



*The Ninth Meeting of the International Committee  
on Global Navigation Satellite Systems*

# **Development of BeiDou Navigation Satellite System**

**China Satellite Navigation Office**

**Prague, The Czech Republic  
November, 2014**

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**System Application**

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**Summary**



# 1. Objectives

- ★ **Serve the world, benefit all mankind**
- ★ **Provide continuous, stable and reliable satellite navigation services for global users**
- ★ **Meet civil and national security demands, and promote global eco-social development**
- ★ **Boost cooperation with other GNSS**



## 2. Principles

Openness

Independency

**Basic  
Principles**

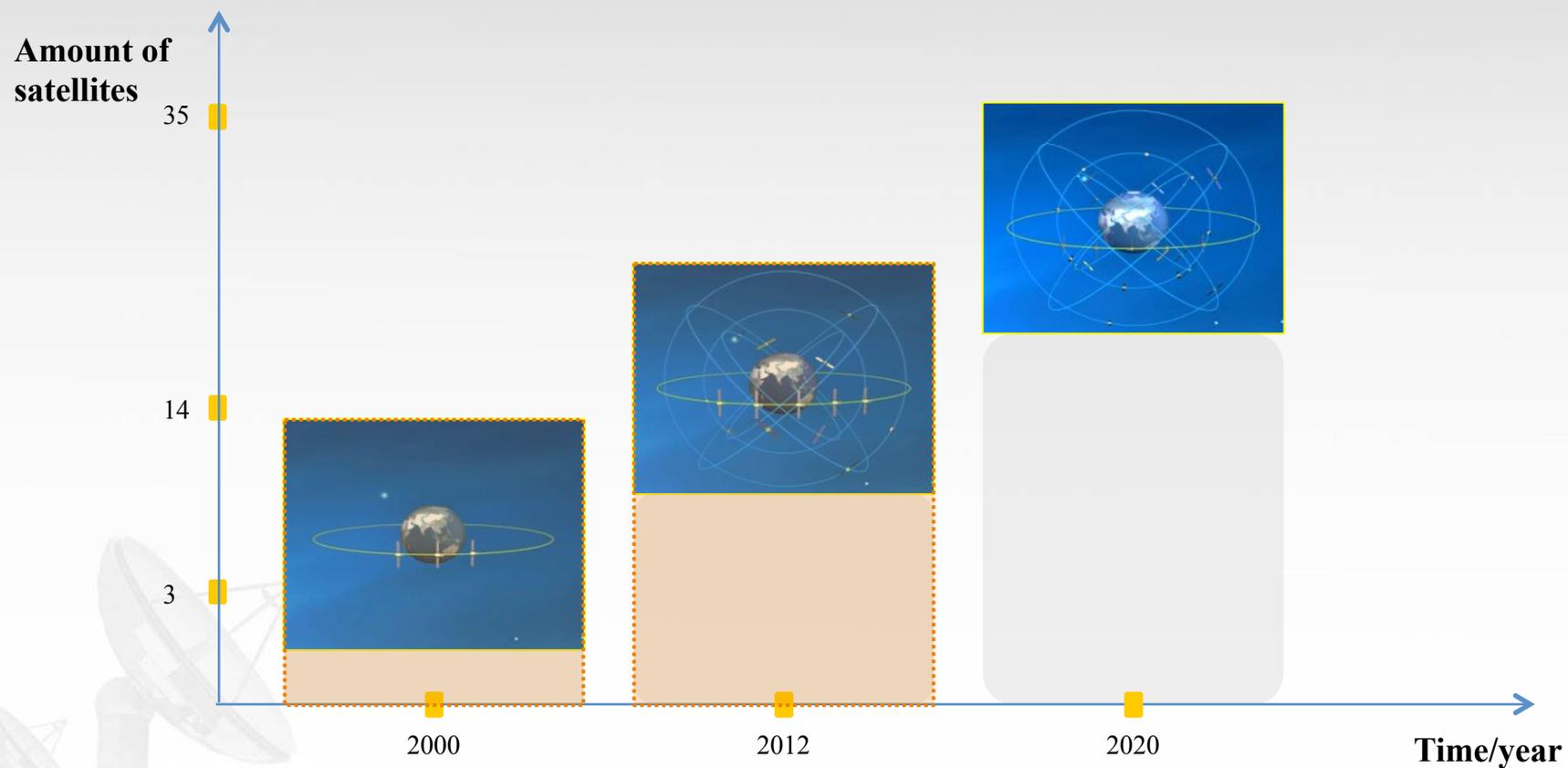
Compatibility

Gradualness



# 3. Roadmap

## ★ “Three-step” plan





# 4. System Architecture

## Basic System

### Space segment

- 5 GEO
- 30 Non-GEO



### Ground segment

- Master Control Station
- Uplink Stations
- Monitoring Stations



### User segment

- BeiDou/GNSS user terminals
- Solution and system for all sectors

**Four types of services:**

**open, authorized, differential augmentation, short message services**



## 4. System Architecture

### Augmentation Systems

#### ★ Ground & Satellite based

#### ★ Positioning and navigation services

- meter/decimeter—level (wide area)
- centimeter—level (real time, China and its neighboring areas)
- 175 reference stations (backbone network), 1000+ stations (regional density network)

#### ★ CAT-I services for civil aviation users

- Dual-frequency multi-system augmentation signals
- Preliminary Scheme Argumentation & Integrity



## 4. System Architecture

### Testing & Assessment System

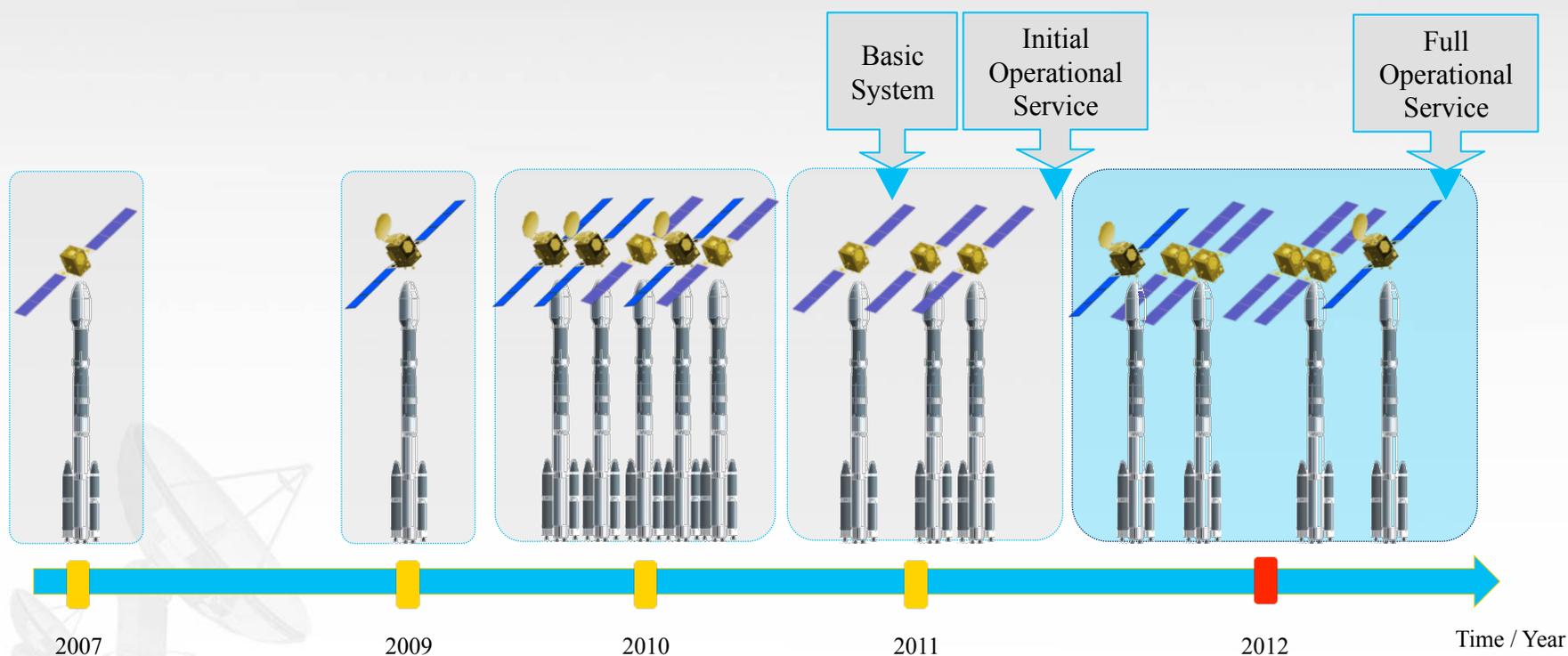
- ★ **Testbed**
  - ★ **For simulation, integrated satellite-ground test**
  - ★ **To reduce risk for integration & launch process**
  
- ★ **International GNSS monitoring and assessment system**
  - ★ **Provide monitoring and assessment information from the third-party perspective**



## 5. Current Status

Accomplished the 2nd step of the “three-step” strategy

★ 14 operational satellites in orbit : 5GEO+5IGSO+4MEO





## 5. Current Status

### ★ Service volume

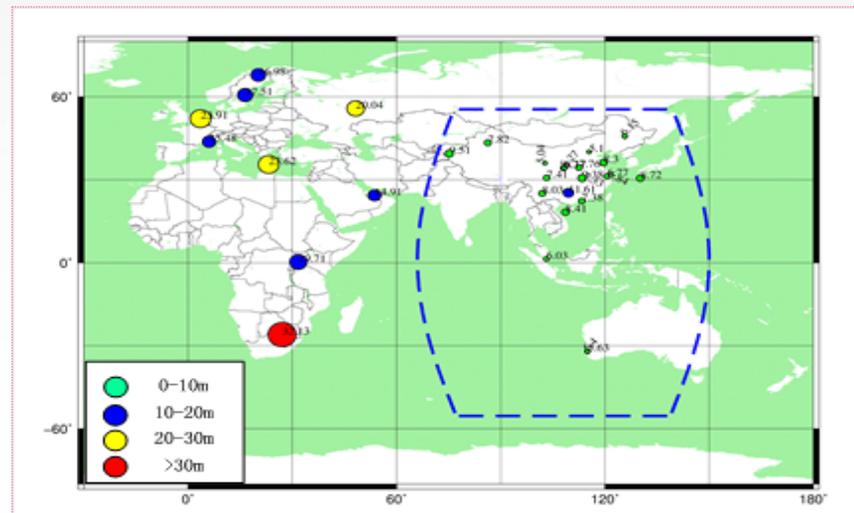
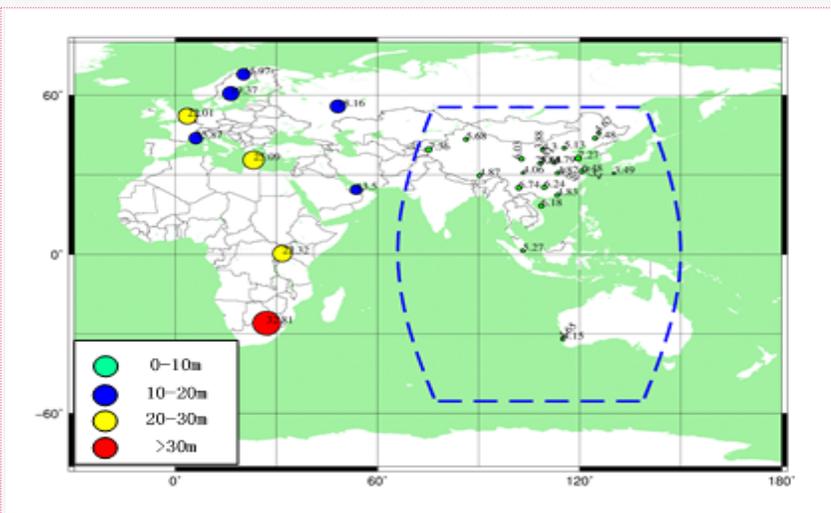
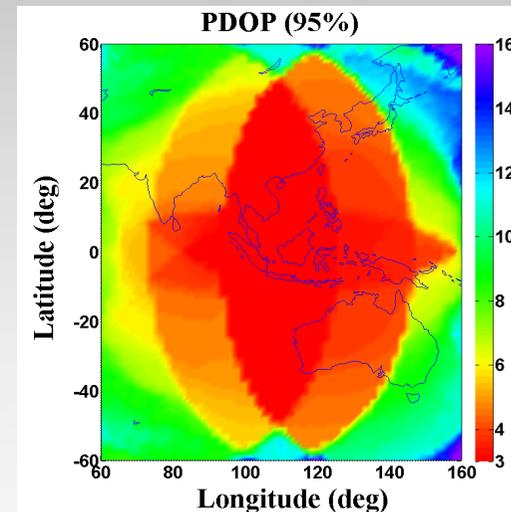
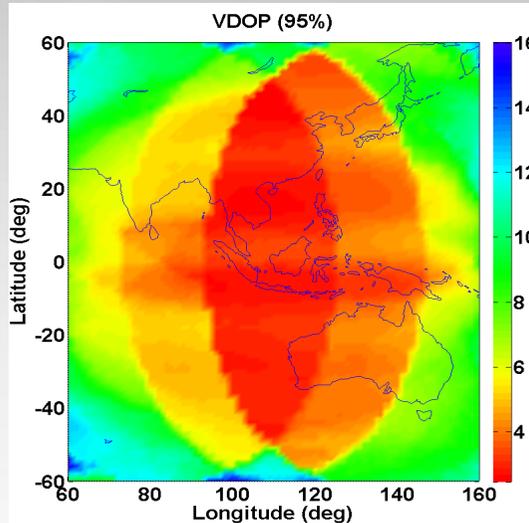
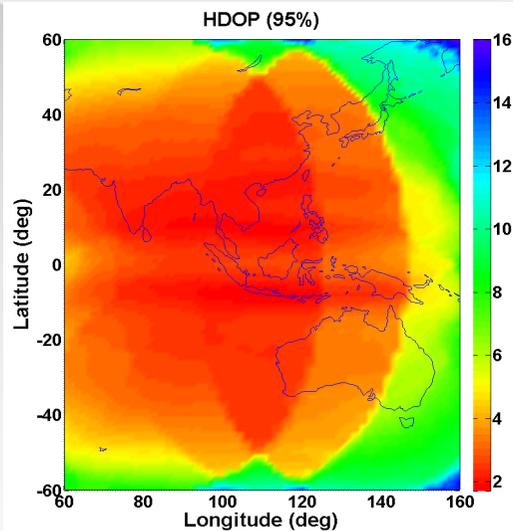
- Most parts of the Asia-Pacific region
- 55° N-55° S; 55° E-180° E

### ★ Open Service Performance Specification

- Position Accuracy: better than 10 m;
- Velocity Accuracy: better than 0.2 m/s
- Time Accuracy: better than 20 ns



# 5. Current Status



B1I Horizontal Positioning Accuracy

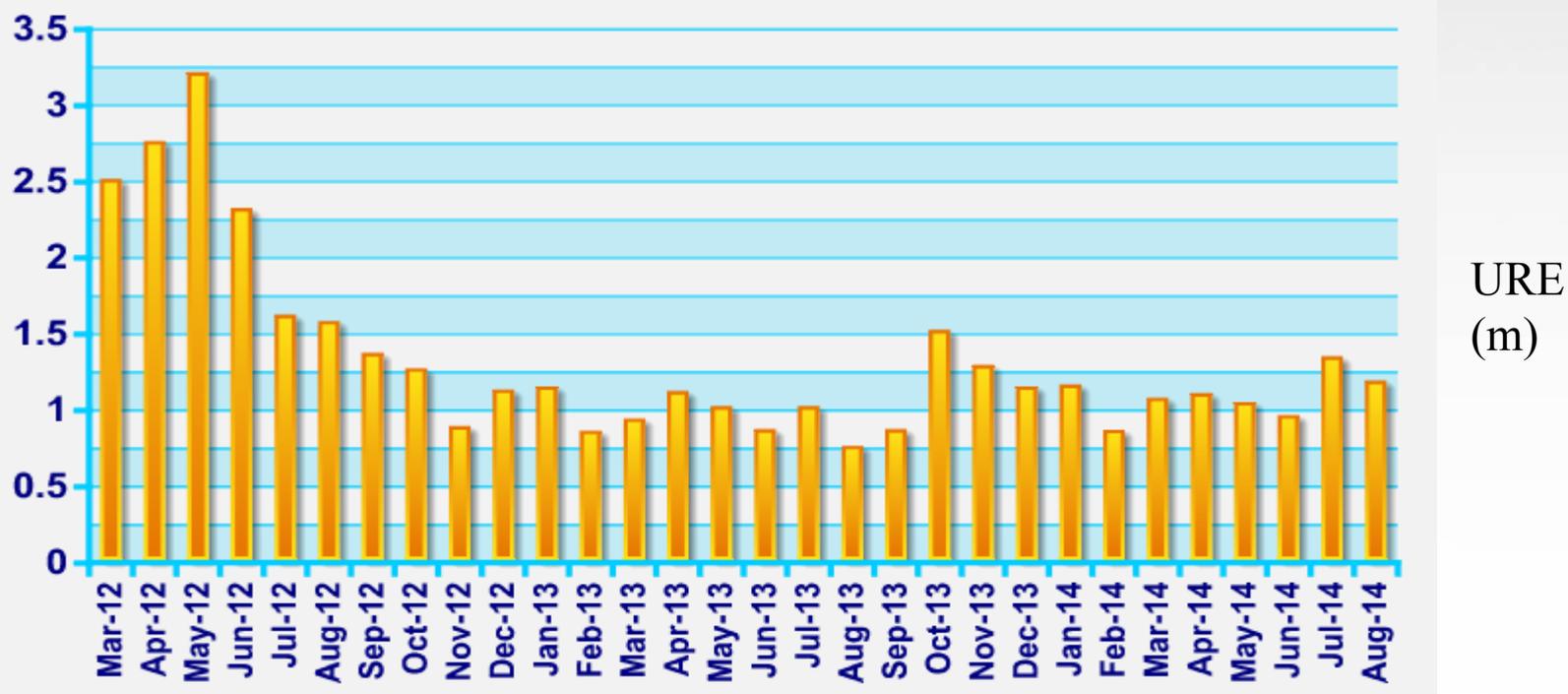
B1I Elevation Positioning Accuracy



## 5. Current Status

### Maintain Stable Operation

- ★ Continuous and stable operation.
- ★ Constantly-improving performance





## 6. Recent Plan

- ★ 4-5 new-generation satellites (MEO and IGSO) will be launched
- ★ New signals and inter-satellite link, and other technologies will be validated





## 7. Policy

- ★ **Essential information infrastructure**
- ★ **Provide open services globally and free of user charge**
- ★ **Provide continuous, stable and reliable services**
- ★ **Improve performance continuously**
- ★ **Encourage compatibility and interoperability with other GNSS**
- ★ **Enhance application efficiency, broaden application domains, promote international applications**

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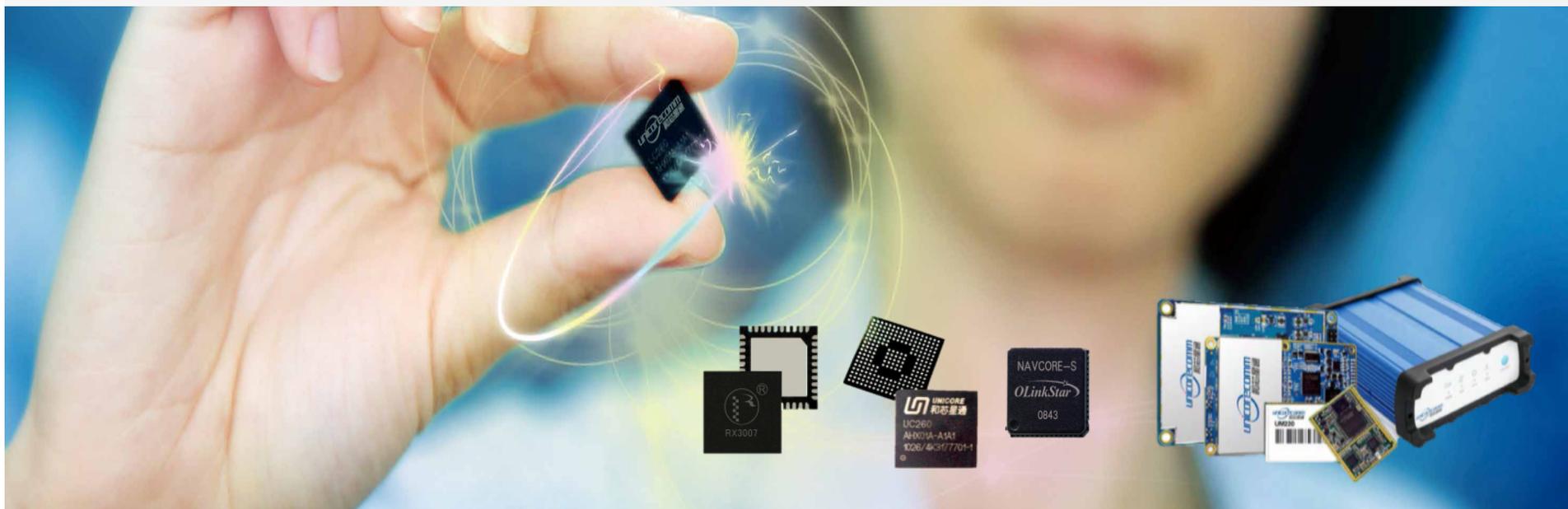
**International Cooperation**

**Summary**



# 1. Fundamental Products

- ★ Performance comparable to international level
- ★ Chips and modules with independent IPR in large-scale production and application





## 2. Market Application

- ★ Application projects have been implemented in many regions and fields
- ★ The industry chain has gradually matured

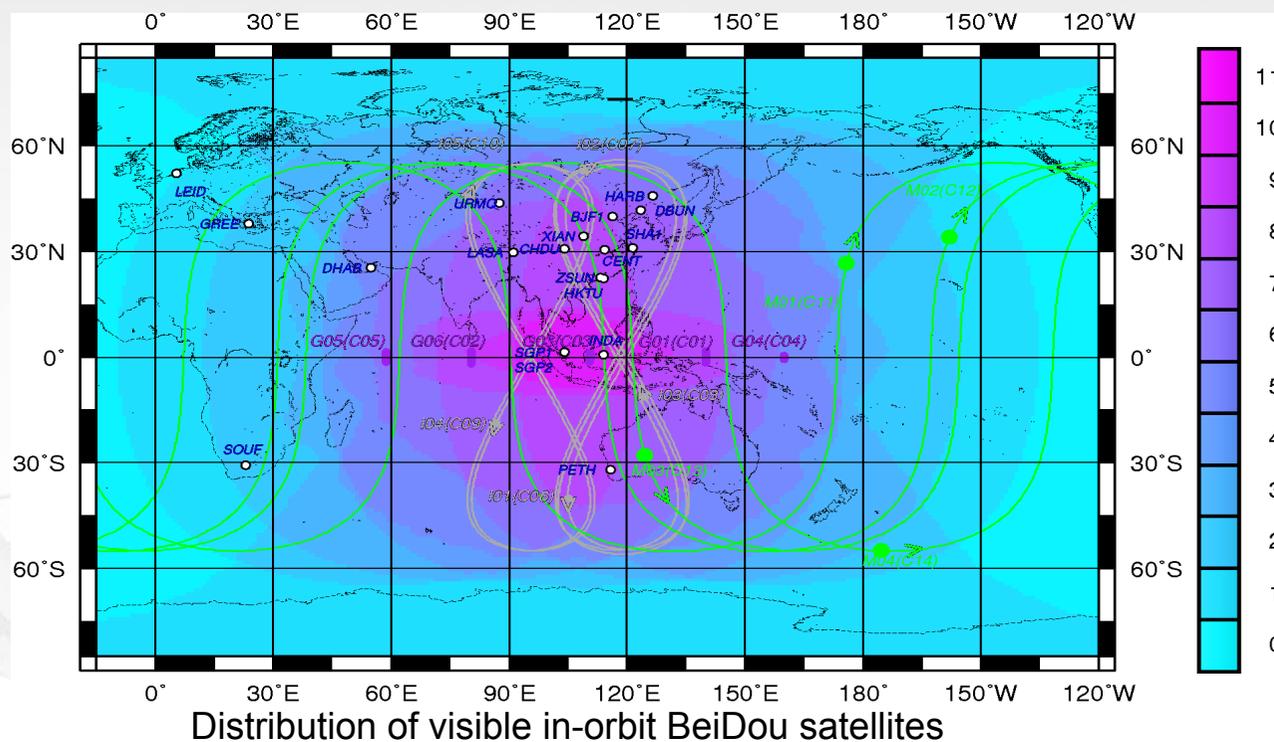




## 3. Service merits

### ★ Reliable Service

- The richest resources and most reliable services
- 3+ systems and 28+ satellites available





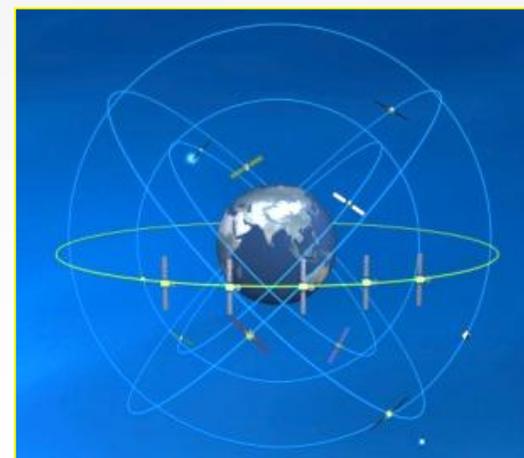
## 3. Service Characteristics

### ★ Unique Constellation

- High elevation orbits (5 GEOs + 5 IGSOs)
- Service performance is more outstanding, especially in the regions with low geographic latitude

### ★ Dual-frequency applications

### ★ Short message services available to China currently



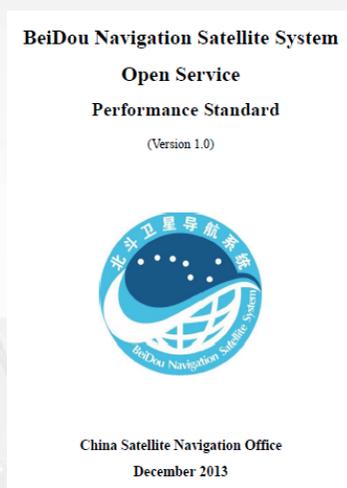


## 4. Published Document

### ★ Related technical documents

- ★ BeiDou Open Service Performance Standard (version 1.0)
- ★ BeiDou Signal-In-Space Interface Control Document (version 2.0)

### ★ Two civil signals of BeiDou- B1I & B2I



*(Both Chinese and English versions of above documents are available at [www.beidou.gov.cn](http://www.beidou.gov.cn); <http://en.beidou.gov.cn/>)*



## 4. Published Document

### ★ Key governmental documents

- PRC State Council: *National Program for Medium and Long-term Satellite Navigation Industry Development*, 2013-09.
- BDS applications are identified as national important programs in accordance with *Some Opinions of the State Council on Promoting the Information Consumption to Expand Domestic Demand* (PRC State Council, 2013-08)
- *Some Opinions on Promoting the Development of BeiDou Satellite Navigation Industry* (NDRC, MoST, MIIT, etc, to be released)

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Summary



# 1. Multi-lateral

- ★ **Contribution to ICG and Providers Forum**
  - proposed the international GNSS monitoring and assessment (iGMA)
  - advocated BDS/GNSS Application Demonstration & Experience Campaign(BADEC)
  - hosted ICG-7, PF-9, Interoperability&IDM&IGMA workshop
- ★ **Frequency coordination under framework of ITU**
- ★ **Cooperation with APSCO, UN-ESCAP, UN-SPIDER and other potential organizations**
- ★ **Host China Satellite Navigation Conference annually since 2010**



## 2. Bilateral

### China-U.S.

- ★ Frequency coordination (2011)
- ★ Informal Meetings
  - on the margins of ICG Meetings/ CAE & UAE Workshop/ CSNC/ ION GNSS+/ ION Pacific PNT Meetings, etc
- ★ Official meeting
  - 1st meeting between BeiDou and GPS (2014)
  - Joint statement (2014)





## 2. Bilateral

### China-Russia

#### ★ Informal Meetings

- on the margins of ICG Meetings/ CSNC/ Moscow International Navigation Forum/ Open & Innovation Forum, etc

#### ★ Official meeting

- Meetings between BeiDou and GLONASS (2014)
- MOU(2014)



## 2. Bilateral

### China-EU

- ★ **TWG(2008-2011)**
- ★ **Informal Meetings**
  - **on the margins of ICG Meetings/ Munich Summit/ ENC/ CSNC/China-EU/ESA Space Technology Cooperation Dialogue, etc**

### Regional systems

- ★ **Frequency coordination and communication with QZSS, IRNSS, etc**



## 3. International Standardization

### ★ ICAO

Take part in ICAO NSP activities and promote BDS to enter into the ICAO standards as planned.

### ★ IMO

The performance specifications of Ship-borne BeiDou receivers approved by IMO MSC.

### ★ 3GPP

The technical standard supporting BDS positioning service approved.

### ★ Other organizations such as RTCM/NMEA/IGS



## 4. Application Cooperation

### ★ Non-GNSS countries

- Joint R&D
- Training & Popularization
- Seeking customer-made application solutions together



## 5. Stance

- ★ Adhere to principles of mutual respect, equal and win-win cooperation
- ★ Pursue compatibility and interoperability among GNSS
- ★ Advocate cooperation to ensure sustainable and healthy development of GNSS. i.e. IGMA, IDM
- ★ Encourage international communication and coordination



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# Summary

## ★ BeiDou System under steady development

- Providing free-of-charge, stable and reliable PVT services
- Improve performance continuously
- Initiate the construction of third-step

## ★ BeiDou System in expanding application

## ★ BeiDou System dedicated to international cooperation





**Thanks**

**China Satellite Navigation Office**

**<http://en.beidou.gov.cn>**