



*The fifty-first session of the Scientific and Technical
Subcommittee of the Committee on the Peaceful Uses of Outer
Space*

Progress of BeiDou Navigation Satellite System/GNSS Applications

China Satellite Navigation Office

Vienna, Austria

February 2014

Contents

Development of BDS

Application Promotion of BDS

Typical Applications of BDS/GNSS

Contents

Development of BDS

Application Promotion of BDS

Typical Applications of BDS/GNSS



1. Objectives and Principles

- ★ Provide continuous, stable and reliable satellite navigation services
- ★ Meet the requirements of national security and economic development, realize social and economic benefits derived from satellite navigation industry

Openness |

| Independency

Compatibility |

| Gradualness

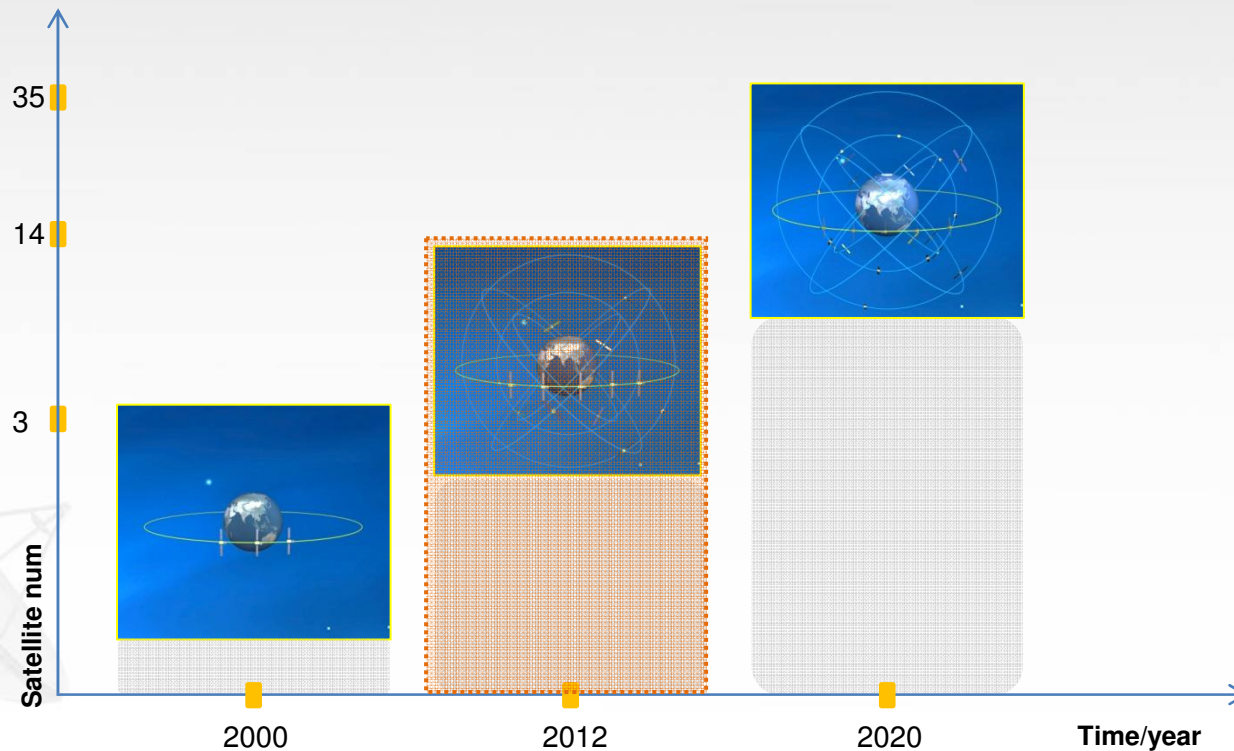




2. Deployment Plan

★ “Three-step” plan

- From regional to global, from active to passive
- 1st and 2nd Steps accomplished, 3rd Step under way

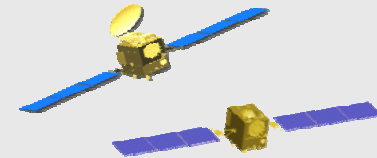




3. System Architecture

Space segment

- 5 GEO satellites
- 30 Non-GEO satellites



Ground control segment

- Master Control Station(MCS)
- Uplink Stations(US)
- Monitoring Stations(MS)



User segment

- BeiDou user terminals
- Terminals compatible with other GNSS



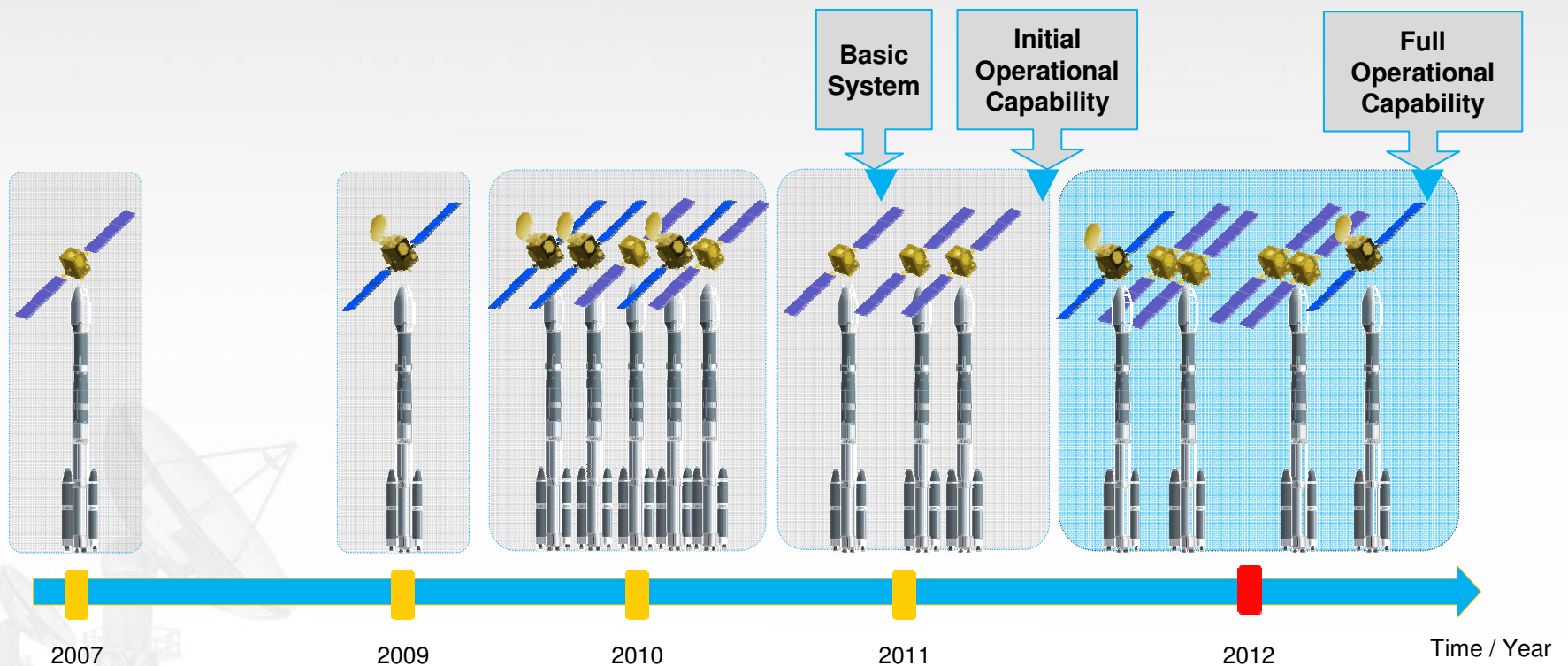
Four types of services: open, authorized, wide-area differential, short messages

- ★ Position accuracy: better than 10 m
- ★ Velocity accuracy: better than 0.2 m/s
- ★ Time accuracy: better than 20 ns



4. Construction Progress

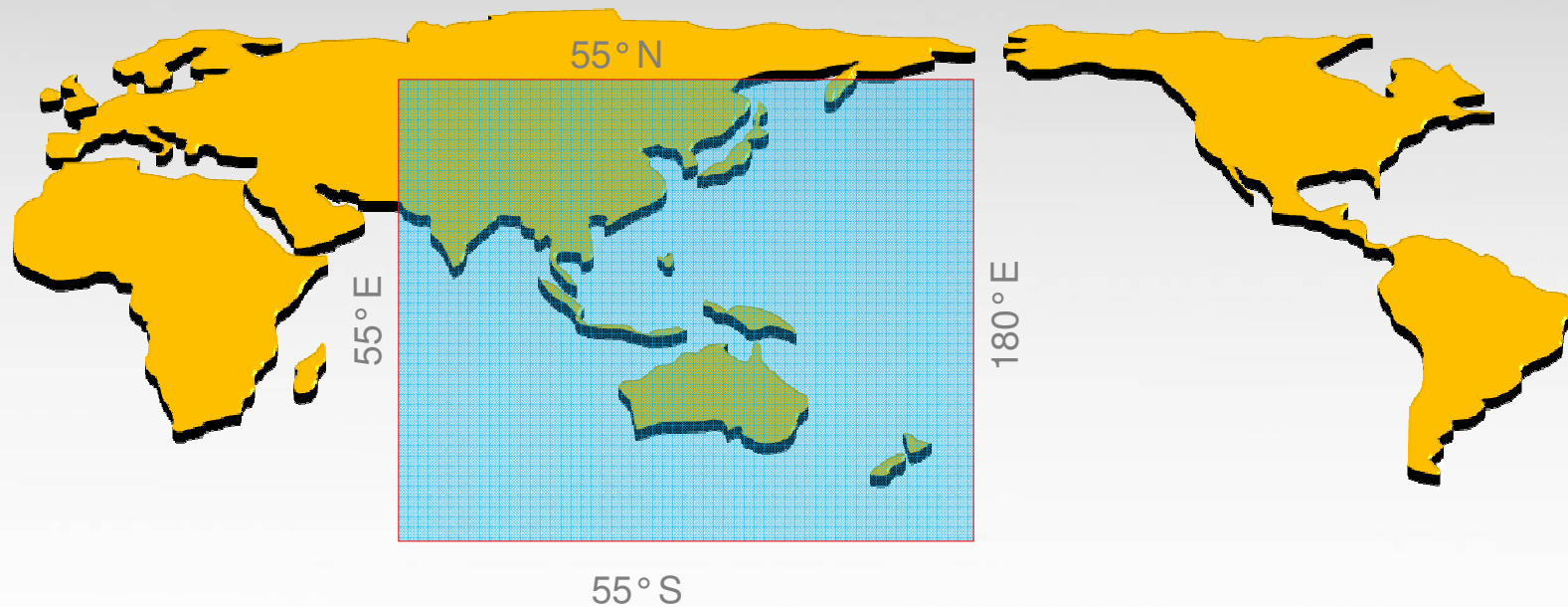
- ★ FOC for most parts of the Asia-Pacific region
- ★ 14 operational satellites in orbit
 - 5GEO+5IGSO+4MEO





5. Service Performance

(1) Current service area



(2) Current open service performance standards

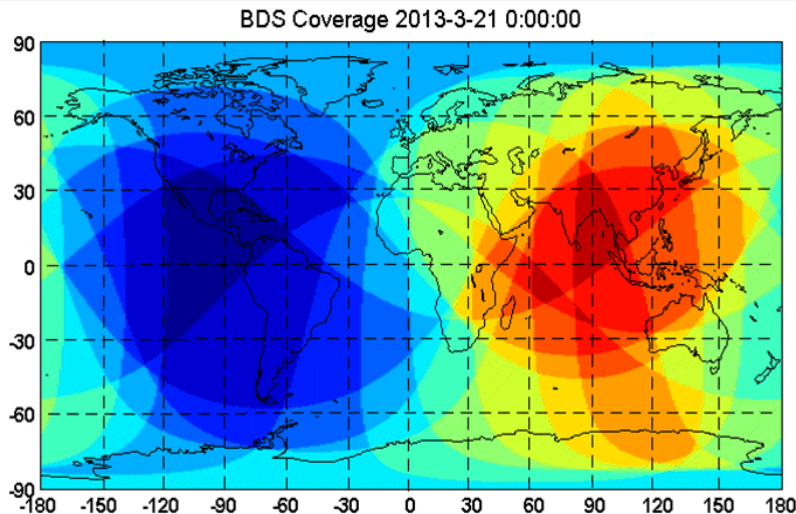
- ★ Position accuracy: better than 10 m
- ★ Velocity accuracy: better than 0.2 m/s
- ★ Time accuracy: better than 50 ns



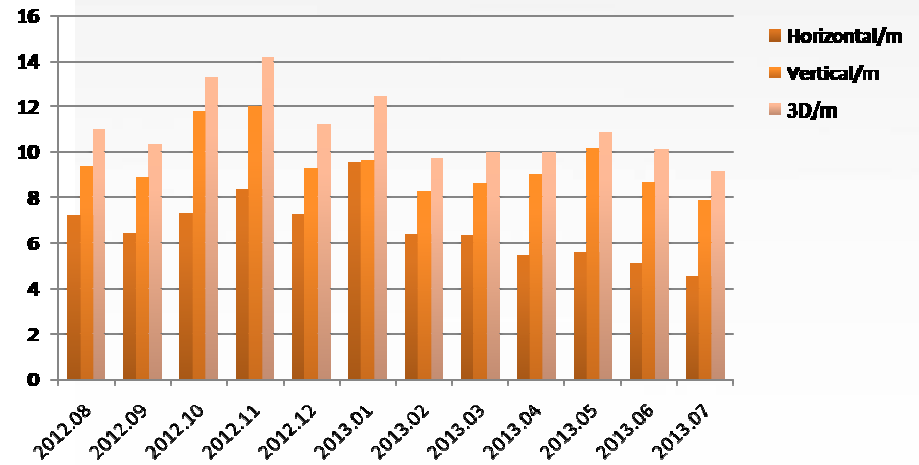
5. Service Performance

(3) Operational service performance

- ★ BDS is under continuous and stable operation
- ★ BeiDou SIS availability in the Asia-Pacific region
- ★ Positioning accuracy has been improved gradually



BDS Coverage



Positioning accuracy (95%)

Contents

Development of BDS

Application Promotion of BDS

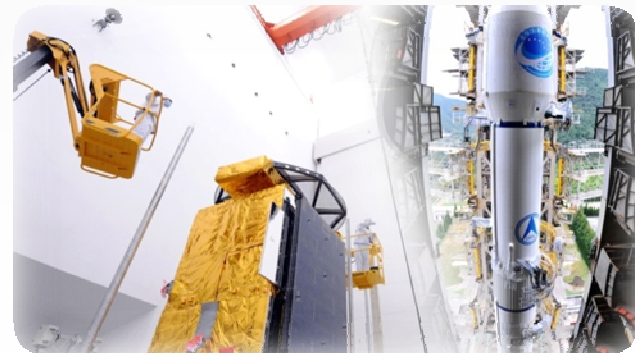
Typical Applications of BDS/GNSS



1. Policies and Measures

(1) System Service

- ★ Provide regional services to users in the Asia-Pacific area from the end of 2012
- ★ Promise to provide global users with open services free of charge
- ★ Persist in system development and enhancement, and keep improving service performances





1. Policies and Measures

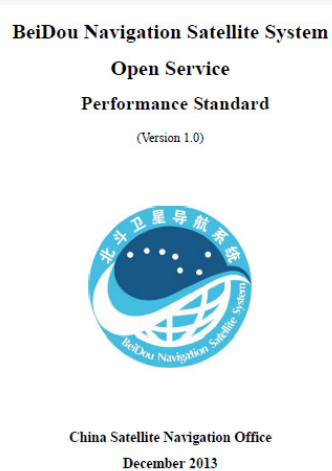
(1) System Service (continued)

★ Published related BDS documents:

★ *BDS Open Service Performance Standard (version 1.0)*

★ *BDS Signal-In-Space Interface Control Document (version 2.0)*

★ Unveil two civil signals of BDS- B1I & B2I



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



1. Policies and Measures

(2) Application industrialization

- ★ **BDS - a key national science and technology program, with satellite navigation as a strategic emerging industry.**
- ★ **Formulate satellite navigation application policies, plans, national standard and IPR policies in the field of satellite navigation**





1. Policies and Measures

(2) Application industrialization (Continued)

★ Key government document:

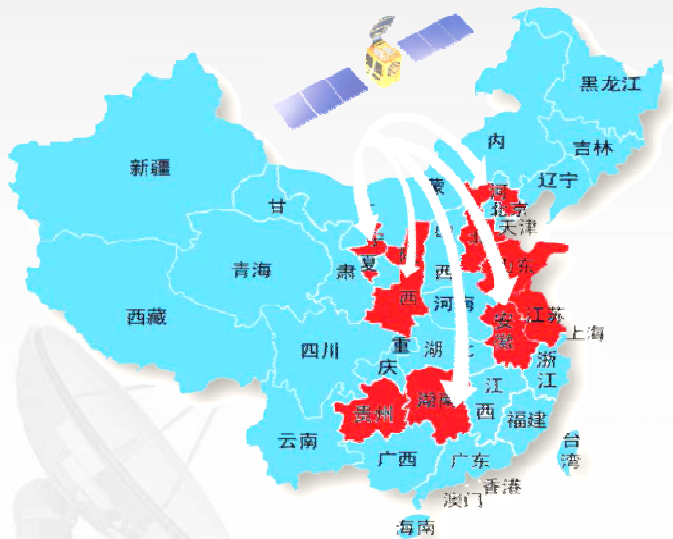
- ★ PRC State Council: National Program for Medium and Long-term Satellite Navigation Industry Development, 2013-09.
- ★ BDS applications are identified as national important programs in accordance with Some Opinions of the State Council on Promoting the Information Consumption to Expand Domestic Demand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



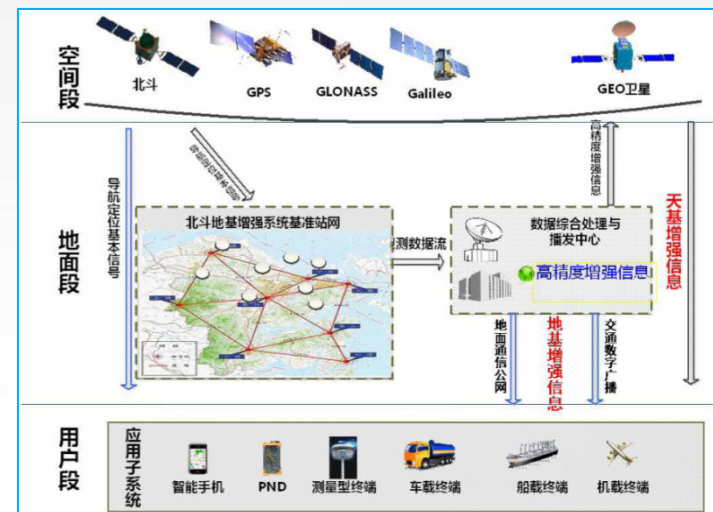
2. Promotion Activities

(1) Application Demonstrations

- ★ Accelerate the demonstration applications of BDS in different industries and regions
- ★ Construct the BeiDou ground-based augmentation system and China Location Based Service Network



Demonstration applications in regions



BeiDou ground-based augmentation system



2. Promotion Activities

(2) International cooperation

- ★ Openness, cooperation, and resources sharing
- ★ BeiDou is of China, and also of the world
- ★ Compatibility and interoperability among multi-GNSS
- ★ International GNSS performance Monitoring & Assessment



Technical Working Group meeting on C&I
between China and Europe



iGMAS tracking stations



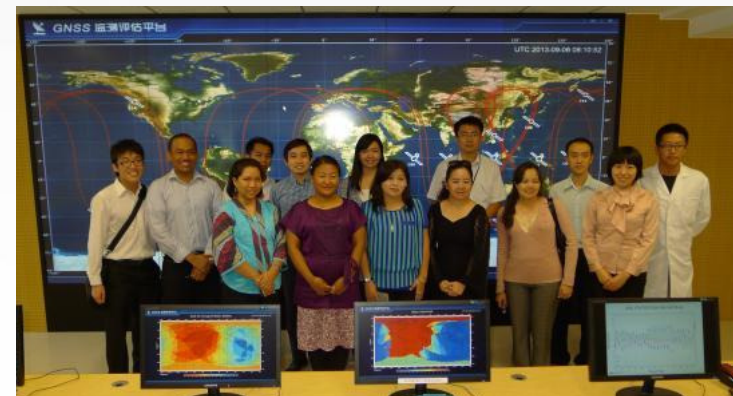
2. Promotion Activities

(3) International Application Promotion

- ★ Carry out extensive cooperation in sectors of precision agriculture, disaster prevention and reduction, transportation and tourism, education and training, system monitoring and assessment
- ★ “BeiDou Asia-Pacific Tour” & “BeiDou ASEAN Tour”



BeiDou Satellite Navigation International Cooperation & Investment Forum



International Education & Training

Contents

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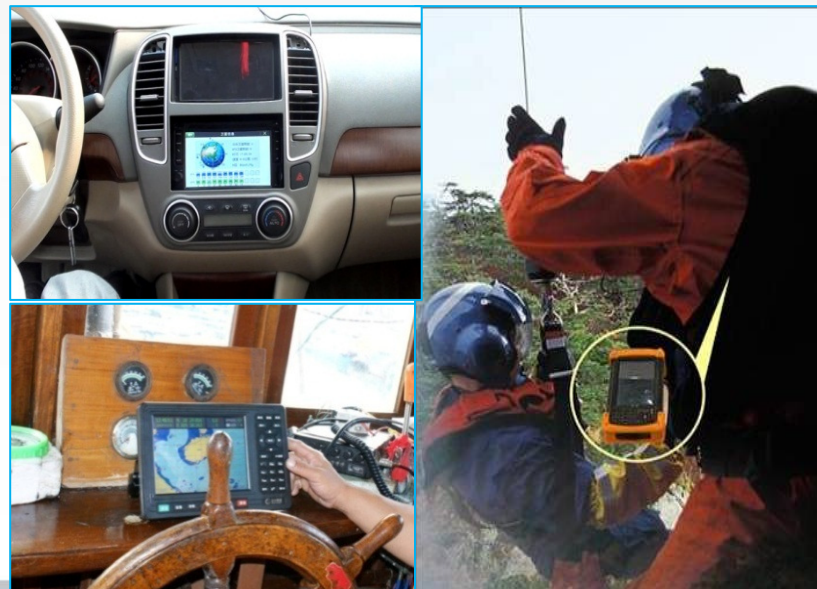
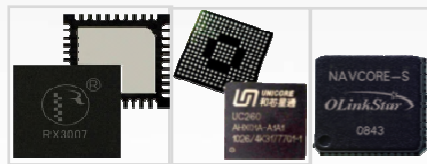
Application Promotion of BDS

Typical Applications of BDS/GNSS



1. Overview of Applications

- ★ A complete application industry chain has been formed
- ★ All-round breakthroughs have been made in some key technical areas
- ★ Related products have been used in transportation, marine fisheries, hydrological monitoring, disaster relief and reduction, mobile phone and vehicle navigation, etc





2. Industry Applications

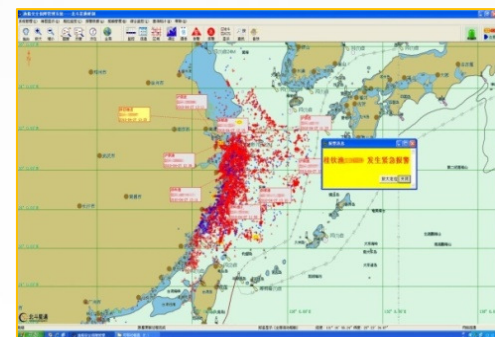
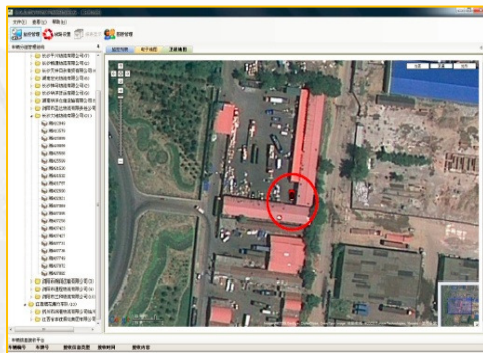
Transportation

- ★ Road transportation management



Marine Fishery

- ★ Vessel position monitoring
- ★ Emergency rescue and region alarm
- ★ Port entry and depart management





2. Industry Applications

Disaster Relief and Reduction

- ★ Rescue dispatching
- ★ Emergency communication
- ★ Rapid report



Meteorology

- ★ Meteorological sounding
- ★ Meteorological monitoring
- ★ Meteorological information gathering and release





3. Core BDS Components and Mass Market Applications

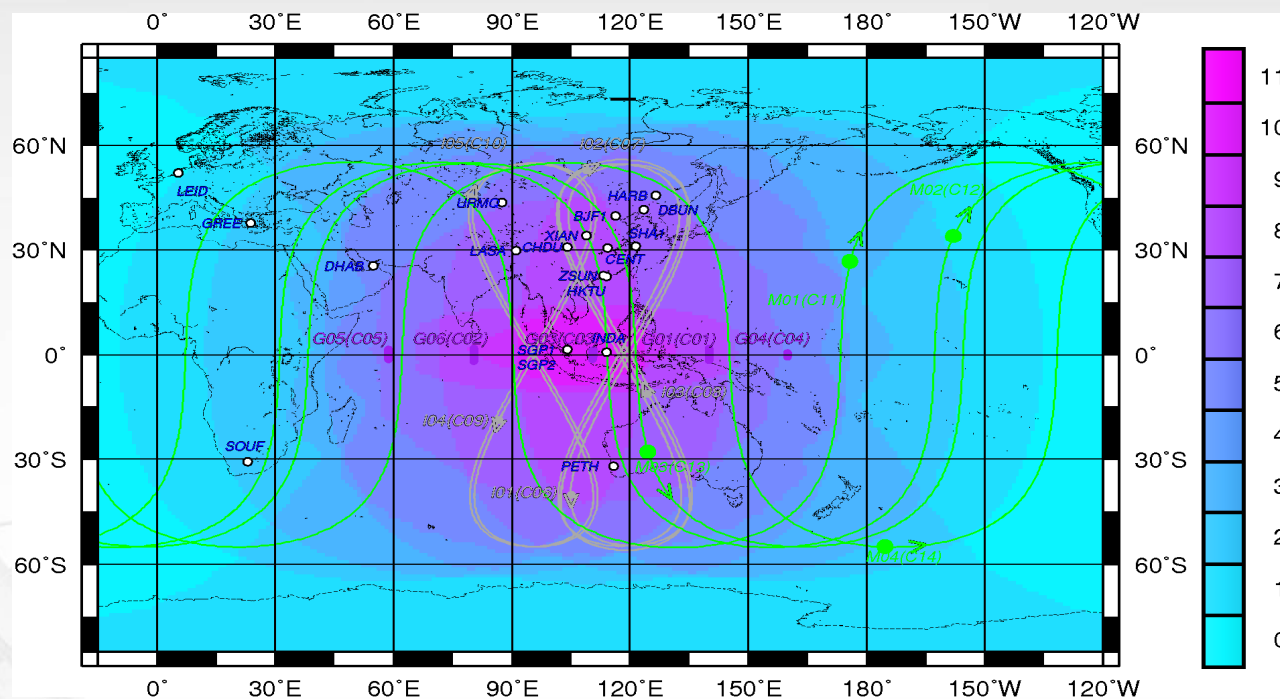
- ★ Numerous BDS core component products have launched, such as baseband chips, RF chips, antennas, high precision OEM boards, etc
- ★ BeiDou chips embedded mobile phones and vehicular terminals have been in practically used





4. Application Characteristics

- ★ More navigation satellites resources in the Asia-Pacific region
- ★ Numerous choices of multi-GNSS compatible application
- ★ More accurate and stable GNSS services with BDS-enabled devices

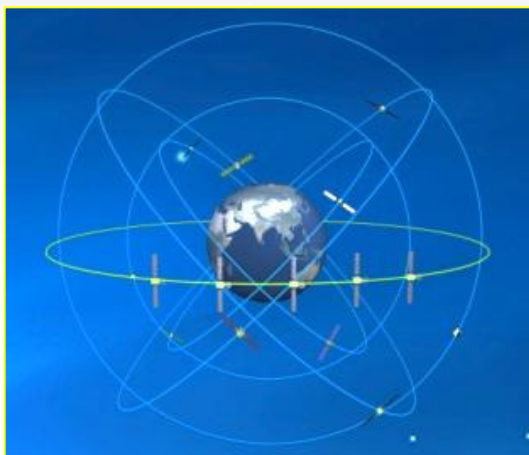


Distribution of visible in-orbit BeiDou satellites

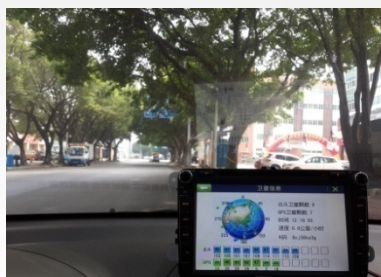


4. Characteristics of Applications

- ★ A hybrid, asymmetric constellation consisting of GEO, IGSO and MEO satellites
- ★ Superior service performance, especially in regions with low geographic latitude, and city canyon, multi-level traffic interchange, tree-sheltered environment



Space constellation



Hydropower station slope monitoring



4. Characteristics of Applications

- ★ Dual-frequency applications and establishment of augmentation systems
- ★ Offer more precise services with meter-level and decimeter-level accuracy to users



Forrest Pest Control



Precision Agriculture



BDS CORS Application in Laos (Courtesy of ComNav)



BDS CORS Application in Pakistan (Courtesy of BDNST)

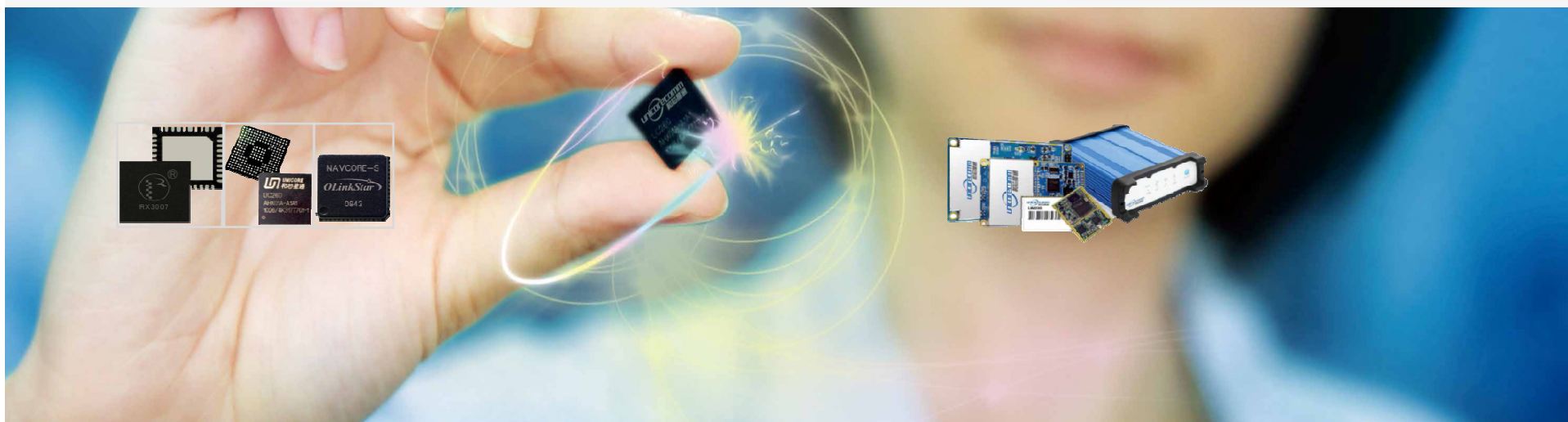


BDS CORS Application in Thailand (Courtesy of Optics Valley BeiDou)



5. Future Applications

- ★ Continuously increase investment and improve system performance to satisfy the market demands
- ★ Integrate with Internet, Internet of things, cloud computing and big data





Conclusions

- ★ **BDS has completed the 2nd step of development plan**
 - Provide Full Operational Service
 - Provide free-of-charge, stable and reliable PVT services
- ★ **Applications of BDS/GNSS is gradually entering into public**
 - Based on breakthroughs in core technology
 - Guided by demonstration and stimulated by innovation
- ★ **BDS belongs to both China and the world**
 - Actively boost the joint development of GNSS
 - Enable resource-sharing and mutual complementarity in the development of navigation satellite systems



China Satellite Navigation Office

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