Prospects for Status and Development of GLONASS System Space Complex

JSC “M.F. Reshetnev “Information Satellite Systems”

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РОСКОСМОС

РЕШЕТНЕВ
ОАО «ИСС»

The Basis for Future Space Complex Development

"GLONASS Sustainment, Development and Use for 2012 – 2020"
Federal Program

The key objectives of the Program with regard to GLONASS Space Complex:

Phase 1.

1. To complete flight test of Glonass-K satellite (of 1st series);
2. To develop and test in flight Glonass-K satellite (of 2nd series).
3. To complete the first phase of modernization of ground control segment and time scale generation & synchronization facilities.

The basis for future space segment development

“GLONASS Sustainment, Development and Use for 2012 – 2020”
Federal Program
The key objectives of the Program with regard to GLONASS Space Complex:

Phase 2 (2016 - 2020):
1. To update the GLONASS constellation with Glonass-K satellites (of 2nd series);
2. To complete modernization of the ground control segment and time scale generation & synchronization facilities.

GLONASS Space Complex Architecture

Space Segment

Generation and transmission of navigation signals (SIS)
Orbit: circular, H= 19100 km, I= 64.8 degrees
Constellation : 24 operational satellites in 3 planes (8 satellites per a plane)
6 spare satellites (2 satellites per a plane)

Launch Vehicles

Development and replenishment of the orbital group

Proton M LV
Breeze M booster
3 Glonass S/Cs

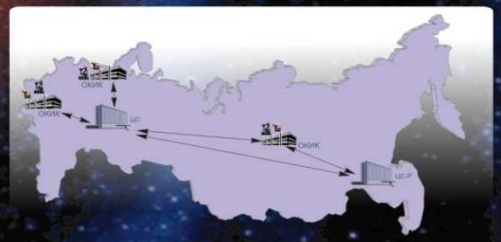
Soyuz 2 LV
Fregat booster
1 Glonass S/C

Ground Control Segment

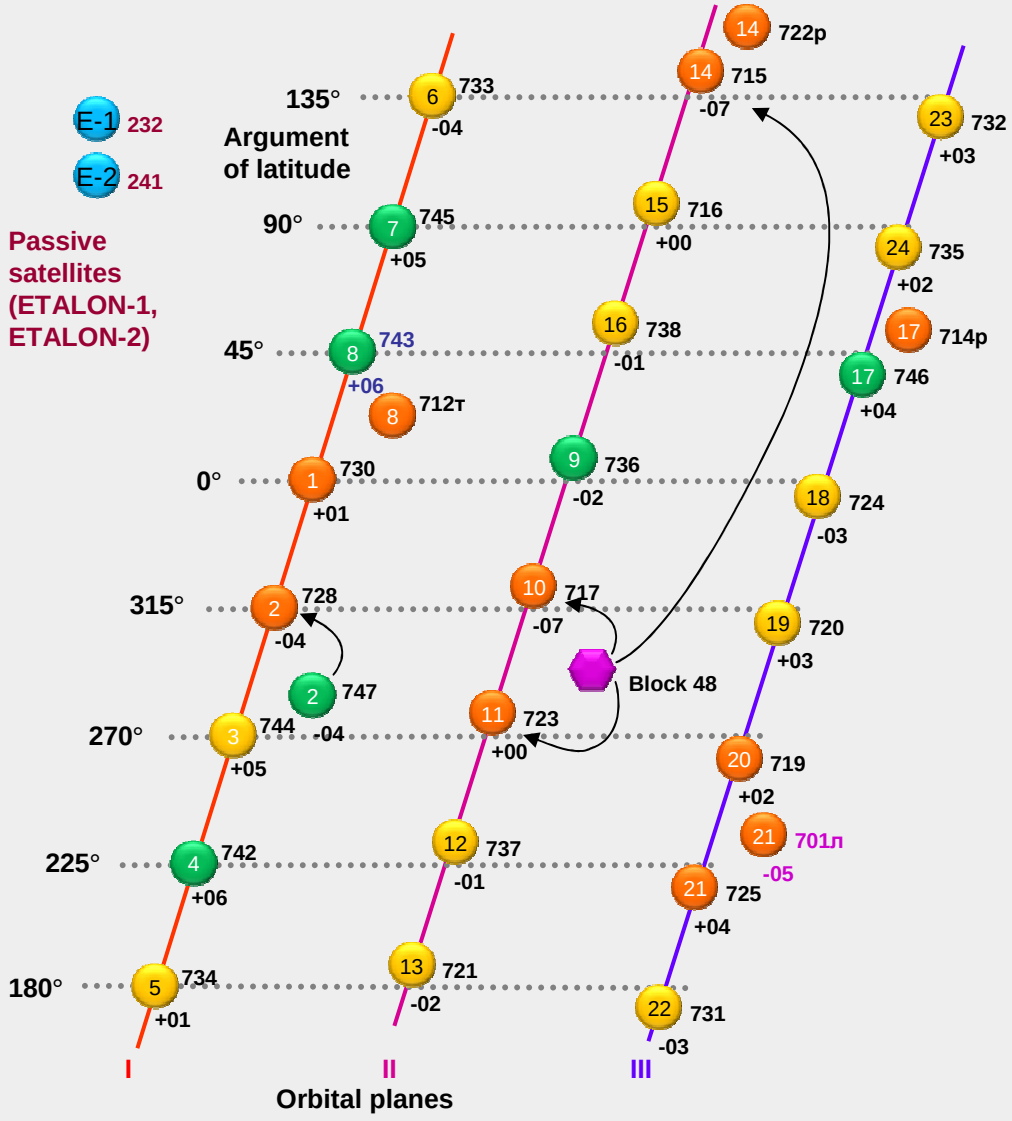
Satellites control & commanding
Clock and Orbit determination
System Control Centre
Commanding & Measuring Stations

Synchronization Facilities

GLONASS Space Complex time scale generation and maintenance
Navigation signals phases synchronization



GLONASS constellation



Constellation status as on 07 of November, 2013

Total	*- 29 S/Cs*
Operational	*- 24 S/Cs*
Spares	*- 3 S/Cs*
Under investigation	*- 1 S/C*
Under flight test	*- 1 S/C*

XXXт Under investigation
XXXр Backup
XXXл Under flight test

Launch Facilities&Vehicles

Baikonur:
Proton-M LV;
Breeze-M booster;
Payload: 3 Glonass-M S/Cs, or
3 Glonass-K S/Cs, or
3 Glonass-K S/Cs (of 2nd series);
a launcher adapter

Plesetsk:
Soyuz-2 LV;
Fregat booster;
Payload: a Glonass-M S/C, or
a Glonass-K S/C, or
a Glonass-K S/C (of 2nd series);
a launcher adapter

Space Segment Modernization

Glonass-M

Design life 7 years
Mass 1415 kg
AFSs 3 CAFs
L1OF, L1SF, L2OF, L2SF, L3OC (from #55, 2014)
Crosslink (RF)
Laser Ranging

Glonass-K ***(of first series)***

Design life 10 years
Mass 935 kg
AFSs 2 CAFs+2 RAFs
Solar Arrays single-junction GaAs
L1OF, L2OF, L1SF, L2SF, L3OC
Crosslink (RF)
Laser Ranging
SAR

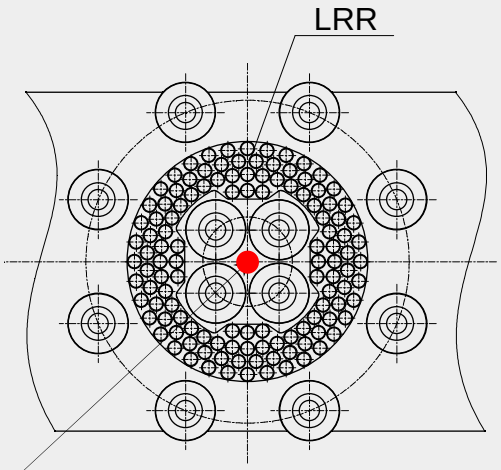
Glonass-K ***(of second series)***

Design life 10 years
Mass 1645 kg (estimate)
AFSs 2 Cs + 2Rb (base option)
Batteries Lithium-Ion
Solar Arrays triple-junction GaAs
L1OF, L2OF, L1SF, L2SF,
L1OC, L1SC, L2OC, L2SC, L3OC
Crosslink (RF + optical)
Laser Ranging
SAR
Additional clock slot for advanced technology qualification

Phased build-up of capabilities

Position of phase center of navigation antennae and LRR

Glonass-K S/C (of 1st series)

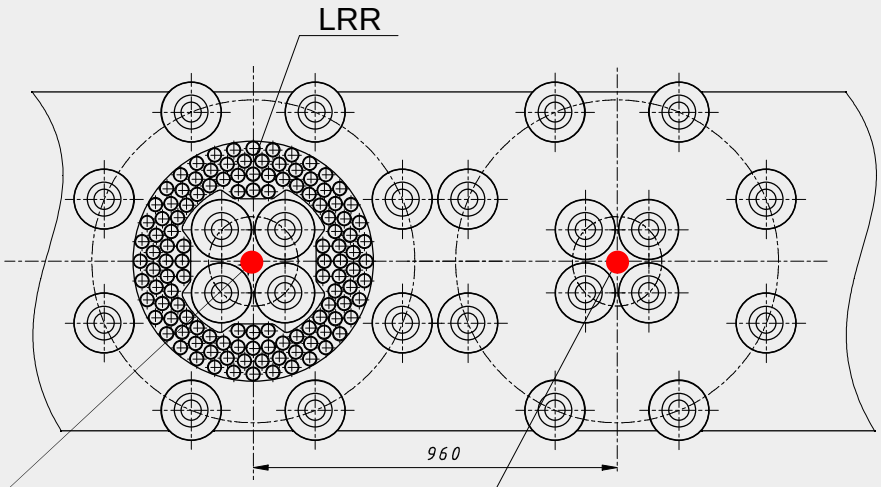


Phase center of antenna transmitting L1OF, L1SF, L2OF, L2SF, L3OC navigation signals

LRR phase center

S/C CoG calculated position

Glonass-K S/C (of 2nd series)



Phase center of antenna transmitting L1OC, L1SC, L2SC, L2OC, L3OC navigation signals

Phase center of antenna transmitting L1OF, L1SF, L2OF, L2SF navigation signals

LRR phase center

S/C CoG calculated position

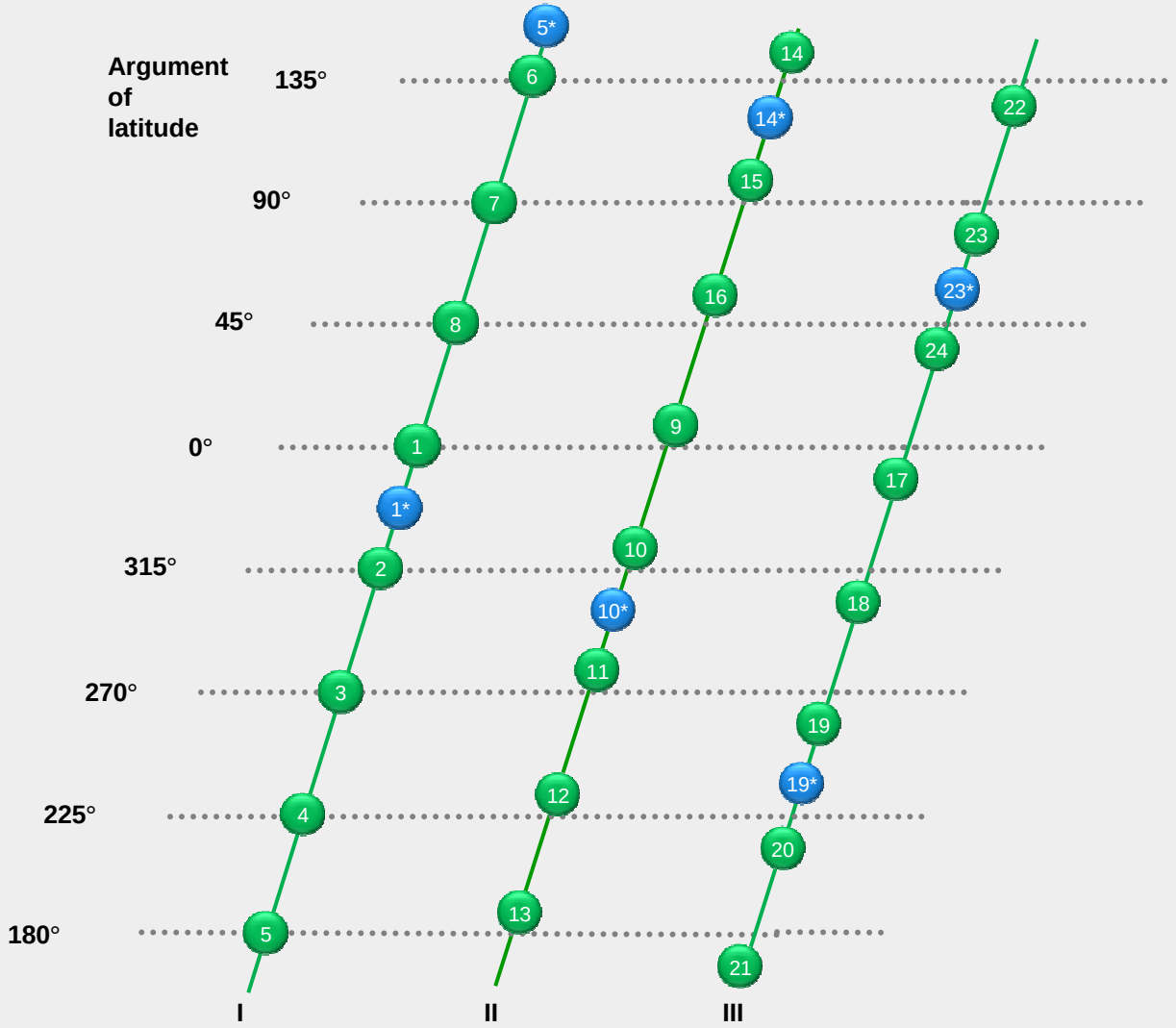
Phase Centers of antennae transmitting navigation CDMA signals and LRR phase centers are in the axis which passes through the S/C CoG and directed to the Earth

GLONASS Constellation Replenishment Program

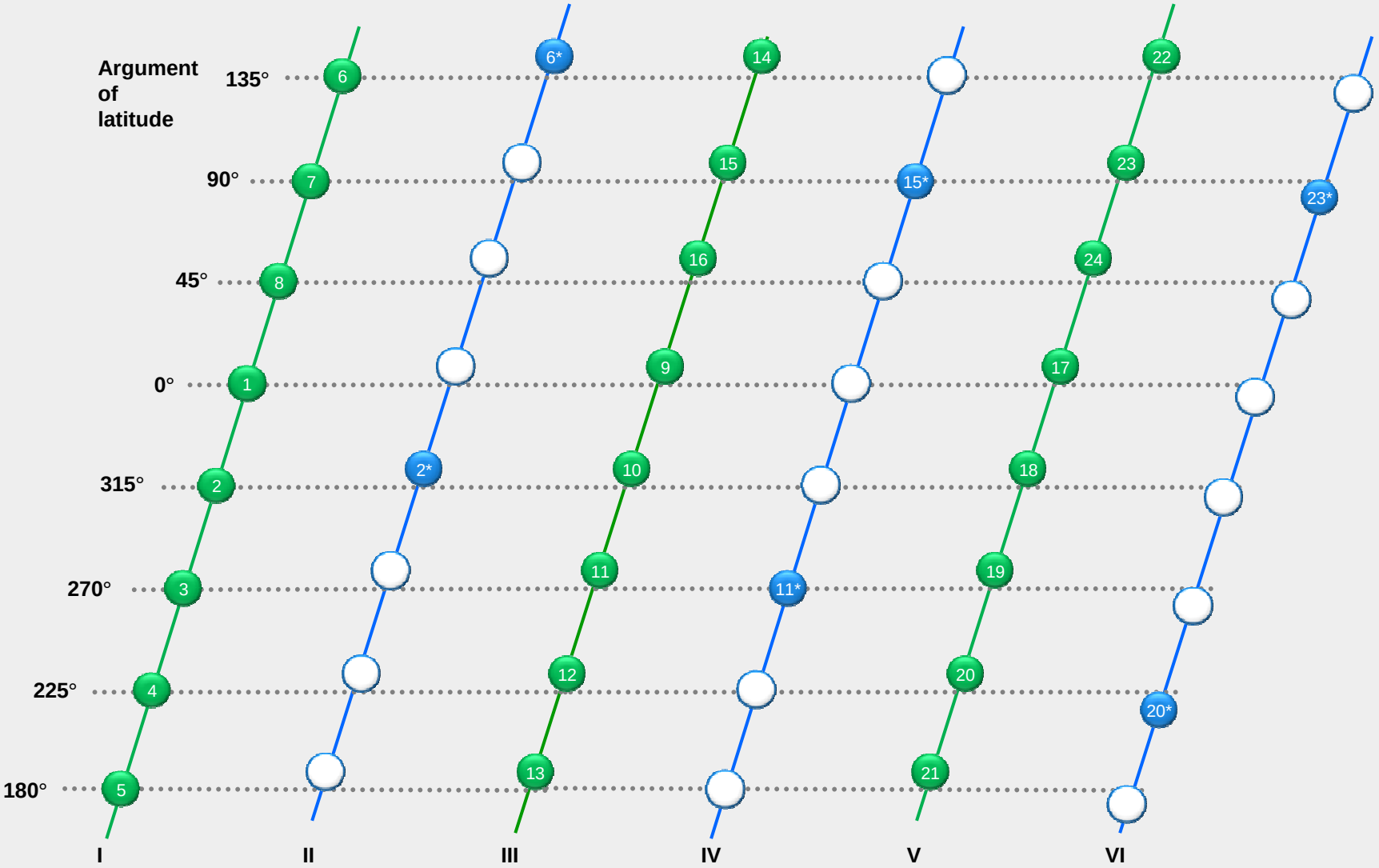
Launch schedule for 2013-2015

	2013				2014				2015			
Total number of S/Cs	29	29	30	29	29	29	26	26	26	27	27	27
S/Cs under flight test				1	1	1	1	2	2	2	2	2
				M51	M52	M53 M54 M55		$K_1$12Л	M56 M57 M58	M59	M60	M61
												
	47c	48		48c	49c	50		K2c	51	52c	53c	54c

30-satellite GLONASS Constellation with 24 Satellites in nominal positions and 6 Satellites Positioned in between Slots



30-satellite GLONASS Constellation with 24 Satellites in nominal positions and 6 Satellites Positioned in Additional Planes



Thank you for your attention!

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