



# The Progress of BeiDou Navigation Satellite System

**China Satellite Navigation Office**

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01

**System  
Construction  
and  
Application  
Promotion**

02

**Achievements  
of  
International  
Cooperation**





# **I : ( I ) System Construction**

## **( II ) Application Promotion**



# ( I ) System Construction

## 1. Basic Principles

### Openness

The BeiDou System will offer open services free of charge for global users.

### Independency

Develop and operate BeiDou system independently.

## Basic Principles

### Compatibility

The BeiDou System is devoted to pursue compatibility and interoperability with other navigation satellite systems, and enable users to obtain better services.

### Gradualness

The establishment of BeiDou System follows a stepwise manner in the light of Chinese actual technical and economic conditions.





# ( I ) System Construction

## 2. Development Steps

The BeiDou System has been developing in line with the “three-step” roadmap and the thinking of “from regional to global, and from active to passive” , and forms a development path as region-highlighted, world-oriented, with its own features.

The 1st step:

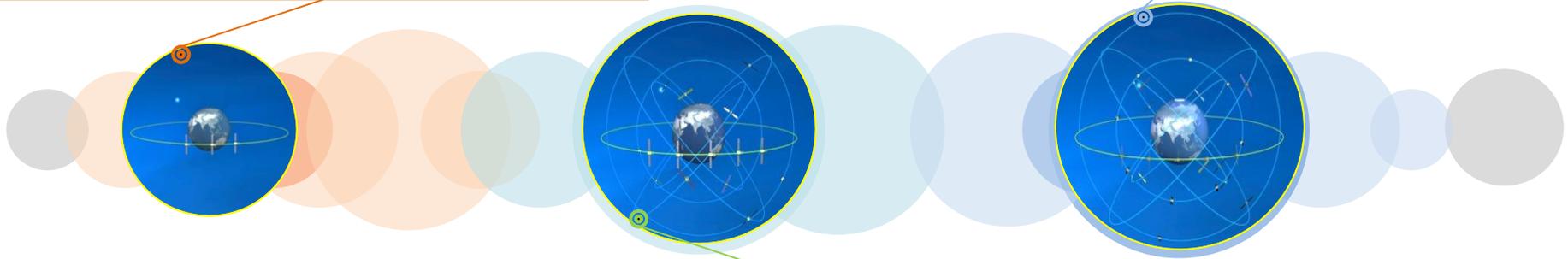
1994~2000, provide regional active services

The 3rd step:

2013~2020, provide global passive services

The 2nd step:

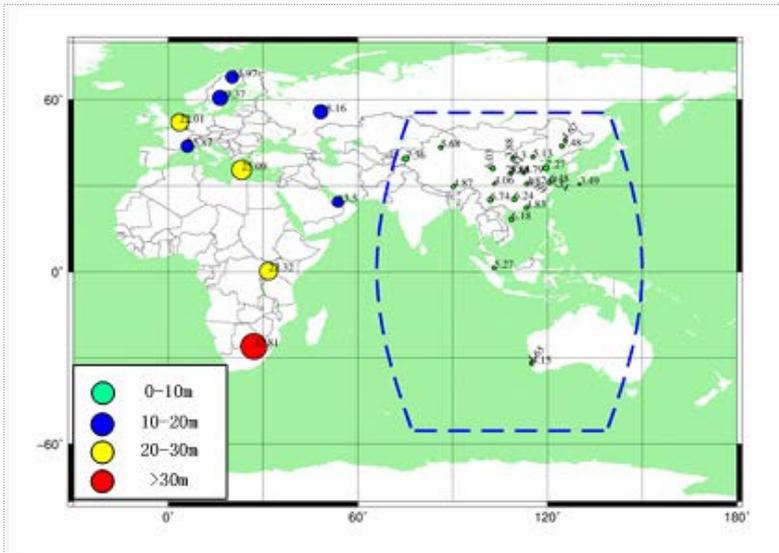
2004~2012, provide regional passive services



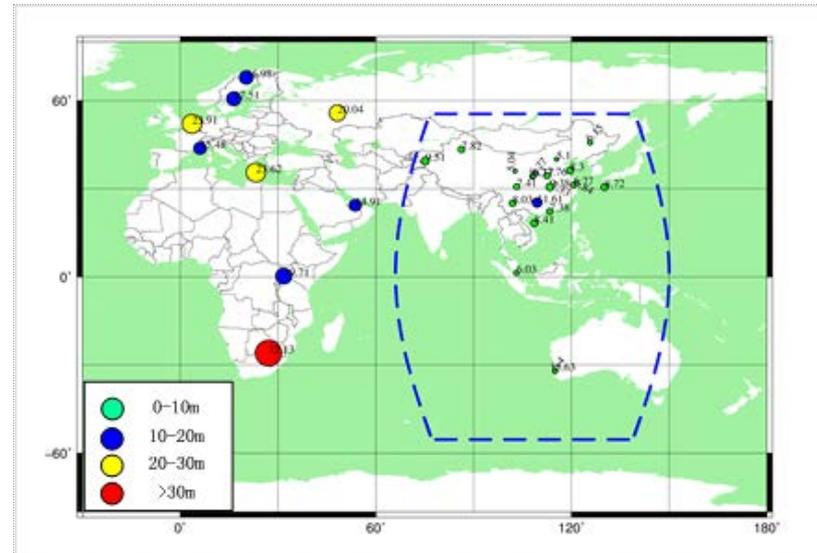
# 》 ( I ) System Construction

## 3. Steady Improvement of the BeiDou System Performance

Since formal regional services provision on December 27 2012, the BeiDou System has maintained continuous and stable operation, and the performance has been steadily improved. The performance meets the specification and the accuracy of positioning is better than 10m in some of the coverage area.



B1I 平面定位精度



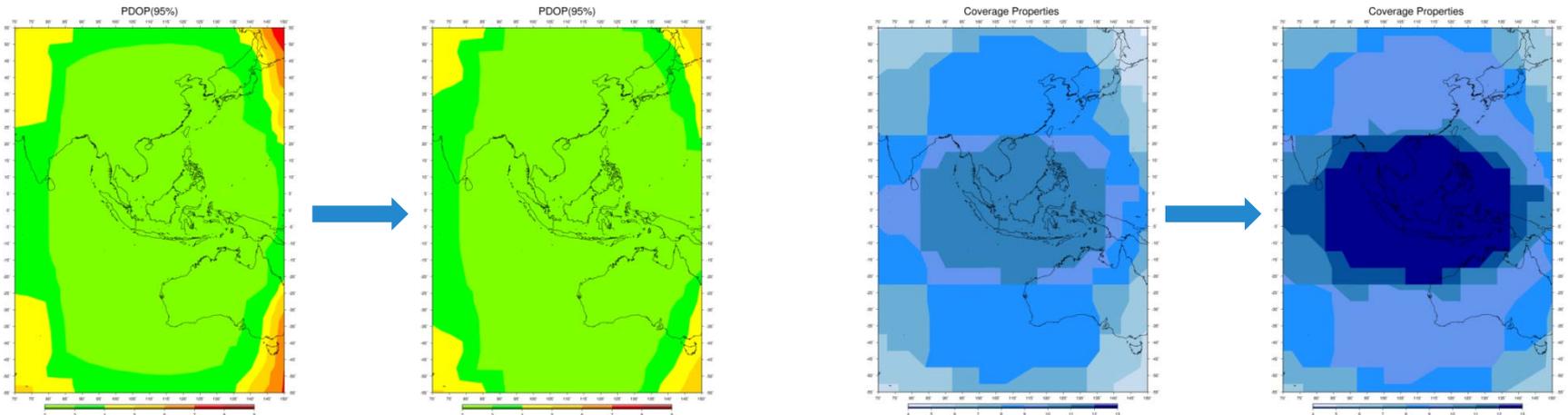
B1I 高程定位精度



# 》 ( I ) System Construction

## 3. Steady Improvement of the BeiDou System Performance

After two IGSO satellites were successfully launched, the average PDOP ( 95 percent ) decreases from 3.07 to 2.84 and the average minimum number of visible satellites increases from 7.0 to 8.3 in the coverage area of the BeiDou System ( 55 degree South Latitude~55 degree North Latitude , 70 degree East Longitude~150 degree East Longitude ) , which further improves the reliability and the performance of the BeiDou System .



# 》 ( I ) System Construction

## 4. “Five Satellites” Make Great Steps on the Deployment of Global Constellation

Since 2015, five new-generation BeiDou satellites have been successfully launched. The advanced signal structure, inter-satellite link, on-board clock with higher accuracy and other key system and technology have been verified. After intra-system technical state is coordinated, five new-generation BeiDou satellites will provide services timely; it will also further enhance the solidity of BeiDou system constellation, improve the ability of system services, and establish a solid foundation for global service.



2015.3.30



2015.7.25



2015.9.30



2016.2.01

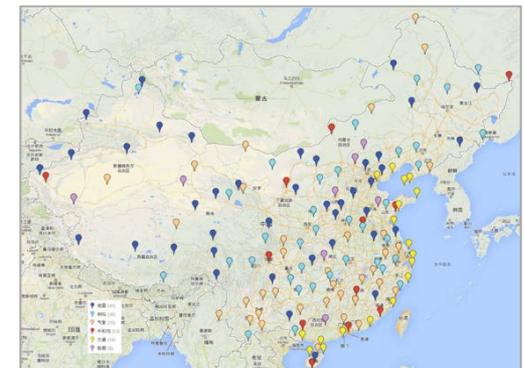


# 》 ( I ) System Construction

## 5. Steady Construction of Satellite-Based/Ground-Based Augmentation System

### Ground-Based Augmentation System

Accelerate the construction of the National BeiDou Ground-Based Augmentation, and create high-accuracy location platform and special application services. The reference station network covering the whole country has been built, and the construction of the basic system has been preliminarily completed. Meanwhile the positioning accuracy is under test, which includes meter and decimeter level for wide-area real-time services, centimeter level for the areas within Beijing, millimeter level for post-processing services.

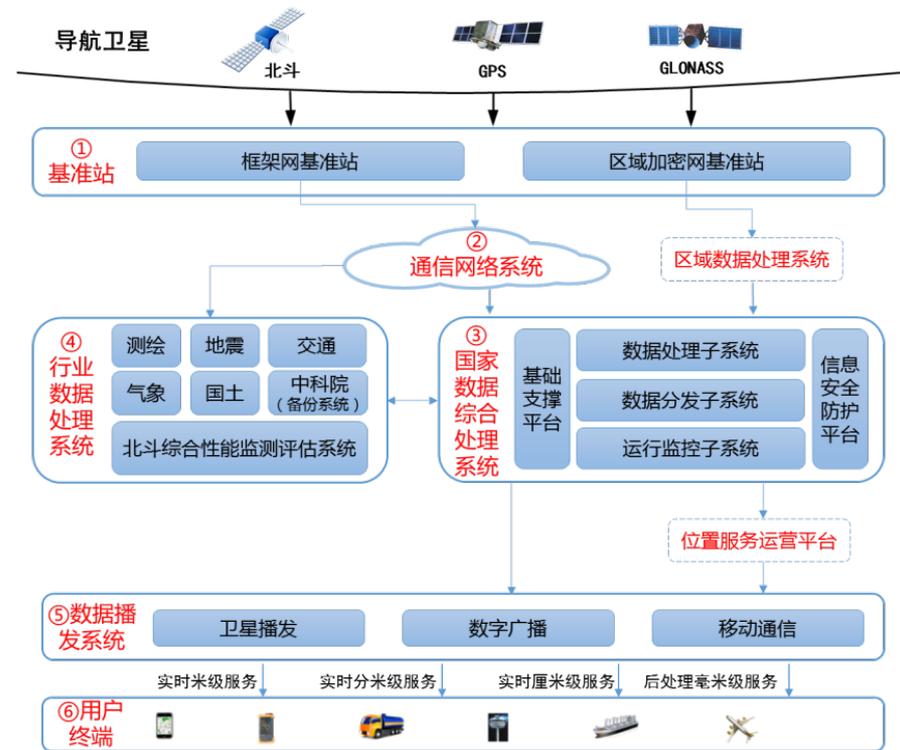


# 》 ( I ) System Construction

## 5. Steady Construction of Satellite-Based/Ground-Based Augmentation System

### Ground-Based Augmentation System

After the system is put into operation, it will provide meter and decimeter level real-time location services for users in China, even centimeter level service in some areas. And lane-level vehicle navigation service based on BeiDou high accuracy service could be realized.

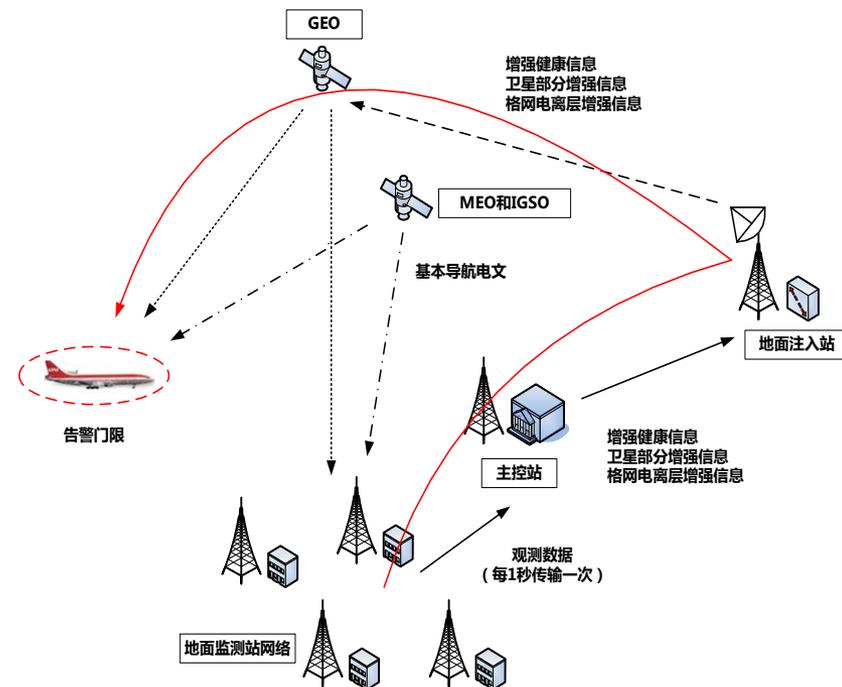


# ❧ ( I ) System Construction

## 5. Steady Construction of Satellite-Based/Ground-Based Augmentation System

### Satellite-Based Augmentation System

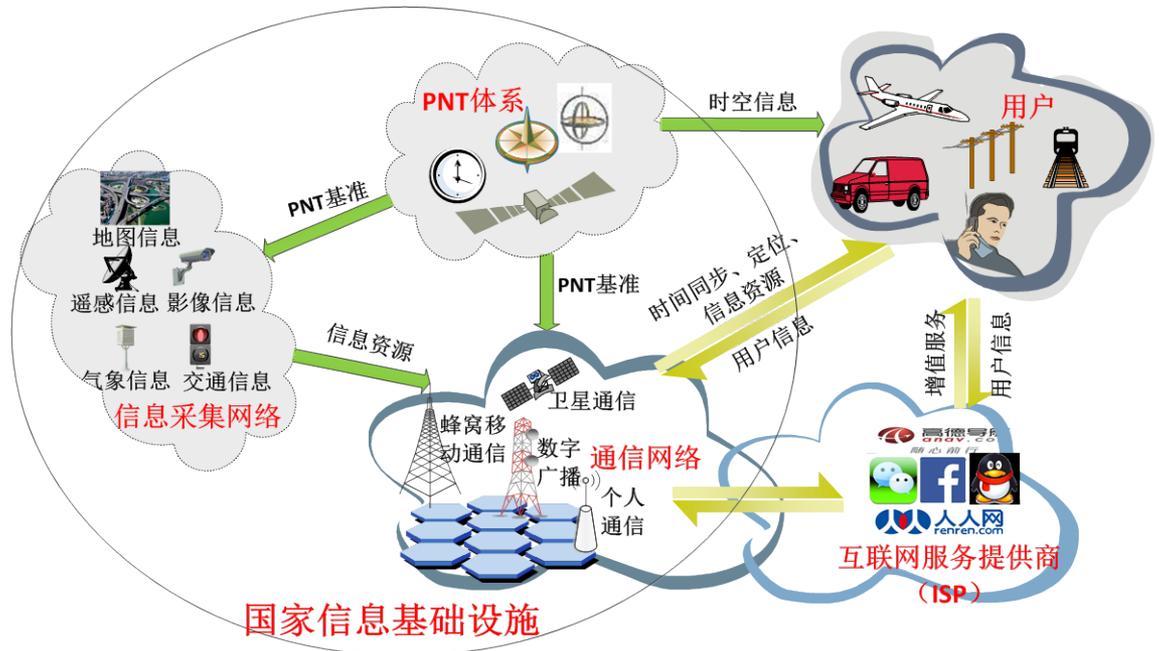
The BeiDou System will comply with the international civil aviation standards, carry out the design, validation and construction of BeiDou Satellite-Based Augmentation System (BDSBAS), and provide CAT-I services to civil aviation users in China and surrounding areas. At present, the BeiDou System is participating actively in the design and international coordination of the next-generation Double Frequency Multiple Constellation (DFMC) SBAS Standards.



# 》 ( I ) System Construction

## 6. Beginning of National Integrated PNT System Constructing

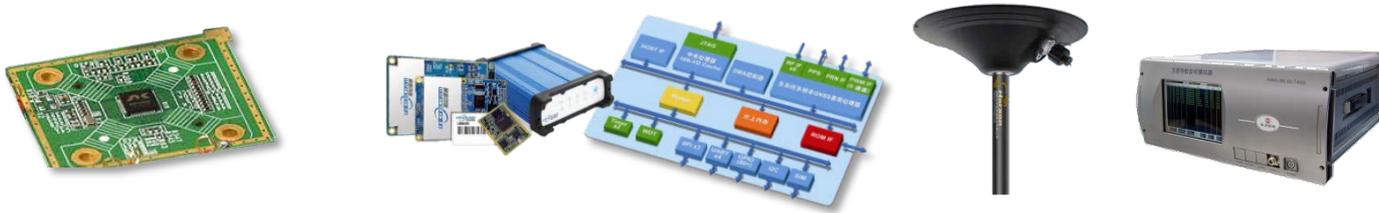
Satellite navigation system has some blind areas in deep spaces, indoor spaces and underwater spaces. In order to compensate it and meet the needs of economic and social development , the cornerstone of BeiDou system is being reinforced. At the same time, national PNT system is being demonstrated, and some related technology research is being carried out.



# 》 ( II ) Application Promotion

## 1 . Upgrade of Fundamental Products

BeiDou fundamental products have achieved self-control and quality and quantity upgrading in 2015. BeiDou chips have entered a new era of 40-nanometer, and achieved a jumped upgrade from basic products to high-end industry.



- BDS/GNSS navigation chip/module, surpass 24 million pieces
- high-precision surveying boards, approximately 120, 000 sets
- navigation antenna, 4 million pieces
- high-precision antenna, surpass 500,000 pieces
- satellite navigation IP core used in mobile communication, approximately 18 million





# ☞ ( II ) Application Promotion

## 2 . Industrial / Regional Demonstration Applications are Steadily Pushed Forward

### Demonstrations in the Yangtze River Delta Region

Some BeiDou application demonstrations of Smart City, such as vehicle monitoring services, public location services and BeiDou high accuracy positioning service etc., have been conducted, and 80,000 sets of BeiDou terminals have been deployed.



# 》 ( II ) Application Promotion

## 2 . Industrial / Regional Demonstration Applications are Steadily Pushed Forward

11 industrial demonstrations, such as maritime transportation, meteorology, fisheries, public safety, disaster relief and civil affairs , as well as 17 regional demonstrations, like Pearl River Delta, Beijing, Shaanxi, Hunan, Guizhou, Hubei and Jiangsu, are being carried out .



# 》 ( II ) Application Promotion

## 3 . Mass Market Applications Flourished



# 》 ( II ) Application Promotion

## 3 . Mass Market Applications Flourished

With the development of some technologies, such as chip miniaturization, low power, low cost, and RF baseband integration etc., as well as extensive integration of satellite navigation IP core and mobile communications, BeiDou will be fully applied to the mass market and serve the public.



# ▶▶ ( II ) Application Promotion

## 4 . Thrived Development of Industrialization

The state attaches great importance to and promote the development of satellite navigation industry actively. “National medium and long term development program on satellite navigation industry” and “National medium and long term development program on civil space fundamental facility” have been released, which makes the general dispositions in the long term development of satellite navigation industry at the national level.



# ( II ) Application Promotion

## 4 . Thrived Development of Industrialization

“White Paper of China ‘s Satellite Navigation System” will be released , “BeiDou Navigation Satellite Standard System (version 1.0) ” and 17 BeiDou standards have been released, which promote the construction of BeiDou navigation satellite standard system.



## 》 ( II ) Application Promotion

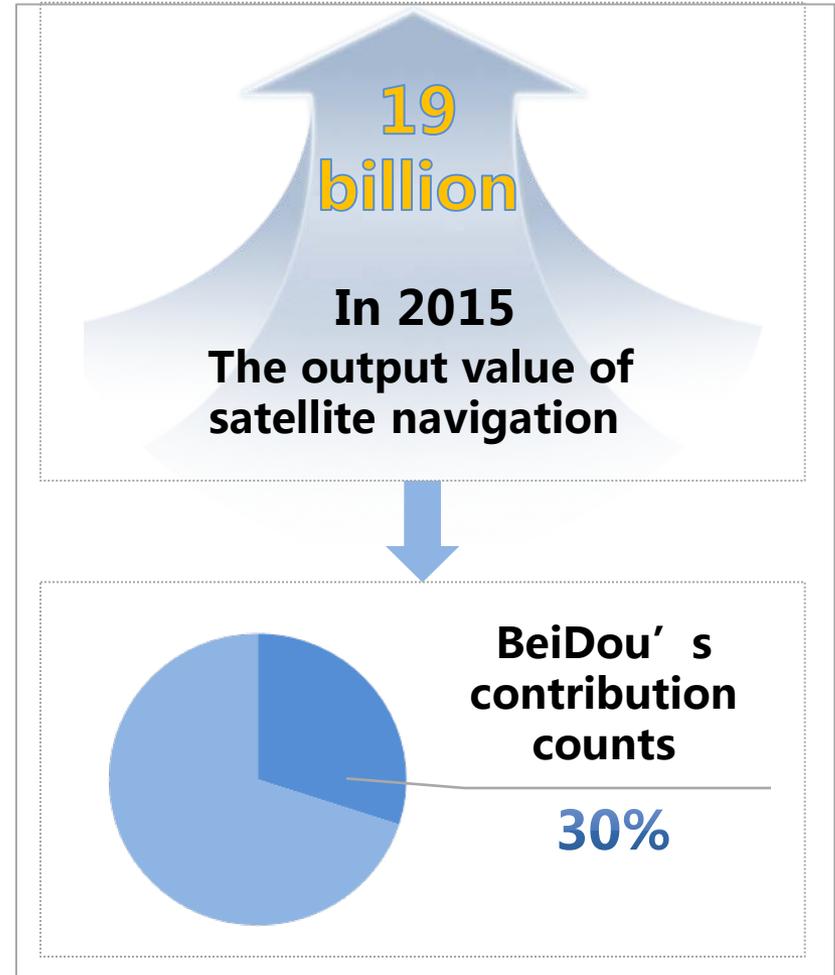
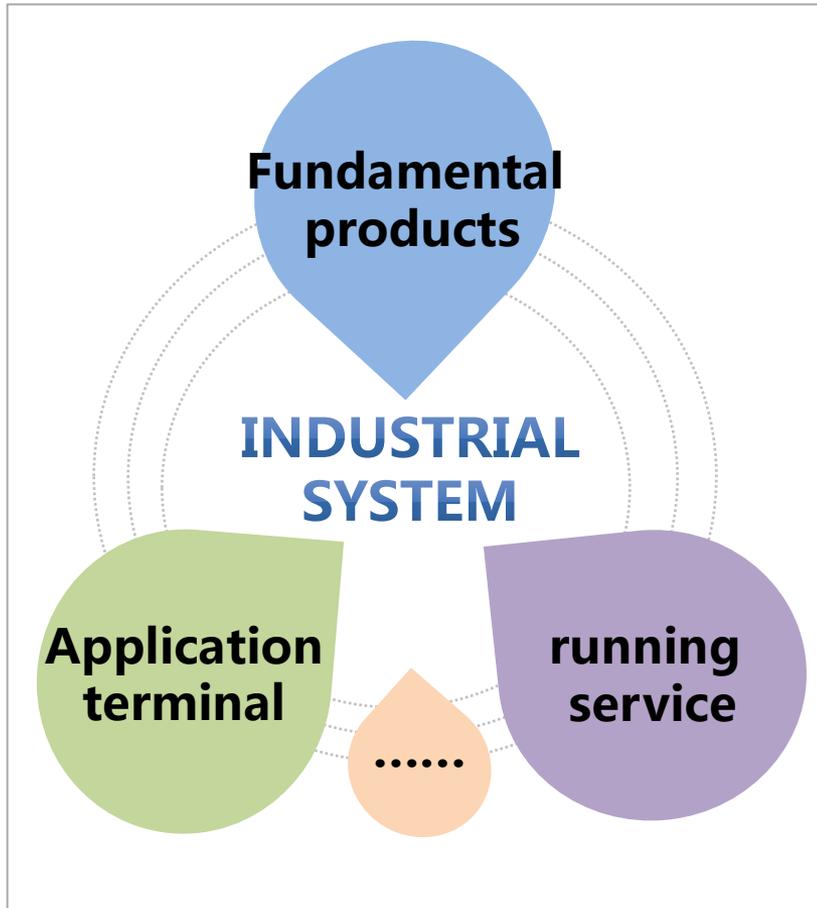
### 4 . Thrived Development of Industrialization

“Legal Rules for BeiDou Navigation” have been listed in the legislation work plan of the state department in 2016, and it will be the first administrative laws and regulations in the field of satellite navigation. It will protect reliable service of BeiDou and improve the level of BeiDou system management.



# 》 ( II ) Application Promotion

## 4 . Thrived Development of Industrialization





# II : Achievements of International Cooperation



# ▶▶ Achievements of International Cooperation

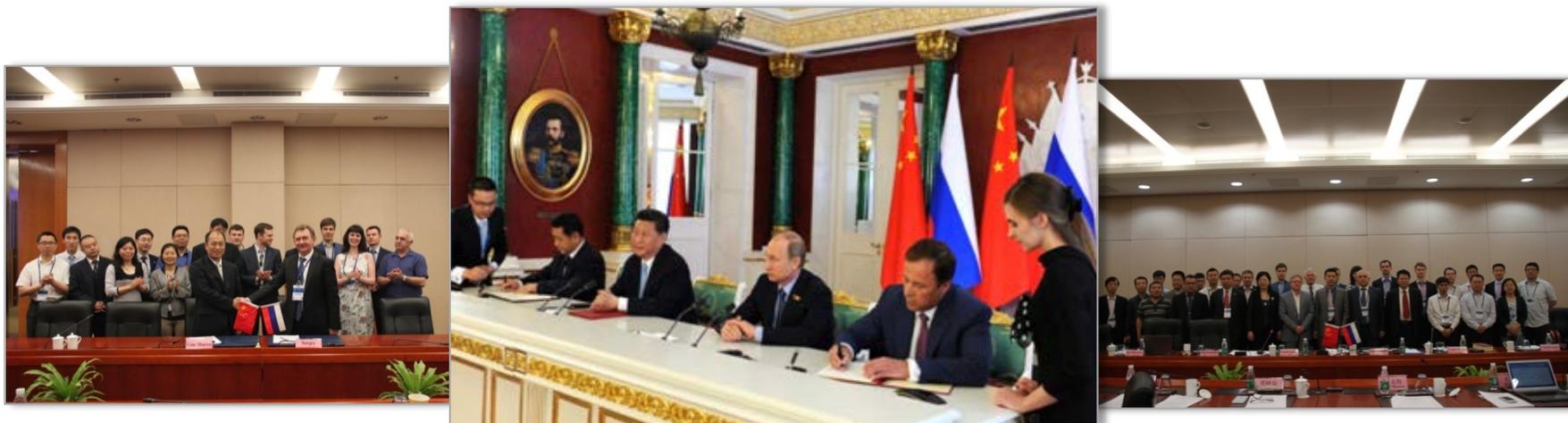
## 1 . Carry Out Bilateral Cooperation



**Keep coordinating with other navigation satellite system providers in the sector of compatibility and interoperability, and provide users together with high quality services.**



# ▶▶ Achievements of International Cooperation

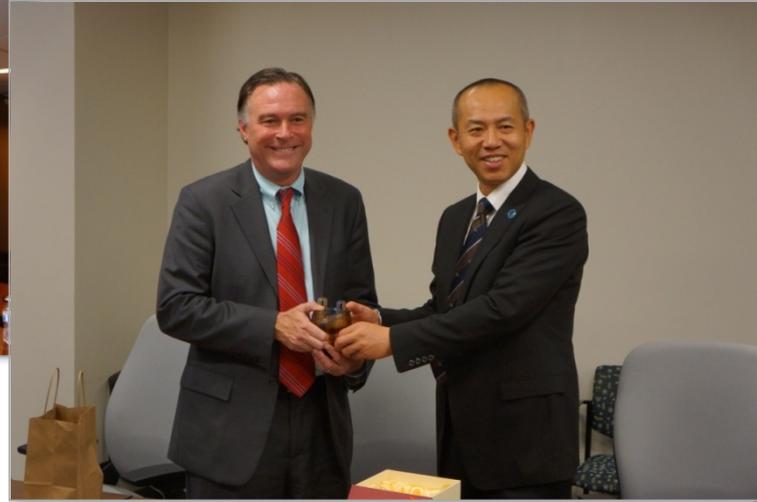


## China -Russia Cooperation

The Chinese-Russian Committee on Important Projects of Strategic Cooperation in the field of Satellite Navigation has been founded within the China-Russia Prime Ministers' Regular Meeting framework. The memorandum of understanding on satellite navigation cooperation has been signed. Working groups have been set up. Station building exploring has been finished. The Joint Statement on GLONASS/BeiDou systems Compatibility and Interoperability and Navigation Technology Application cooperation has been released, and first seven cooperation projects have been brought out.



# ▶▶ Achievements of International Cooperation



## China-U.S. Cooperation

The cooperation mechanism between BeiDou and GPS has been set up. Two bilateral meetings of China- U.S. civil GNSS cooperation were held, and the Joint Statement between these two systems was released. Cooperation has been carried out in the field of compatibility and interoperability, augmentation system and civil aviation application, civil service, monitoring and evaluation.



# ▶▶ Achievements of International Cooperation



## China -EU Cooperation

The frequency coordination towards navigation frequency channel between BeiDou and Galileo has been completed, and the cooperation mechanism between these systems are under discussion, especially in the field of compatibility and interoperability.



# » Achievements of International Cooperation

## 2 . Participate in International Satellite Navigation Organization Activities

Participate in the meetings of the ICG, ITU and other GNSS activities organized by the United Nations. Attend the United States Positioning, Navigation and Timing (PNT) Advisory Board Meeting and ICAO Advanced Meeting for the first time, to carry out technical exchanges and cooperation.



# ▶▶ Achievements of International Cooperation

**Encourage academic exchanges; host the China Satellite Navigation Conference; keep attending other international academic conferences in the field of satellite navigation; carrying out the education and training on global satellite navigation, especially in the developing countries.**

**In the past two years , we provide education training to 100 person-times to more than 20 countries.**



# Achievements of International Cooperation

The 7th CSNC , held in Changsha in May, which attract more than 100 officers and experts from 14 countries. And over 3000 experts and scholars from research institutions and enterprises, as well as other representatives from enterprises share the lasted achievements in the field of satellite navigation. And host the 30th SBAS IWG meeting 、 ICG IDM meeting 、 CSNC-ION Panel.

Welcome to participate in CSNC 2017, in Shanghai.



# ▶▶ Achievements of International Cooperation

## 3 . Promote Application Cooperation

**Promote BeiDou System globally. BeiDou application promotion is included in the strategic planning of Silk Road Economic Belt and 21st-Century Maritime Silk Road. Application cooperation with Pakistan, Thailand, United Arab Emirates, ASEAN, Arab League and other countries and areas is being carried out. The memorandums of understanding on satellite navigation cooperation have been signed with Saudi Arabia and Arab League. BeiDou Asia-Pacific Tour promoting activities and BeiDou/GNSS application presentation experience have been carried out for overseas market which oriented in making more countries and people feel the characteristics and advantage of BeiDou.**



# ▶▶ Achievements of International Cooperation

## 4 . Integrate into the International Standardization

Propel the recognition of the BeiDou System in international organizations such as IMO, ICAO and 3GPP.

BeiDou System has obtained the legal status in international maritime applications and become the global satellite navigation system supported by the international mobile telecommunications. And the RINEX 3.03 standard which supports BeiDou was published in Jan 2016.



A satellite with large solar panels and a gold-colored body is shown in orbit above the Earth. The satellite is positioned diagonally across the frame, with its solar panels extending towards the bottom left. The Earth's surface, showing blue oceans, white clouds, and green landmasses, is visible in the background. A semi-transparent dark grey horizontal band is overlaid across the center of the image, containing the text.

**THANKS FOR YOUR ATTENTION AND  
SUPPORT FOR THE BEIDOU SYSTEM.  
THANK YOU!**