Safety of Global Navigation Satellite System (GNSS) Applications and Joint Countermeasures

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1. Development of BDS
2. Safety of GNSS Applications
3. China's Institutional Measures to Ensure Safe Applications of GNSS
4. Joint Countermeasures
The BeiDou Navigation Satellite System (BDS-3) Is Formally Commissioned
**Development Roadmap:** BeiDou Navigation Satellite System (BDS) has been developing following a “three-step” roadmap, from active to passive services, quickly possessed regional service capabilities, and then gradually extended to global services with unique features.

**Step 1:** 1994~2000, Regional active network service capability

**Step 2:** 2004~2012, Regional passive network service capability

**Step 3:** 2013~2020, Global passive network service capability
### Service capability: Positioning, Navigation, Timing (PNT)

<table>
<thead>
<tr>
<th>Performance characteristics</th>
<th>Performance specification</th>
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<tbody>
<tr>
<td>Service availability (99.99%)</td>
<td>horizontal ≤ 7 m, vertical ≤ 9 m</td>
</tr>
<tr>
<td>Global Positioning accuracy (95%)</td>
<td>≤ 20 ns</td>
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<tr>
<td>Global Velocity measurement accuracy (95%)</td>
<td>≤ 0.2 m/s</td>
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</table>
- **Industrial Chain**: A complete industrial chain integrating chips, modules, boards, terminals, operations and services has been built.
Application Industries: BDS has been widely used in the fields of transportation, public safety, disaster relief, agriculture, forestry, animal husbandry, fishery and urban governance, serving national core infrastructure construction and generating significant economic and social value.
Mass Market: BDS has entered the fields of mass market, shared economy and people's livelihood. 79% smart phones sold in China in the 1st quarter of 2021 supported BDS-based positioning function.
Industrial Output Value:
China's satellite navigation and location-based service industry

Increased by 16.9% compared with 2019

RMB 403.3 Billion Yuan

<table>
<thead>
<tr>
<th>Year</th>
<th>Value (RMB)</th>
</tr>
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<tbody>
<tr>
<td>2012</td>
<td>810</td>
</tr>
<tr>
<td>2013</td>
<td>1080</td>
</tr>
<tr>
<td>2014</td>
<td>1342</td>
</tr>
<tr>
<td>2015</td>
<td>1735</td>
</tr>
<tr>
<td>2016</td>
<td>2118</td>
</tr>
<tr>
<td>2017</td>
<td>2550</td>
</tr>
<tr>
<td>2018</td>
<td>3016</td>
</tr>
<tr>
<td>2019</td>
<td>3450</td>
</tr>
<tr>
<td>2020</td>
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</tbody>
</table>
International applications

- Confirmation of land right
- Precision agriculture
- Digital construction
- Vehicle supervision
- Smart port management
Development of BDS  Applications of BDS

- New Applications
  - New Fields
  - New Business Models
  - New Technologies
2 Safety of GNSS Applications

GNSS is a vivid practice of peaceful use of outer space to serve all humankind

- **GPS** (United States)
- **GLONASS** (Russian Federation)
- **BDS** (China)
- **GALILEO** (European Union)
2 Safety of GNSS Applications

- Risks that threaten the safety of GNSS applications
  - space debris
  - crowded space environment
  - natural and human interference
  - abuse of positioning and navigation data

It is a common challenge faced by all countries using GNSS to prevent risks and realize safe applications of GNSS.
China's Institutional Measures to Ensure Safe Applications of GNSS

1. Improving the legal system
2. Enhancing management transparency
3. Ratification by international standards
4. Strengthening law enforcement
3. China's Institutional Measures to Ensure Safe Applications of GNSS

(1) Improving the legal system

<table>
<thead>
<tr>
<th>laws and regulations</th>
<th>special regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Information Protection Law</td>
<td>中华人民共和国 卫星导航条例 (制定中)</td>
</tr>
<tr>
<td>Data Security Law</td>
<td></td>
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<tr>
<td>Cyber Security Law</td>
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<tr>
<td>Civil Aviation Law</td>
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<tr>
<td>Radio Regulation</td>
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<tr>
<td>Criminal Law</td>
<td></td>
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<tr>
<td>Satellite Navigation Regulation</td>
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</tbody>
</table>
(2) Enhancing management transparency

- Explaining Chinese government's policy stance on protecting the use of satellite navigation spectrum and resolutely resisting harmful interference
- Summarizing the experience and effects of the rule of law of BDS, and explaining Chinese government’s practices in protecting safe applications of GNSS
(3) Ratification by international standards

- Promoting ratification by international organizations to ensure that BDS serves global applications in accordance with international rules.
(4) Strengthening law enforcement

- Prohibiting the production, sale, or use of satellite navigation interfering equipment
- Dealing with any malicious interference behaviors that affect the operation and service of GNSS
Outer Space Treaty provides basic principles for promoting safe and reliable provision of services for mankind by space systems, including GNSS.

- **Article I**  The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.

- **Article IX**  In the exploration and use of outer space, including the Moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty.
Pay attention to the safety issues of GNSS applications

- Definition of safety of GNSS applications
- Safety risks of GNSS applications: types, causes, identification, standards, adverse consequences, solutions

Goal: protecting the safety of GNSS applications
Countermeasures: propelling the establishment of the regulations and laws on safe application of GNSS in varied countries.
Thank you