



# **ANGOLA-RUSSIA COOPERATION IN THE DEVELOPMENT OF GNSS MONITORING GROUND STATION: CAPACITY BUILDING FOR ANGOLAN SPECIALISTS**

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# SUMMARY



**NATIONAL SPACE STRATEGY AND ORGANIZATION**



**CAPACITY BUILDING AND INFRASTRUCTURE**



**COOPERATION FOR INSTALLATION OF GLONASS  
GROUND STATION**



- ❑ Presidential Decree No. 101/13 of 9 October, which establishes the Interministerial Commission for the General Coordination of the National Space Program (PEN);
- ❑ National Space Strategy for 2016-2025, approved by Presidential Decree No. 85/17 of February 22, 17;

Angola and Russia cooperation:

- ❑ ANGOSAT project – communication satellite
  - ❑ The creation of national capacity in terms of space segment – **in progress**;
  - ❑ The creation of national capacity in terms of ground segment – **concluded**;
  - ❑ The creation of national capacity in terms of human resources – **in progress**.
- ❑ Memorandum of Understanding between the Republic of Angola and Russia Federation for Use of Outer Space for Peaceful Purposes, April 2019.

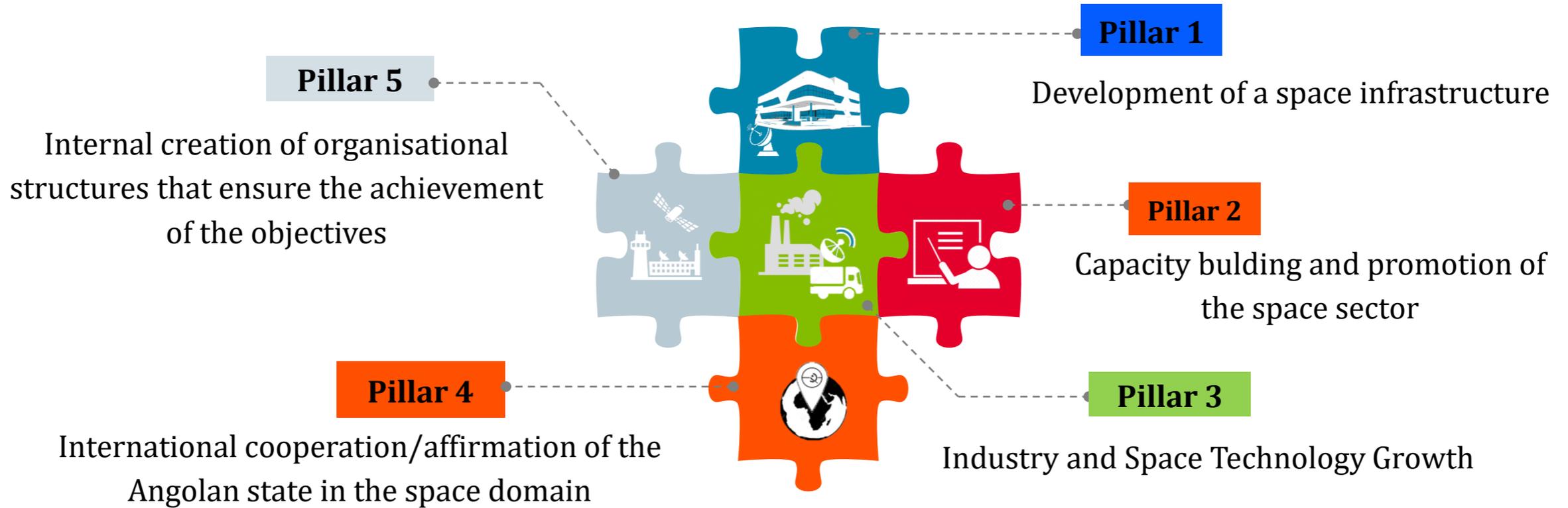
Interministerial Commission for  
PEN – coordinated by Ministry of  
Telecommunications and  
Information Technologies

National Office for Space Affairs

Government and social Contracting  
Authorities



# NATIONAL SPACE STRATEGY AND ORGANIZATION





## Capacity building and infrastructure

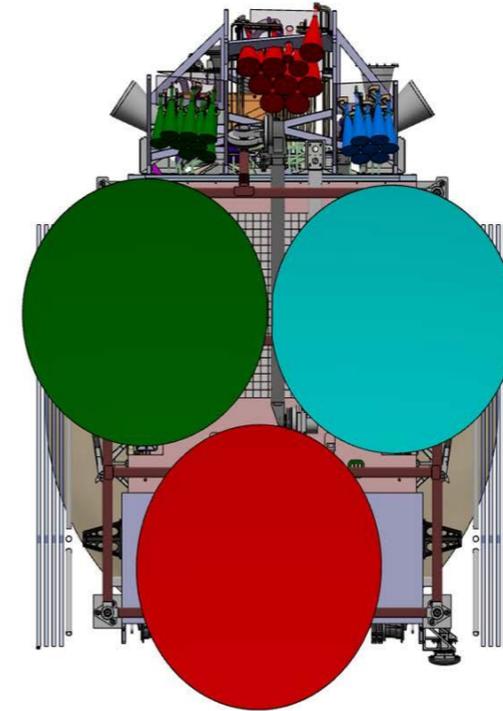
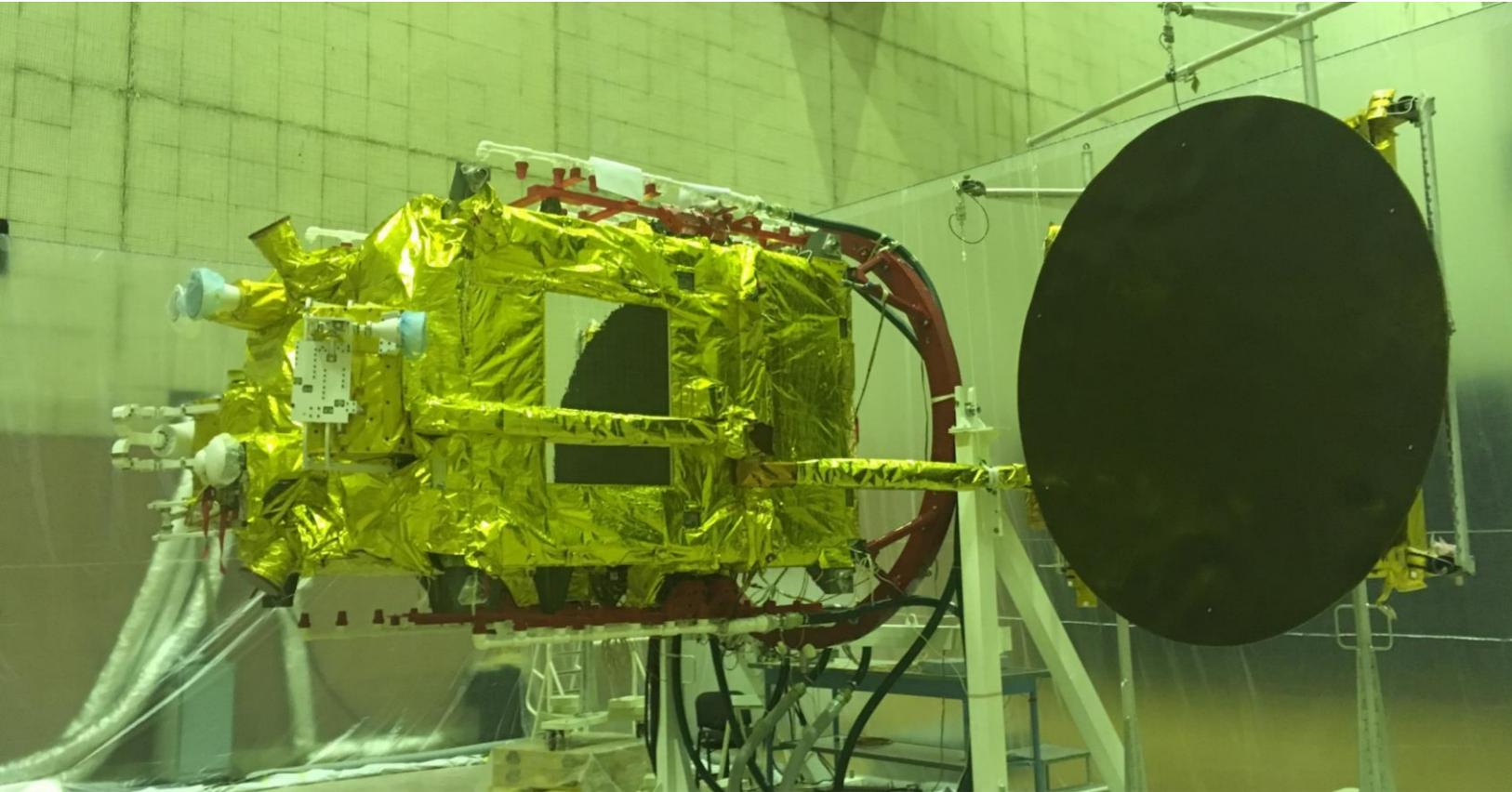
# SATELLITE MISSION CONTROL CENTER AS AN INFRASTRUCTURE FOR GNSS

## Ground infrastructures of the space program...

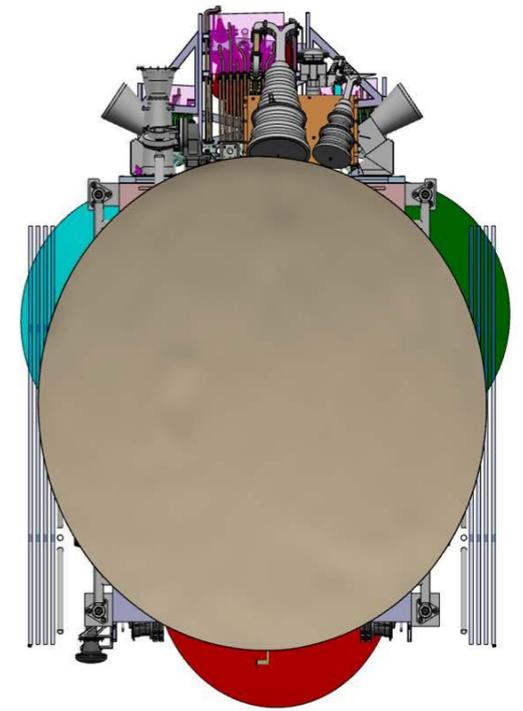


# ANGOLA COMMUNICATION SATELLITE

**Deliver broadband services... transfer of knowledge...**



East (PY)

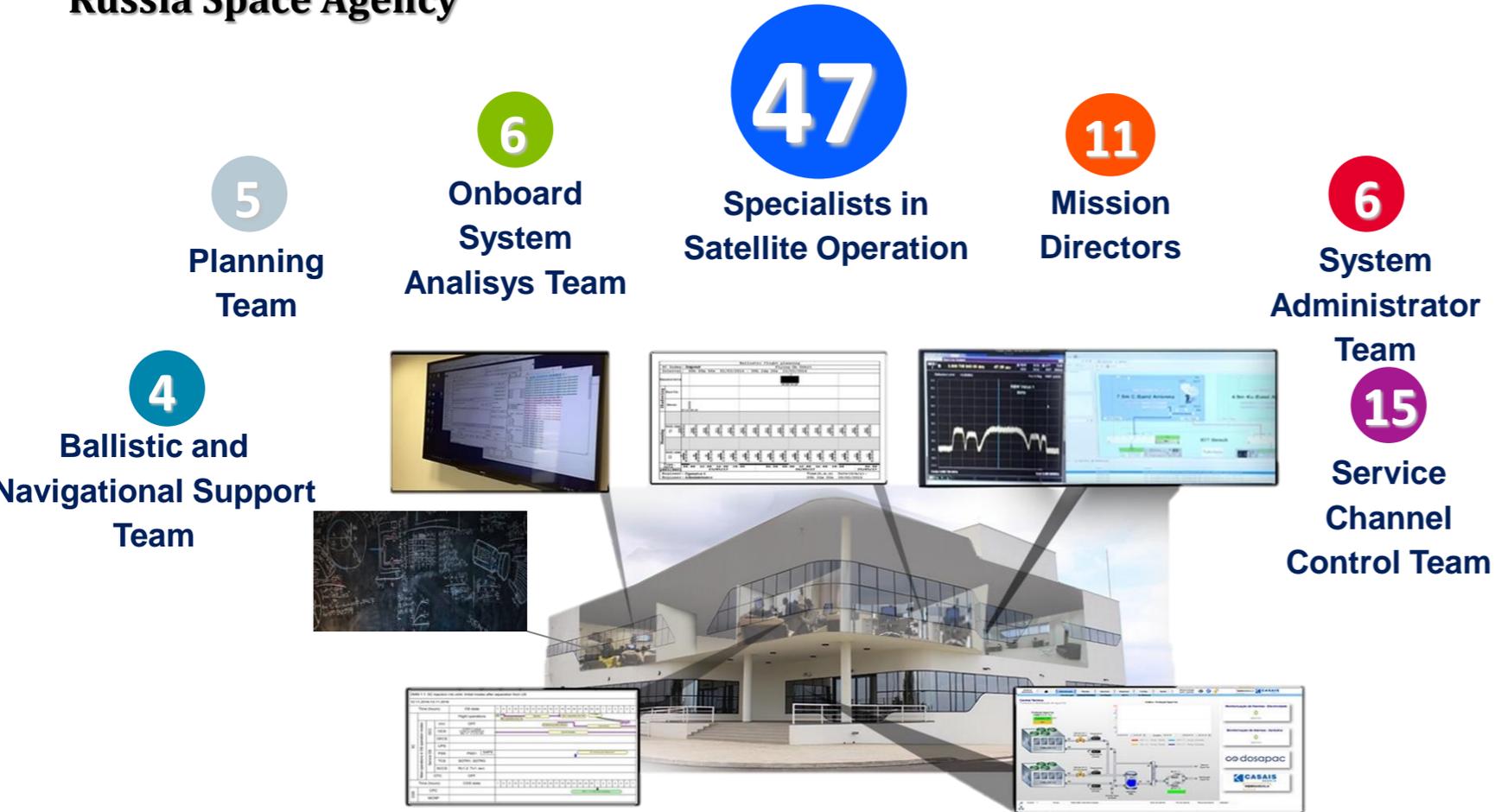


West (MY)

**High-throughput satellite to be launched in 2021**

# CAPACITY BUILDING TO OPERATE SATELLITES

Certified by ROSCOSMOS –  
Russia Space Agency



## SMALL SATELLITE AND SPACE EDUCATION: HETPSAT

- Introductory Course in Small Satellites was offered in June 2018.
- The objective of the course, was to train lectures from different institutions by **using the Small Satellites (HEPTASAT Platform)** in the field of engineering and space technology. **The training was provided by the specialists that were trained by the RSC Energia and certified by the ROSCOSMOS.**



- **26 universities;**
- **48 the total trained**

# SMALL SATELLITE AND SPACE EDUCATION: ANGOLA CANSAT

CANSAT is being used in local educational institutions for academic purposes.



- **30 universities;**
- **30 students participated on the assembly, integration and training**
- **116 the total trained students.**

**Drop from the helicopter with parachute,  
altitude 500 to 400 m**



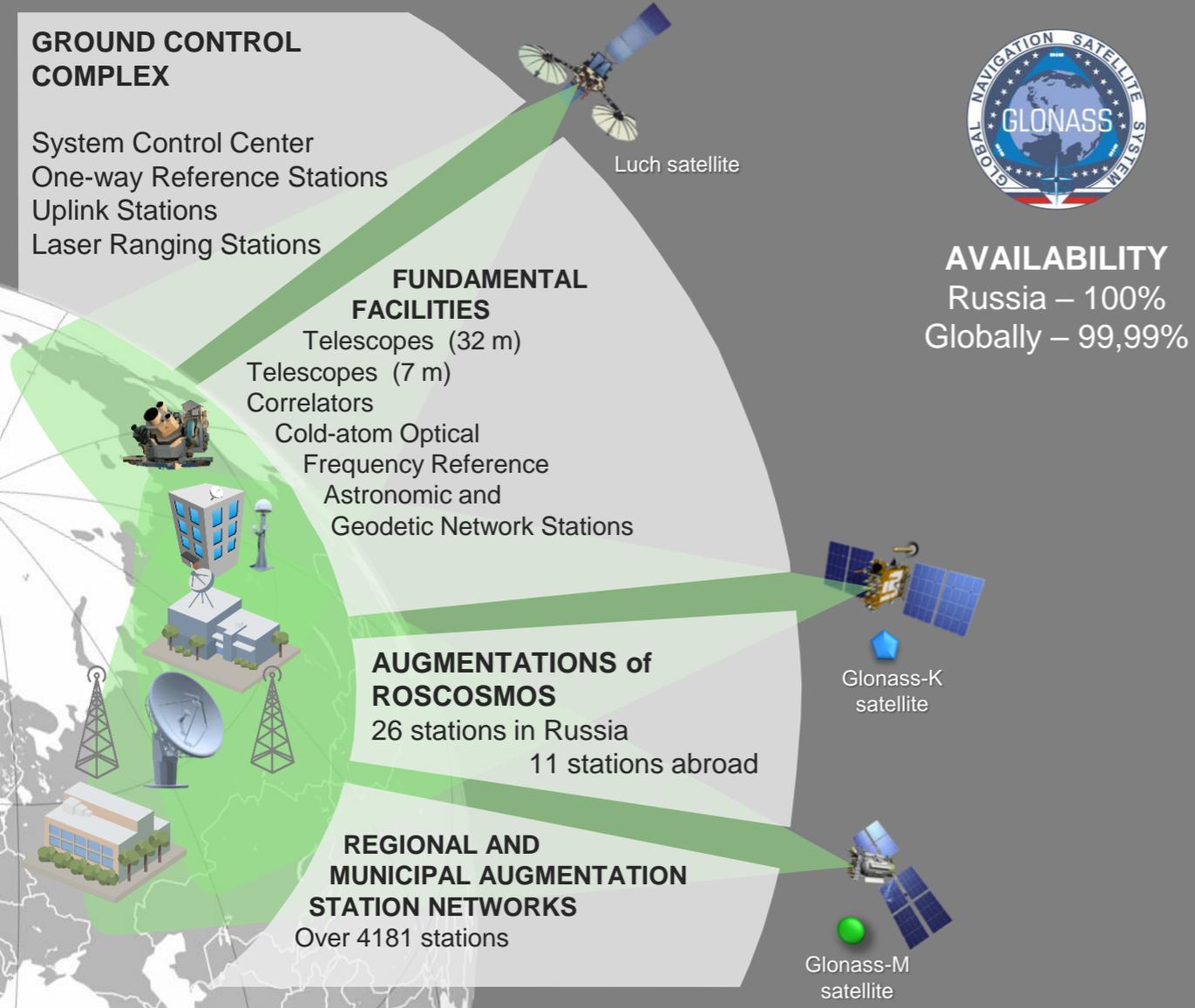
**Telemetry reception. measurements: wind speed; temperature;  
carbon monoxide; photographs; videos and etc.**





## Cooperation for installation of GLONASS ground station

# GLONASS STATUS (as of 10.01.2019)



Satellites in orbit	MEO	GEO
<b>In total</b>	26	3
Operational	23	2
Under commissioning	0	
Maintenance	1	1
Orbital spare	1	
Flight testing	1	

The constellation provides global continuous navigation, source Roscosmos

# APPLICATIONS OF PRECISE POSITIONING AND HIGH-ACCURACY NAVIGATION

IN ANGOLA

## MARITIME TRANSPORT AND FISHING

Monitoring of vessels,  
safe port entries



## LAND SURVEY AND MAPPING

Field works  
automatization,  
compliance with requirements of  
high and ultra-high accuracy



## OIL & GAS, POWER SYSTEMS, COMMUNICATIONS

Oil & gas exploration,  
power networks synchronization,  
optimization of the data traffic,  
increase of the data  
exchange rate



## FORESTRY

Precise estimation  
surveys



## AGRICULTURE

Precise farming  
(inventory, fertilization)



## MINING, CONSTRUCTION, ROAD BUILDING

Structural integrity monitoring,  
seismic and landslide monitoring,  
precision construction



## TRANSPORT

Transport safety,  
intelligent transport systems,  
usage-based insurance



# COOPERATION – ALLOCATION OF RUSSIAN GNSS-MEASUREMENT STATION



Location: **Luanda, Angola**

**Fiji**

Receiving measurement data from the station Angola will be able to use it for development of a national precise positioning and navigation system for many different applications.

# ALLOCATION OF RUSSIAN GNSS-MEASUREMENT STATION

Site and facilities requirements	
Radio visibility zone obstacles	No more than 5° of the elevation angle for all azimuthal directions
Multipath effect	No reflection sources in the radio visibility zone
Basement	Pillar/tower on a metal platform mounted to a load carrying elements on the roof of the building
Pillar height, number	from 1.5 to 2.5 m
High-frequency cable to GNSS receiver	Up to 60 m, inside the cable conduit, separately from the power cables
Temperature at the premises	+5 °C ÷ 40 °C
Humidity at the premises	not to exceed 80 %
Room space	at least 6 m <sup>2</sup> + space for spare parts
Power supply	220 V, 50 Hz
Power consumption	not to exceed 60 W
Communication links	2 independent Internet-links of at least 256 kb/s, VPN-connection
Extra training for staff is not required, station operates autonomously. Periodic visual control of operation and maintenance are required.	



## Station components

- ✓ GNSS antenna;
- ✓ GNSS signals receivers;
- ✓ Equipment for data preprocessing and transfer (computers, Ethernet commutation switches, routers);
- ✓ Uninterruptible power supply equipment.



## Types of navigation signals supported by the Station, characteristics

GLONASS (L1), MHz	$1602 + n \cdot 0,5625$ ;
GLONASS (L2), MHz	$1246 + n \cdot 0,4375$ ,
	where n varies from -7 to +12;
GLONASS (L3), MHz	1202,025
GPS (L1), MHz	1575,42
GPS (L2), MHz	1227,60
GPS (L5), MHz	1176,45
GALILEO (E1), MHz	1575,42
GALILEO (E5a), MHz	1176,45
BeiDou (B1), MHz	1561,098 (1575,42)
BeiDou (B2), MHz	1207,14

- Measurements of the possible interferences;
- Presidential Decree to protect the zone of the interferences.



Installation and operation a GNSS ground station allows to increase the local accuracy precise point positioning of consumer navigation from units of meters (2-5 m) to tens of centimeters (10-30 cm), and open again an opportunity for capacity building.



Thank You for your attention!!!