critical state infrastructure for national security and economical growth
 - ❑ GLONASS is a key element of the Russian Positioning, Time and Navigation service
 - ❑ GLONASS remains as a dual use system
 - ❑ GLONASS is open for civil use world wide. Combination with GPS brings benefits for users already now
 - ❑ Governmental support provided to the spread use of satellite navigation in the different areas of national economy
 - ❑ The main goal of the international cooperation is to provide better compatibility and interoperability with existing and future systems and augmentations for user benefit
 - ❑ New Presidential Directive: to speed up the GLONASS constellation deployment with performance comparable with GPS and future GALILEO
 - ↳ 18 satellites in 2007
 - ↳ 24 satellites in 2009
 - ❑ The GLONASS Program Update approved by the Government at July 2006 for 2007-2011
- 22

GLONASS Status Update

Thank you for your attention!

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23