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BeiDou/GNSS Disaster Reduction Application

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BeiDou Overview

Objective

- To Provide continuous, stable and reliable satellite navigation services for global users

Openness
Free open Services

Independency
Develop By China Self

Compatibility
With any other GNSS

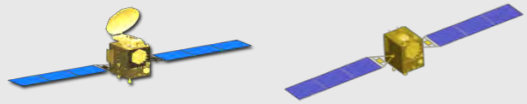
Gradualness
Step by step to avoid risk

- Suffice the requirements of national security and eco-social development, accelerate the national informatization construction as well as economy development mode transformation, realize social and economic benefits derived from GNSS industry ——Serve the world, benefit the mankind

System Composition

Space constellation

- 5 GEO
- 30 Non-GEO



Ground contro segment

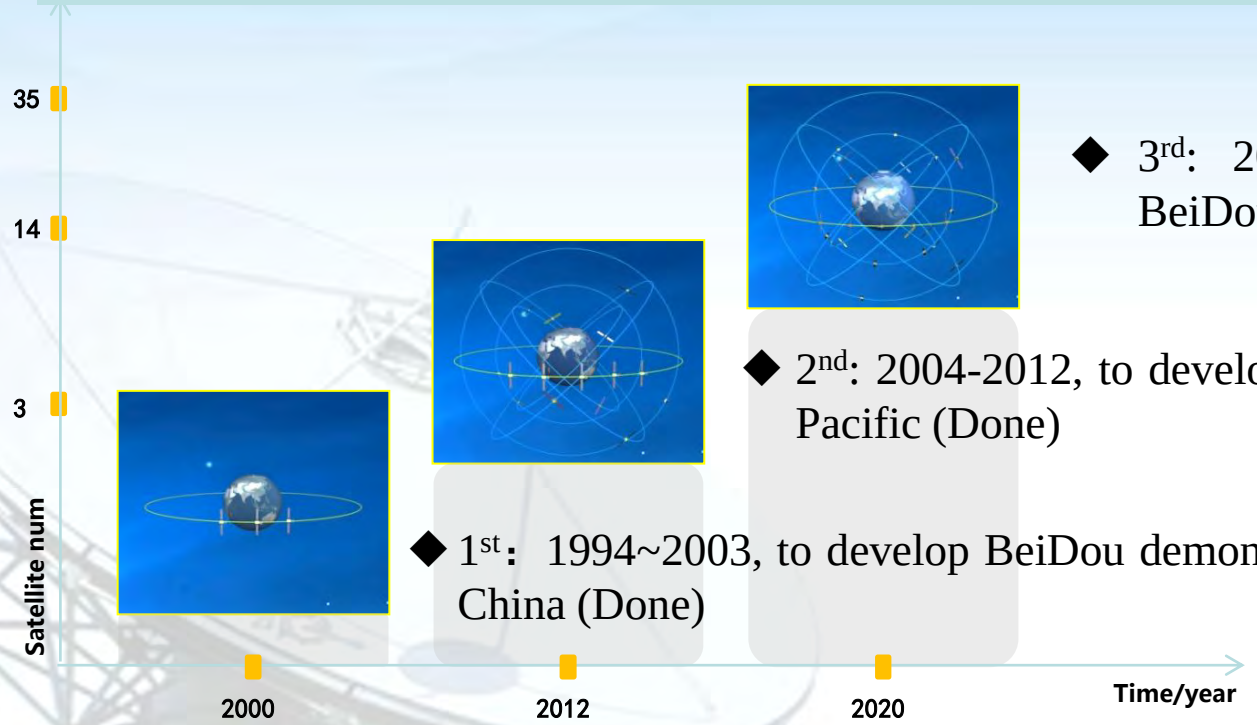
- Master Control Stations (MCS)
- Uplink Stations(US)
- Monitoring Stations(MS)

User terminals

- BeiDou user terminals
- Terminals compatible with other GNSS

Construction Plan

"Three-step" plan: Currently there are 14 operational satellites (2nd Step done) in orbit including 5GEO+4MEO+5IGSO , which formally provide Full Operational Service for China and its surrounding areas since 2012-12-27



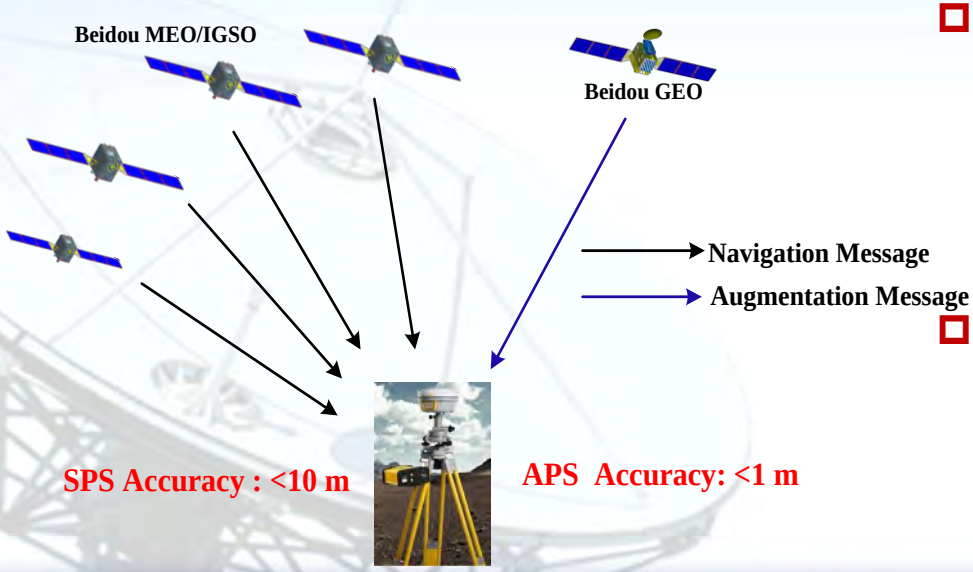
◆ 3rd: 2013~2020, to develop BeiDou to serve the world

◆ 2nd: 2004-2012, to develop BeiDou to serve Asia Pacific (Done)

◆ 1st：1994~2003, to develop BeiDou demonstration system to serve China (Done)

BeiDou Basic Services - Position

BeiDou can provide Standard Position Service(SPS) and Augmentation Position Service (APS). By using the BeiDou navigation message broadcasted from 4 satellites to calculate its 3-d position, and by using additional augmentation message (Orbit/Clock/ionospheric errors)broadcasted by GEO to get sub-meter position accuracy.



- **Navigation Signal Structure：**

  Freq.： B1I(1561.098MHz)

  Mod： QPSK

  PRN: 2.046 Mcps

  Data Rate: 50bps

- **Augmenation Signal Structure:**

  Freq/Mod/PRN same with navigation signal

  Data Rate: 500bps

BeiDou Basic Services - Timing

BeiDou can provide precise timing service for grid electricity, financial, and telecommunication systems synchronization, which can provide mutual backup safeguards to ensure the system security and stable operation as its compatibility with any other GNSS.

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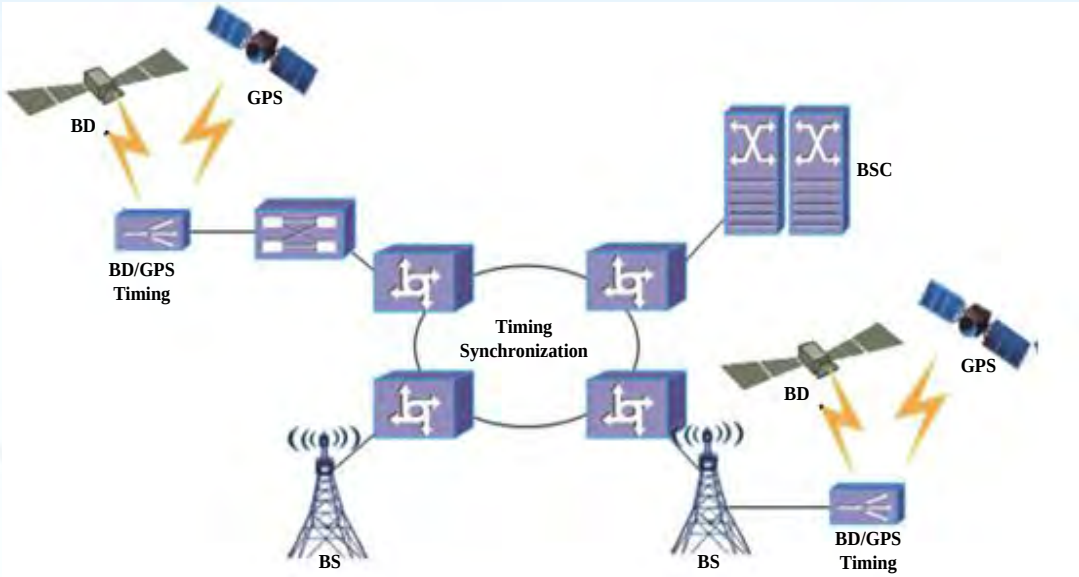
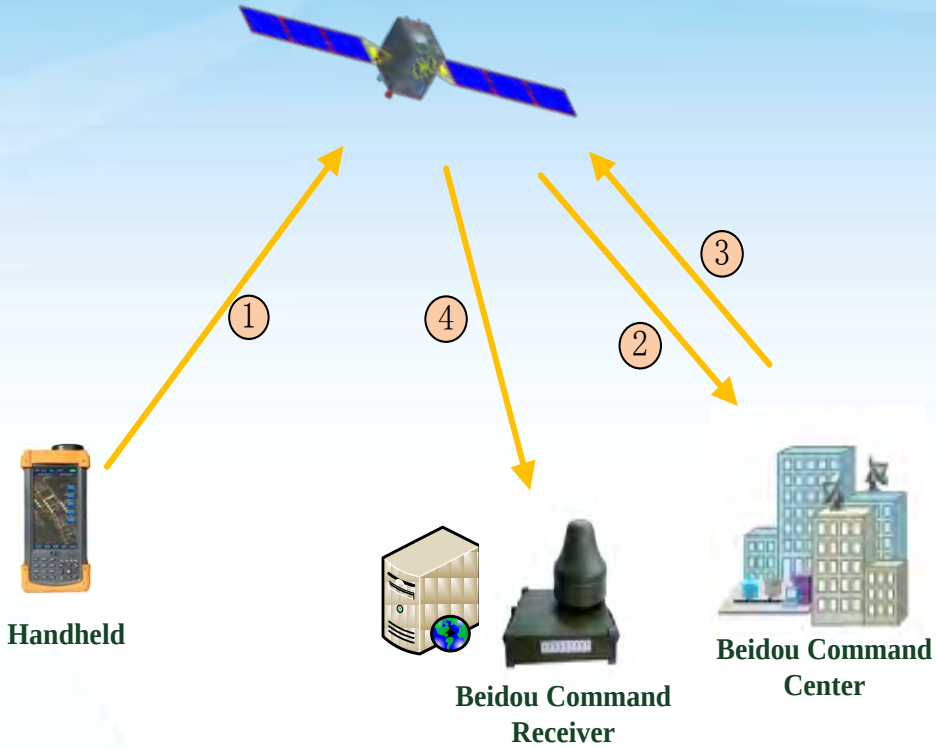


Timing Accuracy : <20 ns

BeiDou Basic Services – Short Message

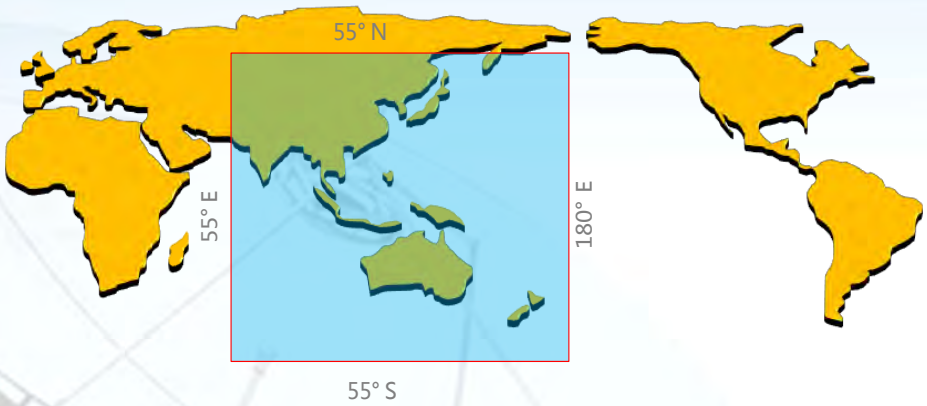
BeiDou also can provide two-way communication (text) service (need authorized), to meet the ocean, remote areas and other fields requirements , such as fishery, forestry, disaster, etc.

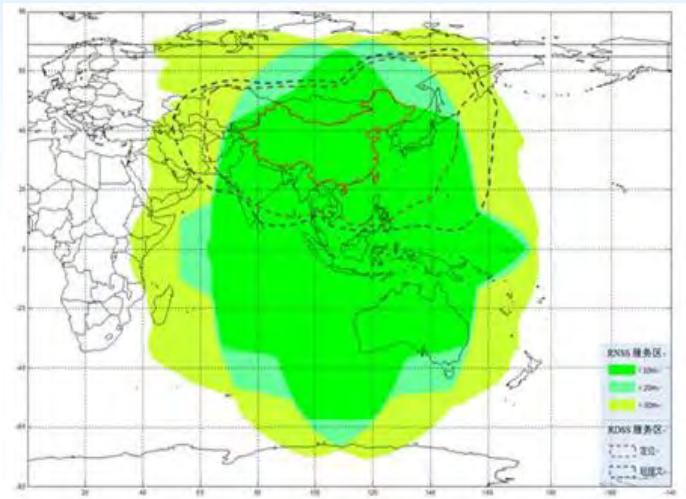


Communication Capability: Maximum 240Bytes/piece

Current Status

- BeiDou can provide continuous, stable and reliable position, navigation, and timing services for Asia Pacific (55° N -55° S, 55° E-180° E), and the position service performances of BeiDou are better than 10m.





Service Range and Performance

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Disaster Reduction Application

Nowadays the natural disasters occur frequently. When big disasters happen, the electricity, communication, roads and other infrastructural facilities of affected area are often severely damaged which make the disaster relief and rescue work much more difficult. It needs to get the disaster related information (Where/When/What) accurately and quickly for emergency response and decision making.

Comprehensive utilization of BeiDou/GNSS position (Where), timing (When) services, combined with remote sensing, geographic information systems, communications (What) and other space techniques to establish disaster reduction system with effective disaster early warning, information collection, rescue & Command and disaster evaluation functions, which has become the important way to raise the capacity of disaster reduction and relief to reduce the losses and achieve long-term development goal.

Disaster Reduction Application

Disaster Early Warning

- Using the seismic stations, buoys, meteorological instruments and other devices installed with BeiDou/GNSS receivers to construct the air-land-sea integrated disaster surveillance networks
- Collecting temperature, humidity, wind speed, wind direction, and three-dimensional position and other information to transmit to the early warning platform through BeiDou Short message, radios, mobile com., Sat Com, and other ways so that the disasters such as typhoon earthquake, and tsunami can be alerted to the public as soon as possible.

Sensors with BeiDou/GNSS Receiver to get Accurate Position & Time

Disaster Reduction Application

Information Collection

- The disaster information lists with location information are designed to satisfy the disaster survey tasks and transmitted to the command center rapidly, which can simplify the relief workers' mission;
- The command center can grasp the disaster related information (Time/Place/Loss/etc) to make decisions for emergency rescue.

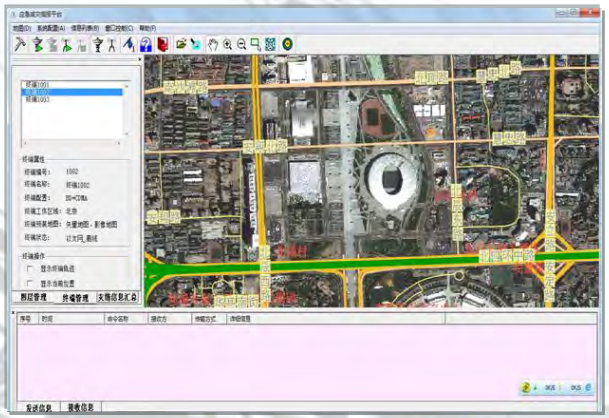
Disaster Report

Single House Survey

Block Area House Survey

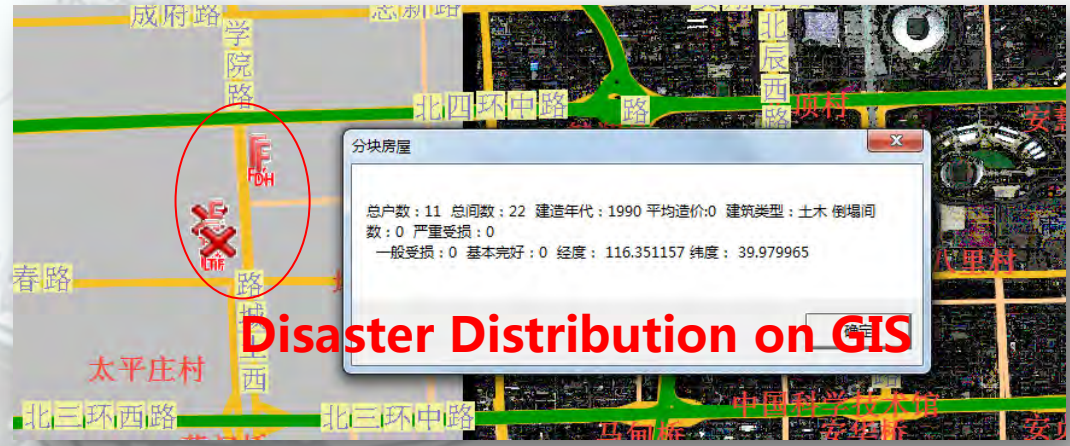
Rescue & Command

- Based on BeiDou positioning data and geographic data of disaster area, to provide navigation services to rescue staff and vehicles, plan the path for the transportation of equipment and supplies, report the information to command center.
- Providing automatic navigation to vehicles, ships, aircraft for supplies transport and automatically forecasting the speed, direction. Providing warning alert for the deviation from the planned route.



Disaster Evaluation

- To make accurate description of the position, affected scope of disasters and provide important information to the assessment of disaster scope, affect population and disaster loss.
- Using multi-source data to accurately extract the affected scope, disaster level to comprehensively evaluate the disaster losses and assess the demand for disaster relief and reconstruction.
- After data collection, the time of producing disaster GIS rapid assessment products is less than 1 hour, the time of producing disaster GIS data monitoring and evaluation products is less than 6 hours.



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Disaster Reduction Demonstration

Since 2008, SSTC and National Disaster Reduction Center have actively cooperated on BeiDou navigation services research in the field of emergency and disaster reduction. **The special navigation terminal of emergency and disaster reduction** combining of navigation, GIS, and communication functions has been developed. It follows disaster investigation and disaster information reporting processes and has been demonstrated and applied successfully in Gansu, Chongqing and Guangxi provinces.

Disaster Reduction Demonstration

Terminals Functions

- Disaster area route guidance function: integration of BeiDou/GPS, positioning, path planning, route guidance, track record and report.
- Disaster area situation contrast: supporting vector, pixel maps, remote sensing maps, overlay function of electronic vector and satellite remote sensing images.
- Disaster information acquisition and plotting function: disaster information collection and report, surveying collapsed houses, important target point positioning, linear infrastructure damage inspections.
- Disaster information sharing capabilities: communication functions, integration of space and ground network, disaster information reporting, command receiving.
- Rescue equipment interconnected functions: variety of data interfaces, supporting interoperability interfaces with shortwave radio, satellite communications equipment and other relief equipment.

Disaster Reduction Demonstration

Demonstration Tasks

- Disaster reporting tasks: collecting indicators including the affected population, deaths, missing persons, relocated population, affected area of crops, collapsed houses, direct economic losses.
- Spot investigation task: surveying collapsed houses, linear infrastructure damage inspections and important target point positioning.
- Emergency rescue mission: emergency communication, monitoring, disaster information acquisition.

Disaster Reduction Demonstration

Benefit Analysis

Social Benefits

- Enhancing the decision-making capability of disaster management;
- Minimizing the damage of natural disasters to people;
- Promoting the establishment of effective disaster reduction mechanism to make the most of satellite resources;
- Providing security to social stability and economic development.

Economic Benefits

- Reducing the economic losses caused by natural disasters;
- Optimizing investment in national disaster relief and improving the effectiveness of disaster relief.

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Conclusions

- Comprehensive utilization of BeiDou, remote sensing, geographic information system and satellite communication technology to establish BeiDou disaster reduction system has broad prospect and will **bring distinct social and economic benefits.**
- Under the support and direction of China Satellite Navigation Office and through the cooperation with national disaster reduction center, SSTC has accumulated rich experience in the field of disaster reduction and obtained mature technology and products. SSTC will strive to promote the **BeiDou/GNSS application in disaster reduction together with BeiDou development to better serve mankind.**

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Thank you !