

# **GLONASS PROGRAM UPDATE**

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Russian Federal Space Agency (Roscosmos)

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#### **GOVERNMENT POLICY**

## The Presidential Decree № 638 of May 17, 2007

"On Use of GLONASS (Global Navigation Satellite System) for the Benefit of Social and Economic Development of the Russian Federation"



 GLONASS is the core element of the national PNT infrastructure ensuring national security and economic development



PNT infrastructure sustainment and development are Government's function

- GLONASS civil services are free and unlimited globally
- GLONASS or GLONASS/GNSS user equipment is to be used for government applications
- GLONASS Federal Program is the instrument for implementing national policy in PNT
- Федеральная целевая программа
  "Поддержание, развитие и
  использование системы ГЛОНАСС
  на 2012 2020 годы"

  Проект Программы разработан ФГУП Центральный НИИ
  машимостроения по заклу
  Федерального комической
  году предуставления постановления постановления постановления постановления предустановления предустановлен

- GLONASS Federal Program 2012-2020
  - Budget for 9 years secured
  - Most contracts awarded

FEDERAL GLONASS PROGRAM IS A BASIS FOR RUSSIAN POLICY IN PNT

#### **GLONASS MODERNIZATION GOALS**

- Improving system performance in terms of accuracy and integrity
- Ensuring guaranteed positioning, navigation and timing solutions in restricted visibility, interference and jamming conditions
- Enhancing current application efficiency and broadening application domains









#### **GLONASS PERFORMANCE IMPROVEMENT PLAN**

55° 37° 48.1° 9

Four-fold Accuracy Improvement



#### by means of

- new CDMA signals implementation
- ground control segment modernization
- introduction of new onboard atomic frequency standards (2 CAFs + 2 RAFs)
- introduction of advanced satellite control and command, orbit and clock determination technologies based on crosslinks in RF and optical bands
- transition to PZ-90.11 Geodetic System aligned to ITRF with mm level
- synchronization of GLONASS Time Scale with UTC (SU) at less than 2ns while keeping UTC (SU) long-term stability at 10 -17

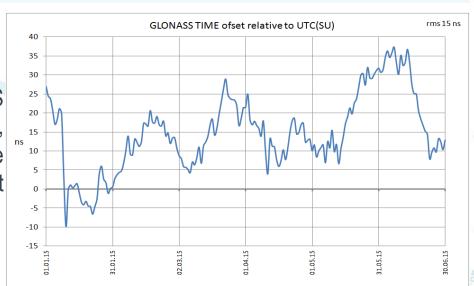




# **BROADCAST GLONASS TIME AND UTC(SU)**

Till August 2014 the offset of GLONASS Time relative to UTC(SU) was about 400 ns.

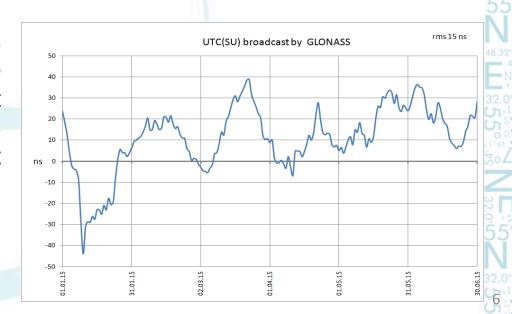
Therefore, to increase the accuracy of GLONASS Time synchronization to UTC(SU) on 18th August, 2014 the procedure for GLONASS Time correction was started. Now the offset is kept within 15 ns (rms).





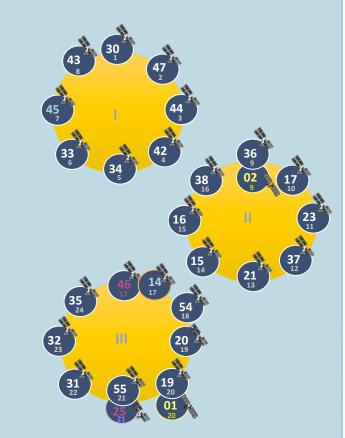


On 18th August, 2014 the generated corrections to GLONASS Time were also changed to eliminate the systematic component of about 200 ns. Now the error of broadcast corrections for GLONASS Time – UTC(SU) offset does not exceed 15 ns (rms).



# **GLONASS ORBITAL CONSTELLATION STATUS** (as of November 2, 2015)

Orbital Constellation and Satell	ite Status
In total	28
Glonass-M	26
Glonass-K	2
Used for navigation	22
On maintenance	2
Orbital spares	0
On-orbit flight test	2
In commissioning phase	0
Prime Contractor Check	2



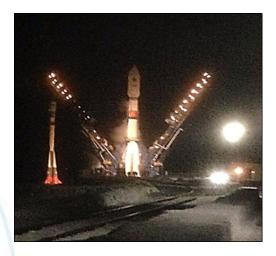






#### LATEST LAUNCHES AND SHORT-TERM SUSTAINMENT

- Glonass-M (#54) launched March 24, 2014
- Glonass-M (#55) launched June 14, 2014
- Glonass-K (#12) launched December 1, 2014
- 2015-2016 up to 9 Glonass-M launches
- Glonass-M single launch by Soyuz is scheduled to the end of December
- Further launches by Soyuz (1 satellite) or Proton (3 satellites in a batch) launch vehicles will be determined by operational necessity



Glonass-M # 54 launch









## **SPACE SEGMENT MODERNIZATION**



- increase of guaranteed life-time
- evolution of satellite service systems
- more stable on-board clocks
- new control, command and ODTS technologies
- introduction of SAR payload
- new signals

## PHASED BUILD-UP OF CAPABILITIES







# **GLONASS SIGNAL IMPLEMENTATION PLAN**

SATELLITE	FDMA Signals		CDMA Signals			
	L1	L2	L1	L2	L3	(
GLONASS-M	L10F L1SF	L2OF L2SF	-	-	L3OC (2014+) 7 SVs	48.
GLONASS-K	L10F L1SF	L2OF L2SF			L3OC	44
MODERNIZED GLONASS-K	L10F L1SF	L2OF L2SF	L10C L1SC	L2OC L2SC	L3OC	24'5 CE









# **GLONASS AUGMENTATIONS**

#### **Objectives:**

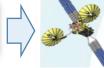
- All types of high accuracy service
- Integrity for safety critical applications





#### **BROADCASTING FACILITY**

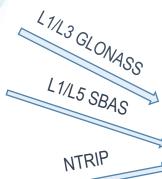














#### **GNSS CONSTELLATION**















- **Master Center**
- Back-Up Center



## **GLONASS USE**

#### **Transport**



Traffic and transportation control

#### Agriculture



High-accuracy tillage, Fertilization optimization, yield control

#### **Power Production**



Power networks synchronization

#### **ERA-GLONASS** and public safety



Road accident emergency response system

and Data Transfer

Data flows synchronization,

capacity growth



Construction

High-rise buildings, bridges, roads construction



Flowrate control





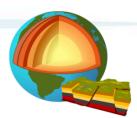
Land surveying, cadastral works, land mapping

**Telecommunications Personal Navigation** 



Positioning, routing

#### Geosciences



Earth modelling, geodynamics research, earthquakes registration







MULTI-GNSS USER EQUIPMENT IS USED (GENERALLY GLONASS/GPS)

#### **INTERNATIONAL ACTIVITIES**

United Nations/Russian Federation Workshop on the Applications of Global Navigation Satellite Systems



18 – 22 May 2015

Krasnoyarsk, Russian Federation



Hosted by JSC Academician M.F. Reshetnev INFORMATION SATELLITE SYSTEMS











## **SUMMARY**

- GLONASS Program is among priorities of the Russian Government Policy
- GLONASS open service is free for all users
- GLONASS Program (2012 2020) approved
- on March 3, 2012
  - Government commitments for major performance characteristics
  - GLONASS sustainment, development, use
- GLONASS will continue
  - Keep the GLONASS traditional frequency bands
  - Transmit existing FDMA signals
  - Introduce new CDMA signals











# Thank you!

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