BeiDou Navigation Satellite System Development

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China Satellite Navigation Office
October 25, 2021
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System Status
Since the last Workshop, 9 BDS-3 satellites (including 6 MEO, 2 GEO, and 1 IGSO) have been launched, marking the full constellation of BDS.

<table>
<thead>
<tr>
<th>Satellite</th>
<th>Launch Time</th>
<th>Orbit</th>
</tr>
</thead>
<tbody>
<tr>
<td>47th&amp;48th</td>
<td>2019.09.23</td>
<td>MEO</td>
</tr>
<tr>
<td>49th</td>
<td>2019.11.05</td>
<td>IGSO</td>
</tr>
<tr>
<td>50&amp;51th</td>
<td>2019.11.23</td>
<td>MEO</td>
</tr>
<tr>
<td>52&amp;53th</td>
<td>2019.12.16</td>
<td>MEO</td>
</tr>
<tr>
<td>54th</td>
<td>2020.03.09</td>
<td>GEO</td>
</tr>
<tr>
<td>55th</td>
<td>2020.06.23</td>
<td>GEO</td>
</tr>
</tbody>
</table>
On July 31st, 2020, Chinese President XI Jinping announced the completion and commissioning of the BeiDou Navigation Satellite System (BDS-3).
BDS is mainly comprised of three segments: a space segment, a ground segment and a user segment.

Up to now, BDS-3 constellation consists of 3 GEO satellites, 3 IGSO satellites, and 24 MEO satellites.

The BDS ground segment consists of various ground stations, including master control stations, time synchronization/uplink stations, monitoring stations, etc.

The BDS user segment consists of various kinds of the BDS terminals.
01 System Status

4. Various Services with Powerful Functions

Global

- PNT
- GSNC
- SAR

Asian-Pacific Region

- RSMC
- PPP
- SBAS
- GAS
System Status

4. Positioning, Navigation and Timing (PNT)

BDS Service Performance Indicator

<table>
<thead>
<tr>
<th>Performance Characteristics</th>
<th>Performance Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Positioning Accuracy (95%)</td>
<td>Horizontal ≤ 2.5m</td>
</tr>
<tr>
<td></td>
<td>Vertical ≤ 5m</td>
</tr>
<tr>
<td>Global Velocity Measurement Accuracy (95%)</td>
<td>≤ 0.2m/s</td>
</tr>
<tr>
<td>Global Timing Accuracy (95%)</td>
<td>≤ 20ns</td>
</tr>
<tr>
<td>Space Signal Continuity</td>
<td>99.996%</td>
</tr>
<tr>
<td>Space Signal Availability</td>
<td>≥ 99%</td>
</tr>
</tbody>
</table>

BDS Availability (5° Elevation Mask, PDOP ≤ 6)
01 System Status

5. Information Dissemination

- The latest released documents of Open Service Performance Standard, Signal In Space Interface Control Document are shown as followings.
- More information is available at: en.beidou.gov.cn

<table>
<thead>
<tr>
<th>Document</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>BeiDou Navigation Satellite System Open Service Performance Standard</td>
<td>2021.05</td>
</tr>
<tr>
<td>(Version 3.0)</td>
<td></td>
</tr>
<tr>
<td>BeiDou Navigation Satellite System Signal In Space Interface Control</td>
<td>2020.08</td>
</tr>
<tr>
<td>Document Open Service Signal B2b (Version 1.0)</td>
<td></td>
</tr>
<tr>
<td>BeiDou Navigation Satellite System Signal In Space Interface Control</td>
<td>2020.08</td>
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<tr>
<td>Document Precise Point Positioning Service Signal PPP-B2b (Version 1.0)</td>
<td></td>
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<tr>
<td>BeiDou Navigation Satellite System Signal In Space Interface Control</td>
<td>2020.08</td>
</tr>
<tr>
<td>Document Satellite Based Augmentation System Service Signal BDSBAS-B1C</td>
<td></td>
</tr>
<tr>
<td>(Version 1.0)</td>
<td></td>
</tr>
<tr>
<td>BeiDou Navigation Satellite System Signal In Space Interface Control</td>
<td>2020.08</td>
</tr>
<tr>
<td>Document Search and Rescue Service (Version 1.0)</td>
<td></td>
</tr>
<tr>
<td>BeiDou Navigation Satellite System Ground-based Augmentation Service</td>
<td>2020.08</td>
</tr>
<tr>
<td>System (Version 4.0)</td>
<td></td>
</tr>
<tr>
<td>System</td>
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</tbody>
</table>
Application Promotion
1. Domestic output value of satellite navigation and location-based service industries reached 403.3 billion RMB.
Making breakthroughs in the key technologies of basic products

Performances and techniques greatly improved, and large-scale applications enter into market

Sales volume domestic BDS-supported chips and modules has exceeded 100 million
Application Promotion

3. Entry into mass market, sharing economy and people's livelihood

79% smart phones sold in China in the Q1 and Q2 of 2021 supported BDS positioning function.

Meter-level positioning is available based on BDS ground-based augmentation service signal.

Smart phone supporting BDS short message service and information interconnection to be launched.
Application Promotion

4. BDS improves the level of traffic informatization

- A large dynamic monitoring and management system for operating vehicles has been built
- 7 million operating vehicles
- Precise bus information inquiry system
- BDS high precision positioning + shared bike
- BDS Lock + smart container

Decreasing incidence of severe traffic accident and accelerating the realization of smart transportation
Application Promotion

5. BDS serves smart and precision agriculture

- Over 45,000 sets of agricultural machinery are equipped with BDS-based autonomous-driving systems
- More than 400,000 sets of agricultural machinery support BDS agricultural working monitoring platform and IoT platform
- 70,000 vessels are served by BDS

Labor cost cut by 50%
6. BDS protects the safety of people's lives and property

- 3-level of disaster relief management platform is built
- Over 45,000 BDS-based terminals and equipment are deployed
- BDS-based high-precision geological disaster monitoring and alert system has been built

The capabilities of disaster and emergency relief, quick response, and coordinated command has been enhanced. Geological disasters have been successfully forecast for many times.
Application Promotion

7. BDS promotes the intelligent health services and epidemic prevention

- Travel record monitoring
- Epidemic prevention
- Tele Medicine
- Smart old-age insurance
- Personal health management
- Material distribution
- Precise disinfection through UAV

Real time data and decision support have been provided
Application Promotion

8. BDS helps the construction of smart city

- Intelligent operation and maintenance of BDS charging pile
- Smart operation and maintenance and centralized meter reading based on IoT
- BDS Intelligent tourism information service system
- The big data service platform of scenic spots

Improving urban power infrastructure and making tourism more smart, informationalized, and modernized
Application Promotion

9. BDS enables precise digital construction

- Emergency communication for field construction
- Precise construction and machinery control
- BDS+BIM visual management on construction
- Monitoring, dispatch, and management of workers, equipment, and vehicles
- Security monitoring of construction environment

Quality and efficiency has been improved
Labor and material costs has been reduced
Security has been enhanced
Application Promotion

10. BDS helps realize standard time applications

- Platform deposit certificate business
- Illegal broadcast video forensics
- Application of product traceability
- Time synchronization systems
- Smart transportation control system

Meeting the needs of different accuracy in different standard time application scenarios
Application Promotion

11. More diversified application mode

BDS & Technologies
BDS & Terminals
BDS & Platforms
BDS & Data
BDS & Services

BDS+5G→More Mature Fusion of Communication & Navigation
BDS satellites can be used to positioning the trajectory of trains, record and save operation information in bad signal reception areas, and then guarantee the integrity of transportation.
Confronted with the threat of potential natural disaster in Sarez Lake in Tajikistan, China and Tajikistan utilized BDS to undertake the deformation monitoring and disaster warning in surrounding area, providing important scientific and technological reference for the safety of the dam.
By establishing the EarthEyes System, a satellite positioning system for vehicle, BDS carries out the monitoring of various kinds of vehicles and equipment and is widely applied in different scenarios. With the CORS system built in Tunis, Mali, Nigeria, etc., BDS supply a real-time, wide spread, continuous, stable and precise positioning GNSS correction data and timing information for African users.
15. BDS provides good services for global users

BDS-based products have been exported to and used in more than half countries and regions in the world. BDS has been widely used in ASEAN, Southern Asia, Eastern Europe, Western Asia, Africa in land ownership confirmation, precision agriculture, intelligent port management, etc., promoting local economic and social development.
International Cooperation
International Cooperation

1. Compatibility and Openness to Provide Better Service (China - Russia)

Cooperation in joint test, station construction, and precision agriculture under the China-Russia Satellite Navigation Key Strategic Cooperation Project Committee.
Fostered the cooperation in compatibility and interoperability, SBAS, and civil use industries
Virtual Signing Ceremony of MoU between CSNO and CONAE

CSNO and CONAE has built a kind of normal cooperation mechanism in satellite and navigation, and will carry out cooperation in joint applications, test and assessment, education and training, etc., to accelerate economic and social development in Argentina.
International Cooperation

4. Joint Discussion, Construction and Sharing with The Belt and Road countries

3rd China-Arab States BDS Cooperation Forum
Nov. 2, 2021

2nd China-Central Asia BDS Cooperation Forum
Oct. 13, 2021

1st China-Africa BDS Cooperation Forum
Nov. 5, 2021

EXPO 2020 Dubai BeiDou Showcase
Oct. 2, 2021
Communicated with other GNSS providers technically, and issued updates on BDS in multilateral academic platforms such as Munich Satellite Navigation Summit, Scientific and Technical Subcommittee, UNOOSA, etc.
International Cooperation

6. Ratification by International Standards
International Cooperation

On September 16, 2021, the First International Summit on BDS Applications was hosted in Changsha, Hunan Province. Chinese president XI Jinping sent the congratulation letter.
Future Plans
Future Plans

1. A Comprehensive PNT System will be Established with BDS as the Core
2. Adoption of Standardized Solutions to Meet Common Needs

- Positioning precision at decimeter level
- Global integrity services

- Navigation and communication empowers each other
- Communication accessible areas are navigable

- Acquire PNT information autonomously

Deeply Integrated PNT System

- High Accuracy
- High Availability
- High Continuity
- Low cost
Thanks for your continuous attention and support to the BDS development. [http://en.beidou.gov.cn](http://en.beidou.gov.cn)