



ROSCOSMOS

**STATUS AND PROSPECTS OF THE RUSSIAN PPP
SYSTEM FOR HIGH-PRECISION DETERMINATION OF
NAVIGATION AND EPHEMERIS-TIME INFORMATION**

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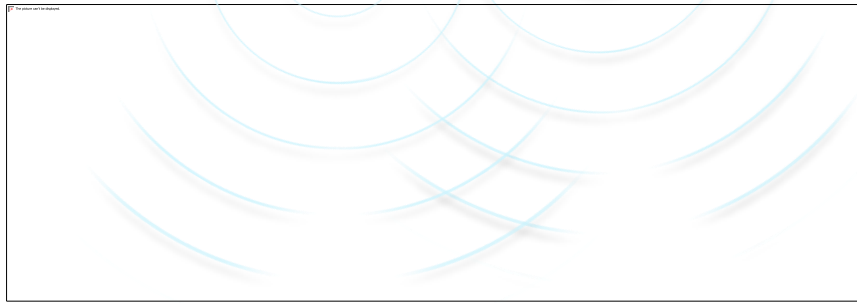


**28 OF JUNE, 2019
FIJI**

GLOBAL NAVIGATION SATELLITE SYSTEMS SERVICES



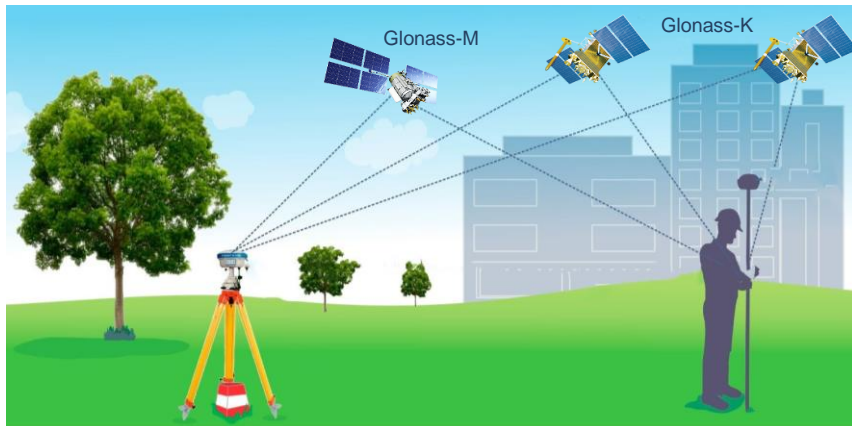
1 BASIC SERVICE



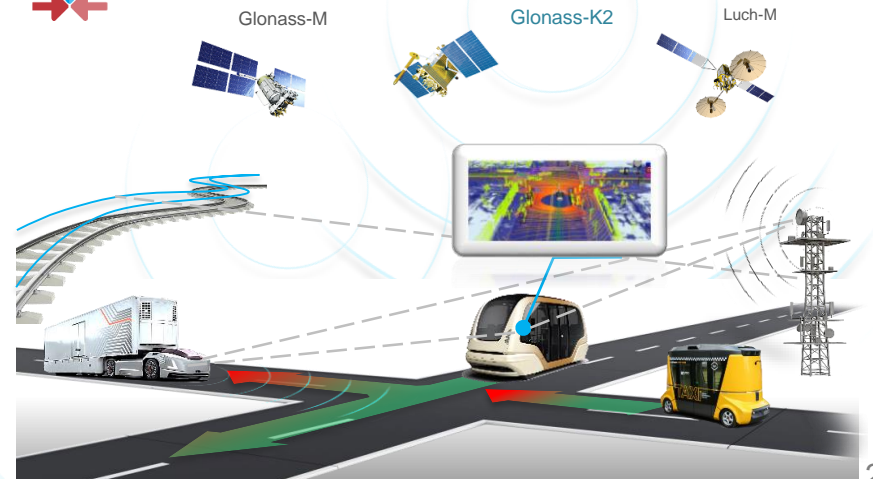
2 RELIABILITY AND ACCURACY IMPROVEMENT SERVICE



3 RELATIVE NAVIGATION SERVICE



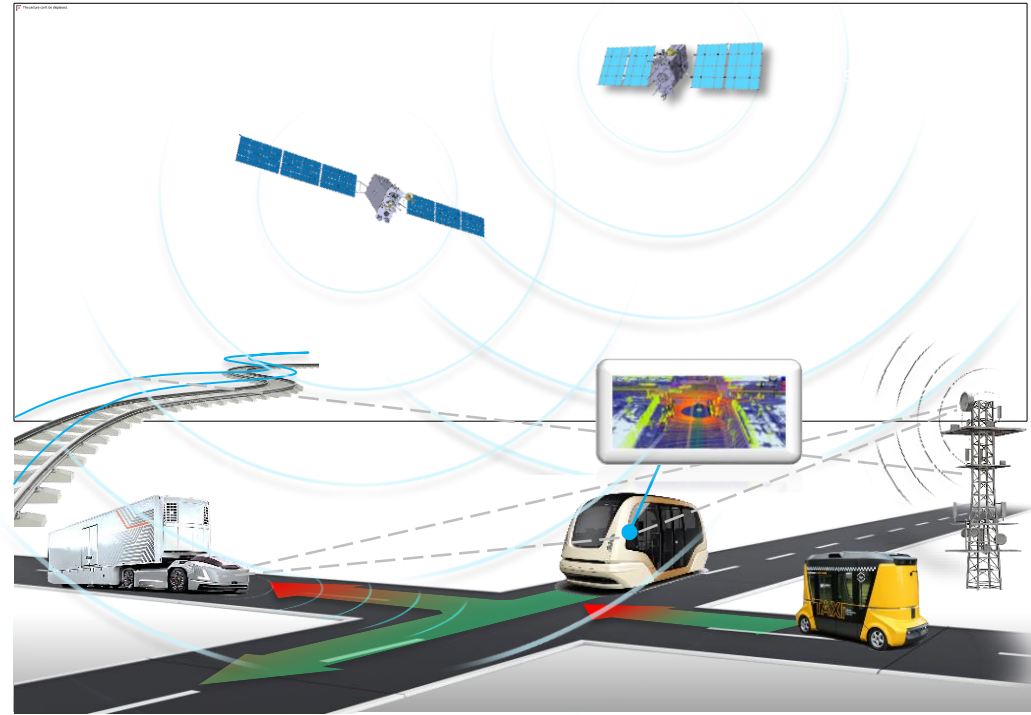
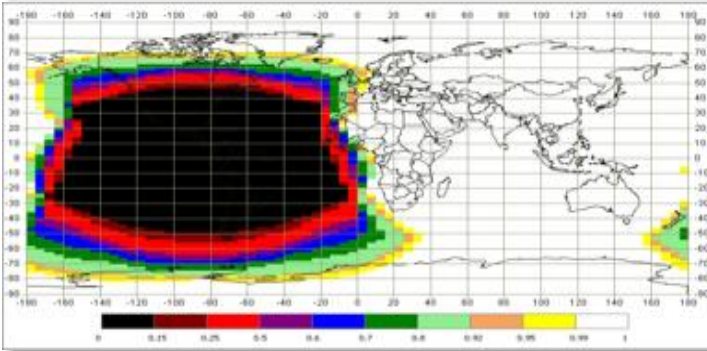
4 HIGH PRECISION SERVICE



Complex observing conditions



Open territory



- ✓ Convergence time reduction
- ✓ Integration in portable devices

Error

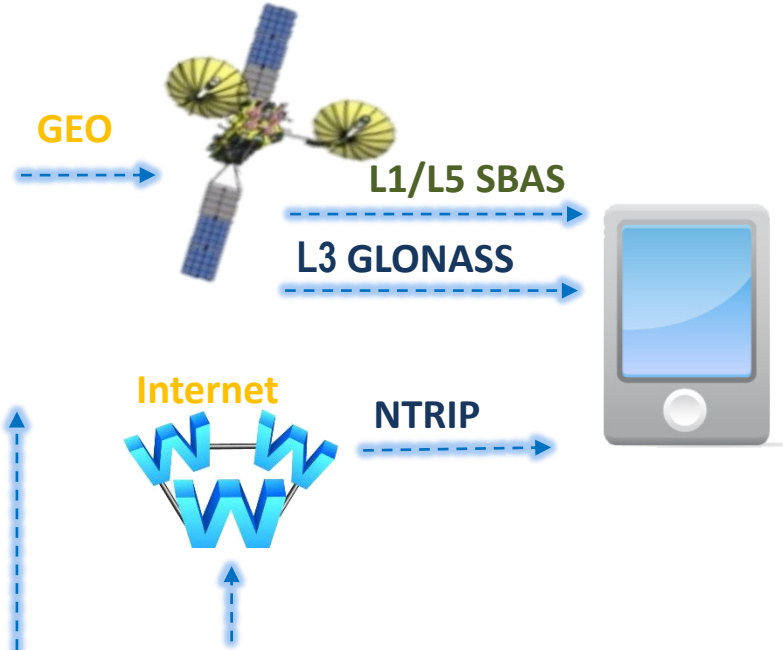
by 2030
up to 0.04 m

Availability increase

by 2030
up to 100 % (Russia)

HIGH-PRECISION SERVICE AUGMENTATION ARCHITECTURE

DATA TRANSFER FACILITIES



GNSS CONSTELLATION



DATA PROCESSING SYSTEM

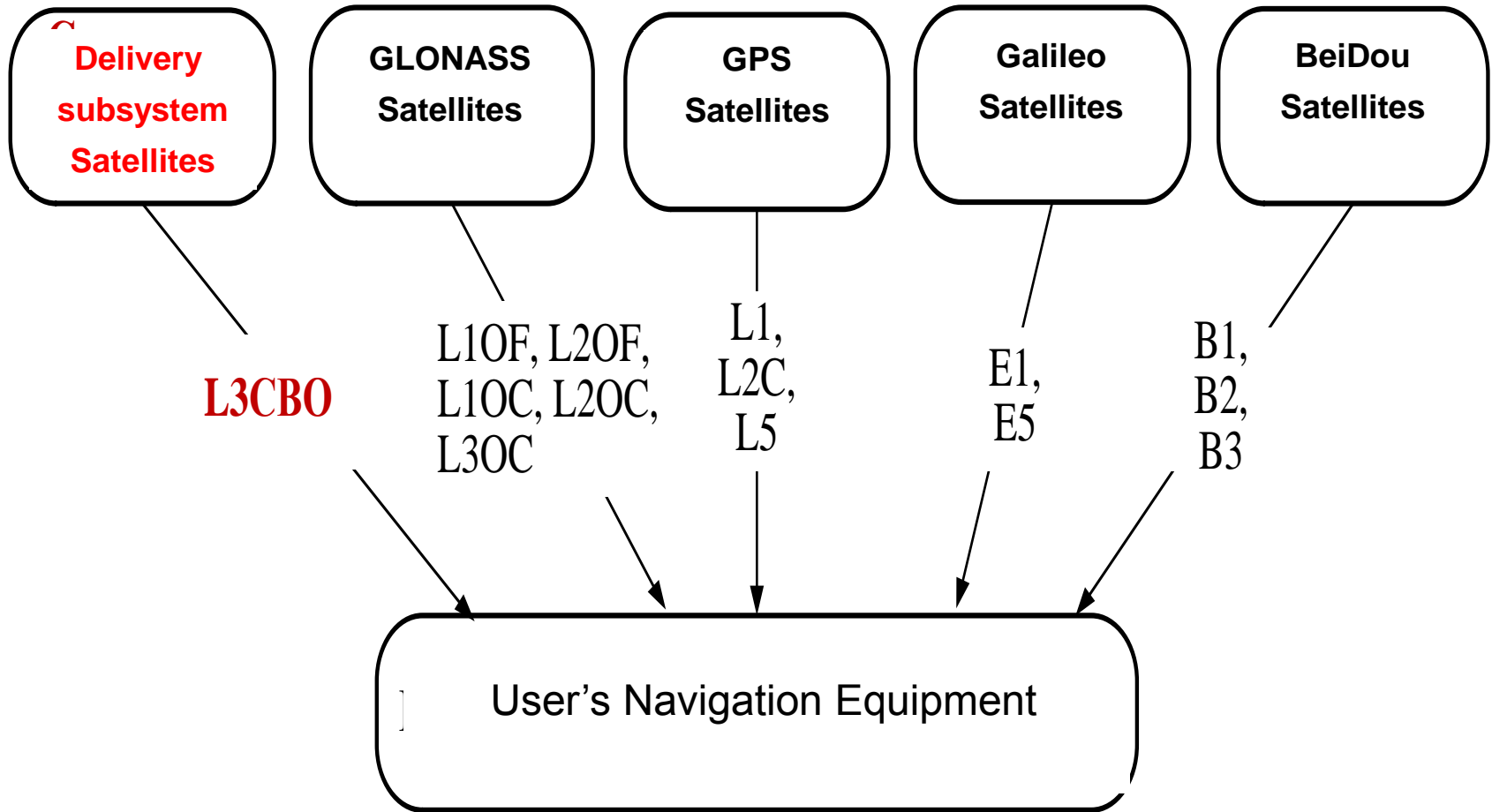
- Master Center
- Standby Center



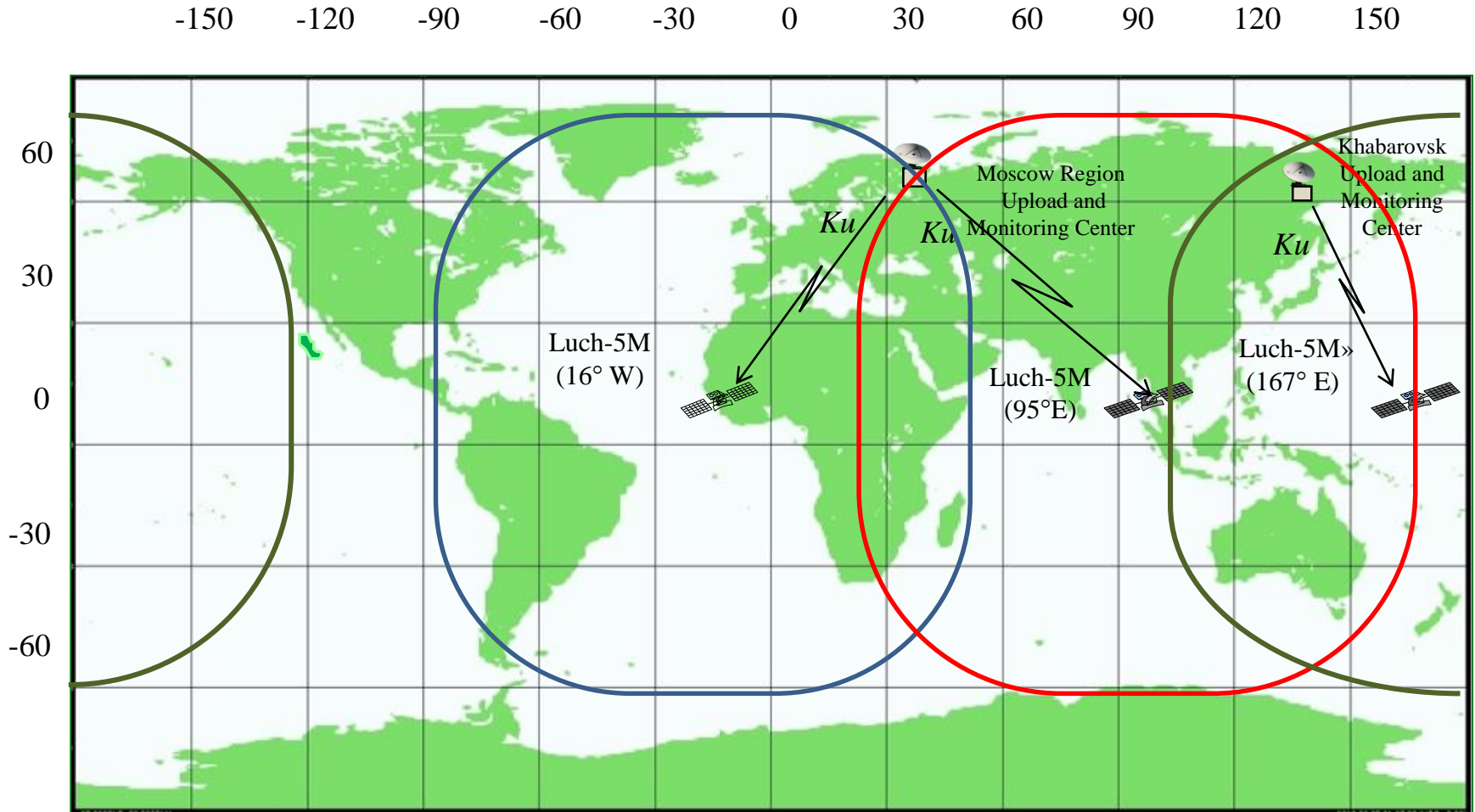
GLOBAL MONITORING NETWORK



GNSS FREQUENCIES AND SIGNALS



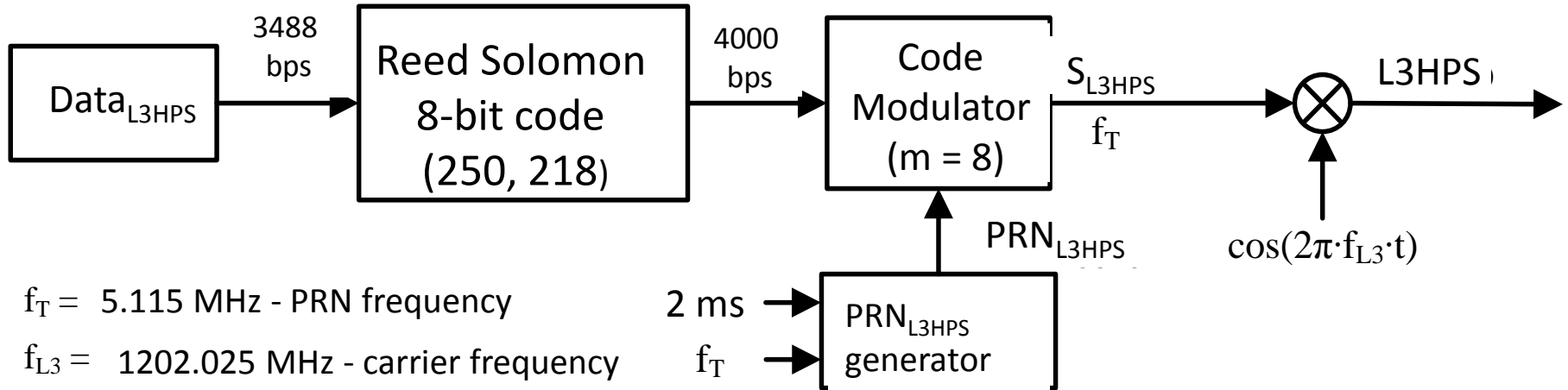
SERVICE COVERAGE AREAS



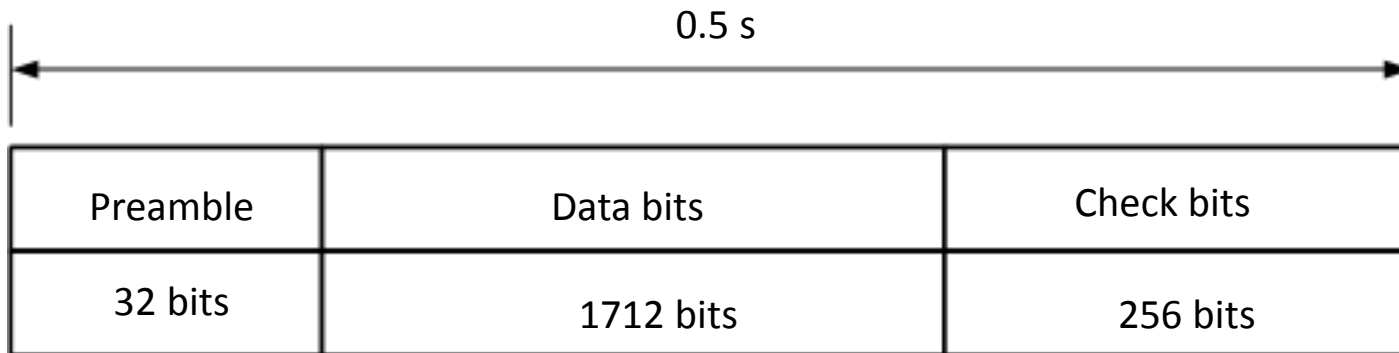
Depend on the GEO Luch-5M SC coverage area



L3 SIGNAL STRUCTURE FOR DATA TRANSMISSION



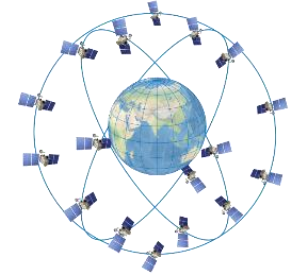
The information of the System for High Precision Determination of Ephemeris and Time Information(HPS) is converted into blocks having duration of 0.5 s and consisting of 2000 bits in length



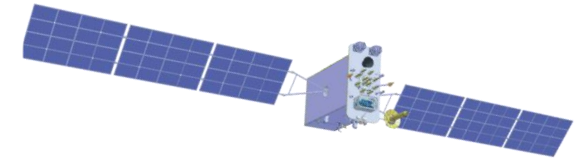
Data transmission rate: $R = 3424 \text{ bps}$



SERVICE SPECIFICATIONS



	PPP	PPP-AR	SSR-RTK
Satellite orbits	✓	✓	✓
Satellite clocks	✓	✓	✓
Code biases	x	✓	✓
Phase biases	x	✓	✓
Ionospheric delay	x	x	✓
Tropospheric delay	x	x	✓



Basic PPP service implemented

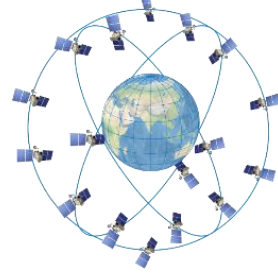


Reference frames: PZ90.11, WGS84, GTRF, CGCS2000



Time scales: UTC(SU), GPS Time, GST, BDT

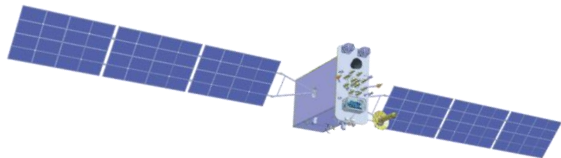


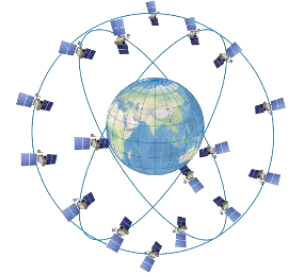


GNSS	Type of data transmitted	RTCM message numbers	Number of Nav SVs	Bytes	Data update time, s
GLONASS	Orbit corrections	1063	24	417	10-30
	Nav SV code biases corrections	1064	24	239	5-10
	Nav SV phase biases corrections	-	24	239	5-10
GPS	Nav SV orbit corrections	1057	32	555	10-30
	Nav SV code biases corrections	1058	32	319	5-10
	Nav SV phase biases corrections	-	32	319	5-10
BeiDou	Nav SV orbit corrections	1258	35	719	10-30
	Nav SV code biases corrections	1259	35	347	5-10
	Nav SV phase biases corrections	-	35	347	5-10
Galileo	Nav SV orbit corrections	1240	30	529	10-30
	Nav SV code biases corrections	1241	30	300	5-10
	Nav SV phase biases corrections	-	30	300	5-10

SERVICE TARGETED ACCURACY GOALS

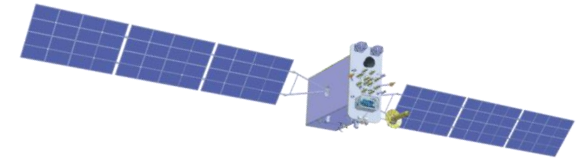
Performance	2020	2030
Positioning error in the State geocentric reference frame through the space segment with augmentations in real time with primary initialization (of meters)	0.09	0.04





Trial operation (by 2020)

Data transmission through ground links with authenticated access to the data (positioning error: **0.09 m**)



Commercial use (by 2030)

Data transmission through space links with data coding (positioning error: **0.04 m**)



RECOMMENDATIONS FOR DEVELOPMENT AND HARMONIZATION



Create a joint Target Group Subgroup within ICG-14 (we are ready to chair the group/subgroup)



Generate unified templates containing data on PPP service providers and publish those templates at the ICG site



Define unified terms and definitions describing the PPP services



Establish unified standard requirements for assessment and monitoring of performance for PPP service providers



Workout a roadmap for the activities aimed at interoperability and compatibility of PPP service providers

Thank you for your attention!



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