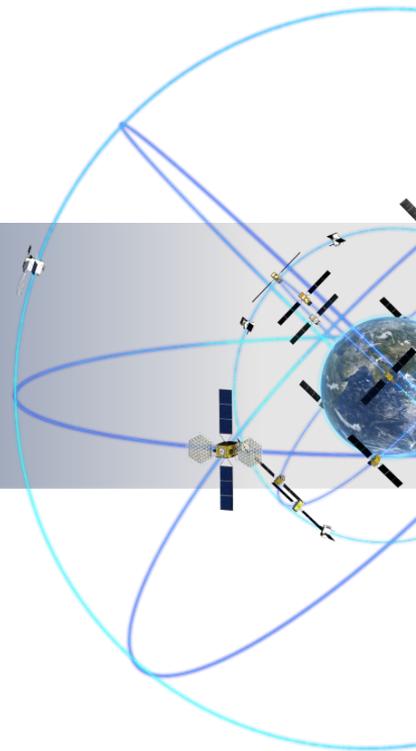




Featured Services and Applications of BDS



LU Jun

China Satellite Navigation Project Center

February, 2023



Featured Services of BDS

BDS/GNSS Applications

Future Visions

1

Featured Services of BDS

1 Featured Services of BDS

1.1 Constellation Status

No.	PRN	Sat Type	Sat Status	No.	PRN	Sat Type	Sat Status
1	1	BDS-2 GEO	Healthy	24	27	BDS-3 MEO	Healthy
2	2	BDS-2 GEO	Healthy	25	28	BDS-3 MEO	Healthy
3	3	BDS-2 GEO	Healthy	26	29	BDS-3 MEO	Healthy
4	4	BDS-2 GEO	Healthy	27	30	BDS-3 MEO	Healthy
5	5	BDS-2 GEO	Healthy	28	32	BDS-3 MEO	Healthy
6	6	BDS-2 IGSO	Healthy	29	33	BDS-3 MEO	Healthy
7	7	BDS-2 IGSO	Healthy	30	34	BDS-3 MEO	Healthy
8	8	BDS-2 IGSO	Healthy	31	35	BDS-3 MEO	Healthy
9	9	BDS-2 IGSO	Healthy	32	36	BDS-3 MEO	Healthy
10	10	BDS-2 IGSO	Healthy	33	37	BDS-3 MEO	Healthy
11	11	BDS-2 MEO	Healthy	34	38	BDS-3 IGSO	Healthy
12	12	BDS-2 MEO	Healthy	35	39	BDS-3 IGSO	Healthy
13	13	BDS-2 IGSO	Healthy	36	40	BDS-3 IGSO	Healthy
14	14	BDS-2 MEO	Healthy	37	41	BDS-3 MEO	Healthy
15	16	BDS-2 IGSO	Healthy	38	42	BDS-3 MEO	Healthy
16	19	BDS-3 MEO	Healthy	39	43	BDS-3 MEO	Healthy
17	20	BDS-3 MEO	Healthy	40	44	BDS-3 MEO	Healthy
18	21	BDS-3 MEO	Healthy	41	45	BDS-3 MEO	Healthy
19	22	BDS-3 MEO	Healthy	42	46	BDS-3 MEO	Healthy
20	23	BDS-3 MEO	Healthy	43	59	BDS-3 GEO	Healthy
21	24	BDS-3 MEO	Healthy	44	60	BDS-3 GEO	Healthy
22	25	BDS-3 MEO	Healthy	45	61	BDS-3 GEO	Healthy
23	26	BDS-3 MEO	Healthy				

A total of **45** satellites on orbit

Including:

15 BDS-2 Satellites

30 BDS-3 Satellites

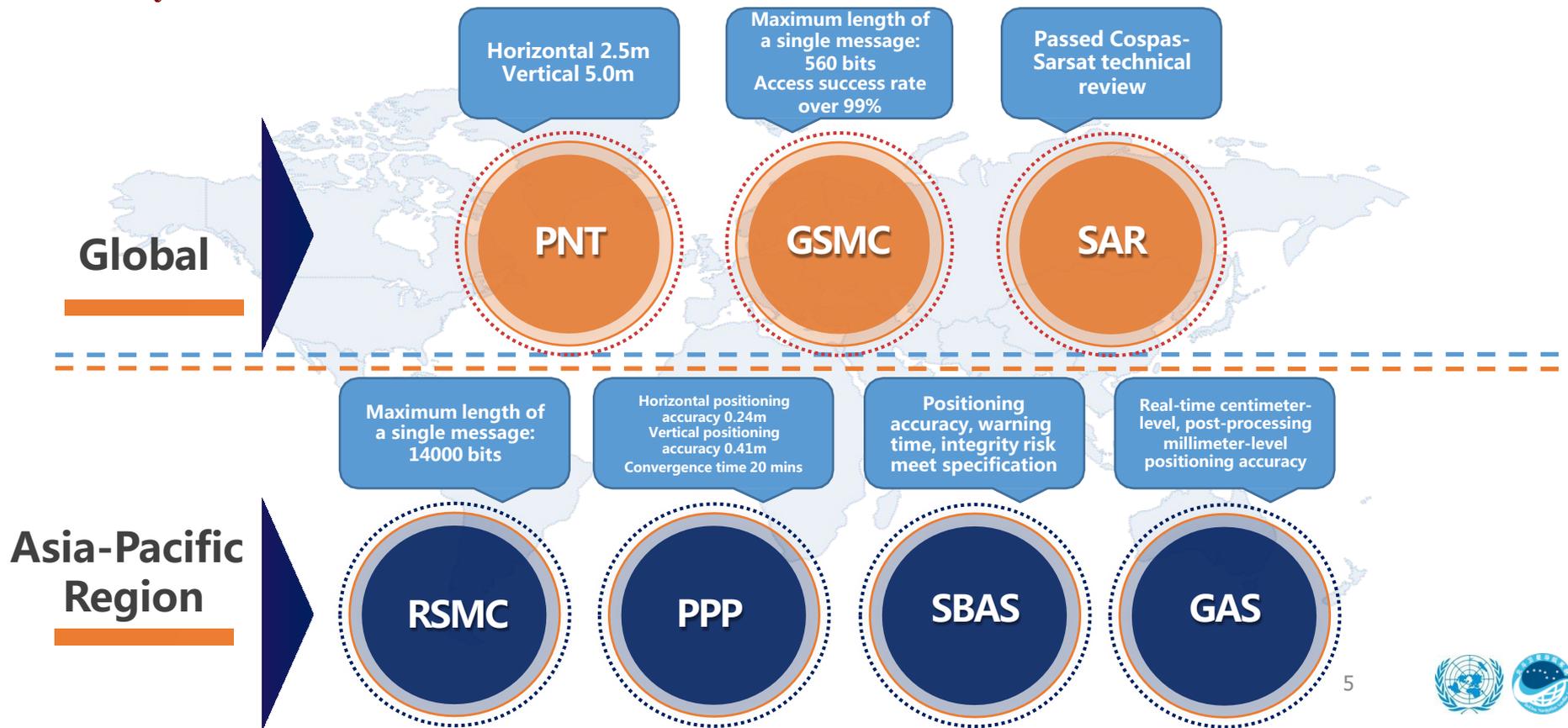
Reliable Services

Healthy State

Stable Operation

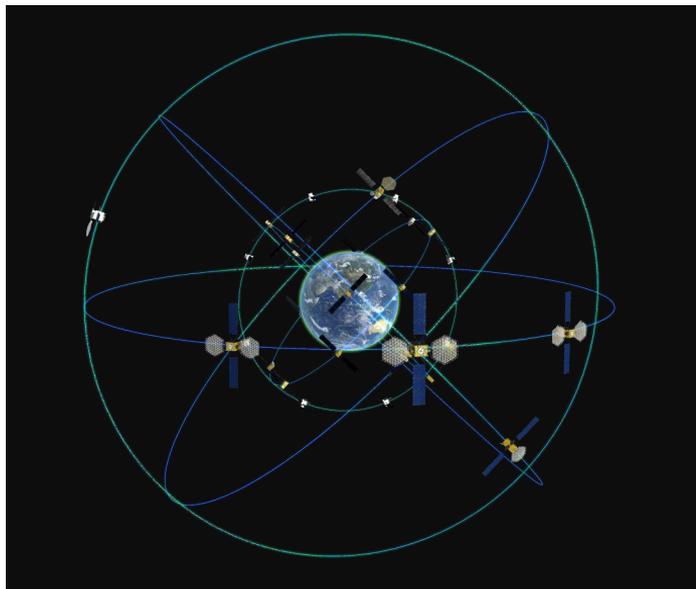
1 Featured Services of BDS

1.2 System Services



1 Featured Services of BDS

1.3 System Performances and Comparison with Specification

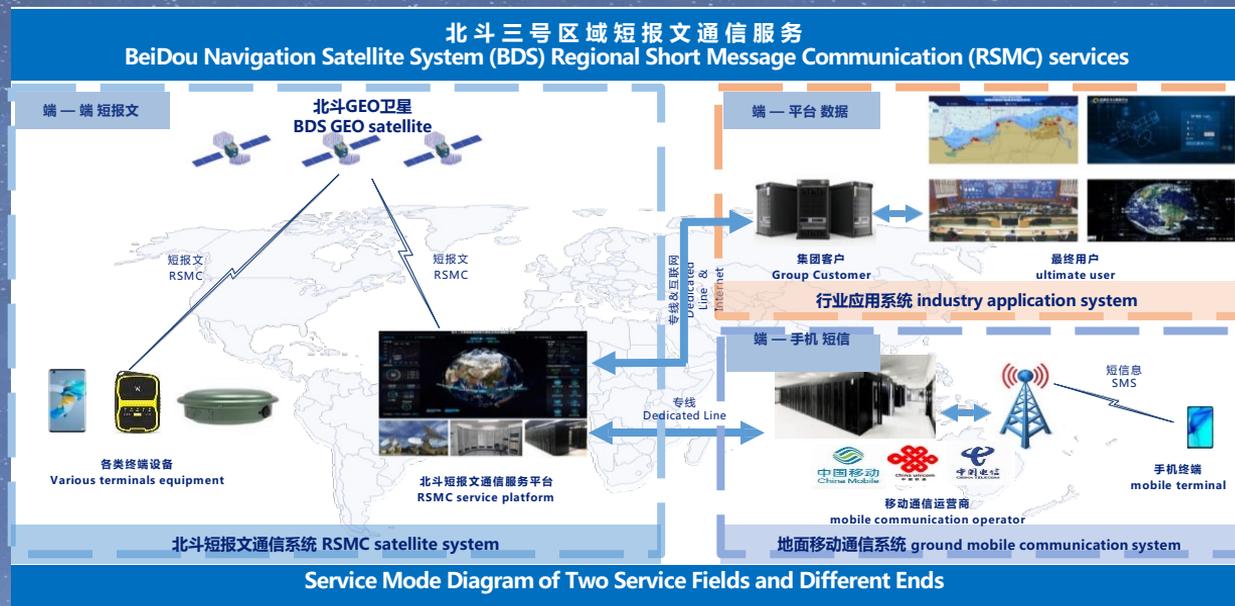


International GNSS Monitoring & Assessment System (iGMAS) Test Results and Comparison with Specification

Items	Test Results	Specification
Global Positioning Accuracy (95%)	horizontal 2.5m vertical 5.0m	horizontal 9m vertical 10m
Global Velocity Measurement Accuracy (95%)	better than 0.1m/s	better than 0.2m/s
Global Timing Accuracy (95%)	better than 20ns	better than 20ns
Space Signal Continuity	99.996%	better than 99.8%
Space Signal Availability	99%	better than 98%

1 Featured Services of BDS

1.4 Four Service Platforms for Civil Use—BDS RSMC Civil Use Service Platform



BDS short message communication civil use service platform consists of wide aperture antenna, signal processing system, information processing system and information platform, and realizes the interconnection with ground-based mobile communication system and network.

1 Featured Services of BDS

1.4 Four Service Platforms for Civil Use—BDS SBAS Civil Use Service Platform

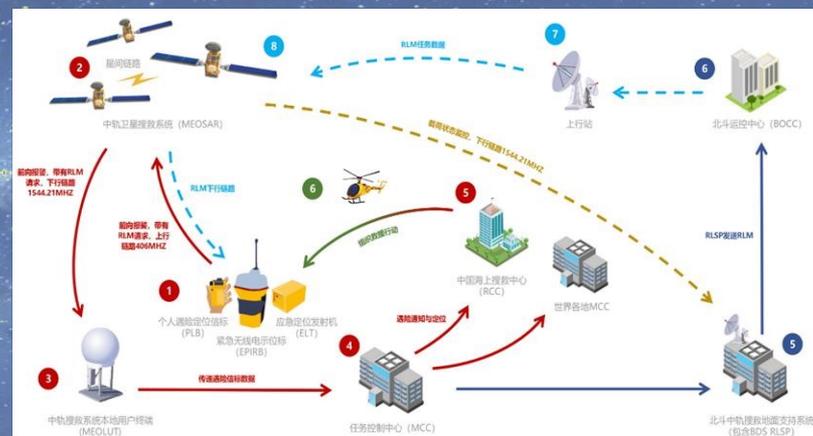
As an outside window of BDS SBAS, the Platform is to be used to carry out **airworthiness authentication, international standard promotion, systematic performance assessment, service and application promotion**, etc.



The platform has been established and is in stable operation. The Single frequency service ionospheric correction area is being expanded. Civil Aviation Administration of China is carrying out the certification of the BDSBAS SF service and to be finished within 3 years, then providing BDSBAS SF aviation service. The BDS Standardization Working Group has been working with EUROCAE and RTCA in aviation equipment development.

1 Featured Services of BDS

1.4 Four Service Platforms for Civil Use—China COSPAS SARSAT Civil Use Service Platform



SAR Return Link broadcast at B2b frequency point
Supported by 24 MEO Satellites and 3 IGSO satellites

- 增强遇险人员信心
Increase Confidence of people in emergency
- 协助救援行动
Facilitate Search and Rescue Movement
- 降低误警率
Lower Spurious Alarming Rate

The platform is carrying out joint debugging test. The ground-based support system of the platform realizes stable test and monitoring on 6 payloads equipped on BDS satellites, deals with and transmit return-link information, and upload operation status of BDS SAR payloads to COSPAS/SARSAT.

1 Featured Services of BDS

1.4 Four Service Platforms for Civil Use—GAS Civil Use Service Platform



1 Featured Services of BDS

1.5 Ratification by International Standards



BeiDou has been adopted as the third operator to provide tracking systems for ships after being given a certificate by the International Maritime Organization (IMO).



1 Featured Services of BDS

1.5 Ratification by International Standards



**DECLARATION OF INTENT
BETWEEN THE CO-OPERATING AGENCIES
OF THE INTERNATIONAL COSPAS-SARSAT PROGRAMME AND THE
MARITIME SAFETY ADMINISTRATION OF THE PEOPLE'S REPUBLIC OF CHINA
FOR CO-OPERATION ON THE COSPAS-SARSAT MEDIUM-ALTITUDE EARTH
ORBIT SEARCH AND RESCUE (MEOSAR) SATELLITE SYSTEM**

The Co-operating Agencies of the International COSPAS-SARSAT Programme and the Maritime Safety Administration of the People's Republic of China, hereinafter referred to as the Signatories:

NOTING the successful implementation of the COSPAS-SARSAT search-and-rescue Satellite System currently operated under the terms of the International COSPAS-SARSAT Programme Agreement, done at Paris on 1 July 1988;

NOTING the continued operation of the COSPAS-SARSAT System and its significant international contribution to the saving of human lives for more than forty years through the use of search-and-rescue instruments on satellites in low-altitude Earth orbit (LEOSAR), and geostationary Earth orbit (GEOSAR);

NOTING the commitment of the COSPAS-SARSAT Parties to the Agreement to assure the long-term operation of the COSPAS-SARSAT System and access to this System to all States on a non-discriminatory basis, and free of charge to the end-user in distress;

RECOGNIZING that parallel efforts are being undertaken by the COSPAS-SARSAT Parties, the European Union, and the People's Republic of China in the investigation of enhancing global satellite-aided search and rescue by placing 406-MHz transponders on the satellites of Global Navigation Satellite Systems (GNSS) in medium-altitude Earth orbit, known as BDS, GALILEO, GLONASS and GPS;

NOTING the COSPAS-SARSAT Council decisions, reflected in document C/S R.012, "COSPAS-SARSAT 406 MHz MEOSAR Implementation Plan", to ensure that new MEOSAR satellite constellations would be compatible with the existing COSPAS-SARSAT System, and to the greatest extent possible, interoperable at the user level;

RECOGNIZING that it is desirable for the Russian Federation, the United States of America, the European Union and the People's Republic of China to coordinate planning and development of their MEOSAR satellite constellations (including GNSS elements related to COSPAS-SARSAT System) to ensure that their satellite constellations will be compatible with the existing COSPAS-SARSAT System, and to the greatest extent possible, interoperable at the user level;

NOTING the COSPAS-SARSAT Parties' desire to co-operate at relevant COSPAS-SARSAT fora on matters related to the use by global search-and-rescue services of the distress-location services developed using the BDS, GALILEO, GLONASS and GPS platforms;

NOTING that the People's Republic of China, through the implementation of a SAR/BDS programme (search-and-rescue distress alerting using its BDS spacecraft and compatible ground segment), aims to become one of the providers of space and ground segments of the COSPAS-SARSAT MEOSAR system;

- 8 -

Signed in 6 (six) originals in each of the English, French and Russian languages, each version being equally valid.

For the Maritime Safety Administration of the People's Republic of China

For the National SAR Secretariat (NSS), Co-operating Agency of Canada

For the Centre National d'Etudes Spatiales (CNES), Co-operating Agency of the French Republic

For Federal State Unitary Enterprise Morvinsputnik, Co-operating Agency of the Russian Federation

For the National Oceanic and Atmospheric Administration (NOAA), Co-operating Agency of the United States of America



1 Featured Services of BDS

6. White Paper “China's BeiDou Navigation Satellite System in the New Era” Published



- The State Council Information Office of the People's Republic of China published a white paper titled "China's BeiDou Navigation Satellite System in the New Era" on Nov. 4th, 2022.

- Innovative System Configuration, Quality and Diverse Services
- Improving BDS Operation Management
- Promoting Sustainable Development of the BDS Applications Industry
- Upgrading BDS Governance
- Contributing to Building a Global Community of Shared Future

For more information :

<http://www.scio.gov.cn/zfbps/32832/Document/1732795/1732795.htm>

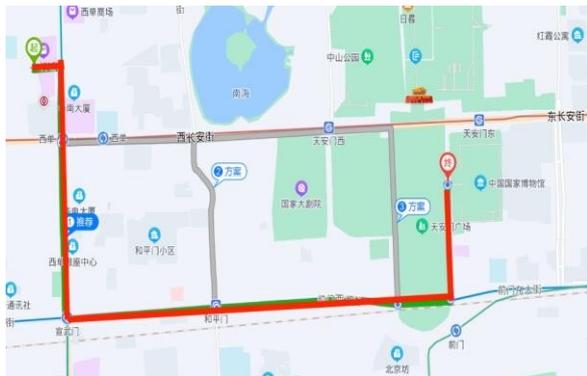
2

BDS/GNSS Applications

2 BDS/GNSS Applications

2.1 Navigation Maps and Mobile Navigation

BDS-based Services Launched in Mobile Navigation



- By Sep. 2022, Baidu Map BDS-based positioning service platform has served for more than 2.25 million users.
- Since Nov. 2022, Gaode Map used BeiDou satellites to make more than 210 billion positioning calls each day.



Detailed Information of BDS satellites shown in interface



Lane-Level Navi/Traffic Light Reminder

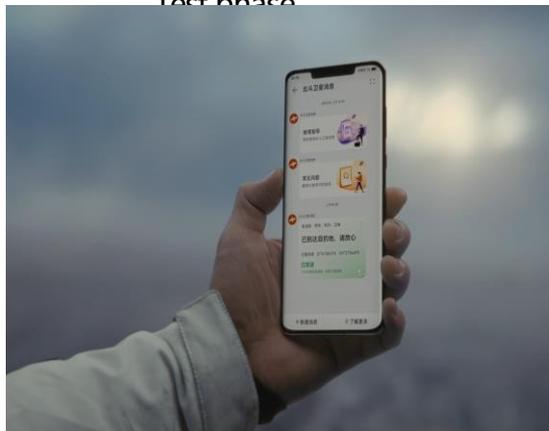


Real-time Location Sharing

2 BDS/GNSS Applications

2. Availability of SMC for Mobiles

- BDS Short Message Communication applied to Smart phones without changing devices in July
- BDS Short Message Communication entering Actual Test phase



Sender



Receiver



2 BDS/GNSS Applications

2.3 Electric Power Industry



Digitalization Construction of Power Grid Infrastructure



High Precision Unmanned Powerline Inspection



Safety Management of Employees



Real-time Monitoring of Power Grid Operation

BeiDou Services including PNT, Timing and Frequency, and Short Message Communication all fully applied in the field, with more than 380,000 devices and terminals



Power Regulation, Information Management
All applying BDS Timing Signals



Frequency Synchronization Backbone Network
All receiving BDS Frequencies



Vehicles in Power Industry
All equipped BDS Terminals

2 BDS/GNSS Applications

2.4 Smart Transportation

Navigation System

车牌号码	状态	洋货
沪D2761	在线	洋货
沪D8883	在线	洋货
沪D00379	在线	洋货
沪D4689	在线	洋货
沪D2647	在线	洋货
沪D3033	在线	洋货
沪D3411	在线	洋货
沪D4628	在线	洋货



- World largest dynamic monitoring system on commercial vehicles with **8.14 million** in total
- **100%** application usage rate in public service vessel, costal navigation equipment, etc., realizing full coverage
- More than **5 million** BDS high precision positioning based shared bikes available



2 BDS/GNSS Applications

2.5 Precision Agriculture

Accuracy of 2.5 cm , 30% increase in machinery scheduling efficiency, 5% enhancement in crop production, 10% saving in fuel consumption.

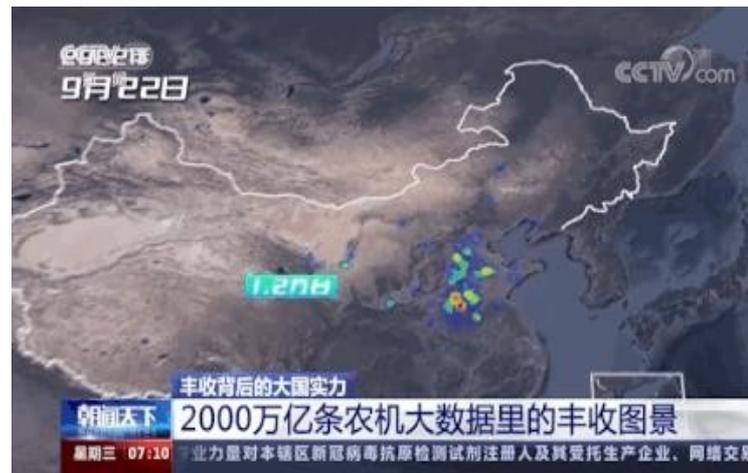
Requirement	Solutions	Effects
Precise Positioning	Satellite-based Positioning	Provide high-accuracy real-time location information for machinery
Precise Quantification	Satellite-based Positioning & Field Information Collecting Techniques	Realize collecting and analyzing field situation
Precise Timing	Satellite-based Positioning	Work without limitation of time and weather



2 BDS/GNSS Applications

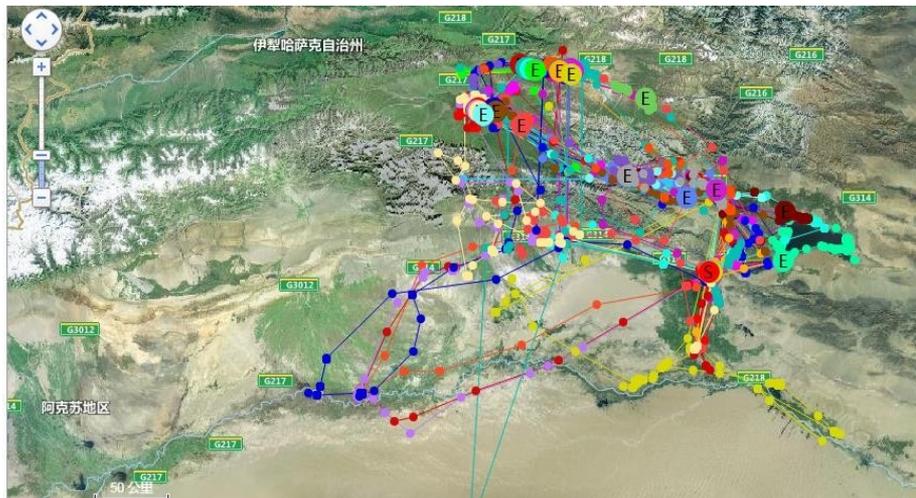
2.5 Precision Agriculture

Agricultural Machineries equipped with BDS terminals played important role in grain production in summer and autumn harvests. Trillions of big data statistics were generated.

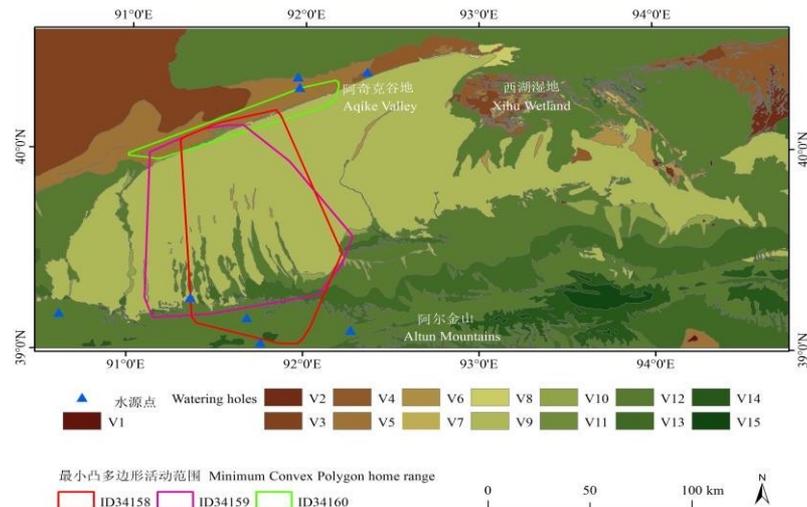


2 BDS/GNSS Applications

2.6 Wildlife Protection



BDS Based Studies on Bird Migration Activities



BDS Based Studies on Home Range of Wild Camel

2 BDS/GNSS Applications

2.7 BDS/GNSS International Applications



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.

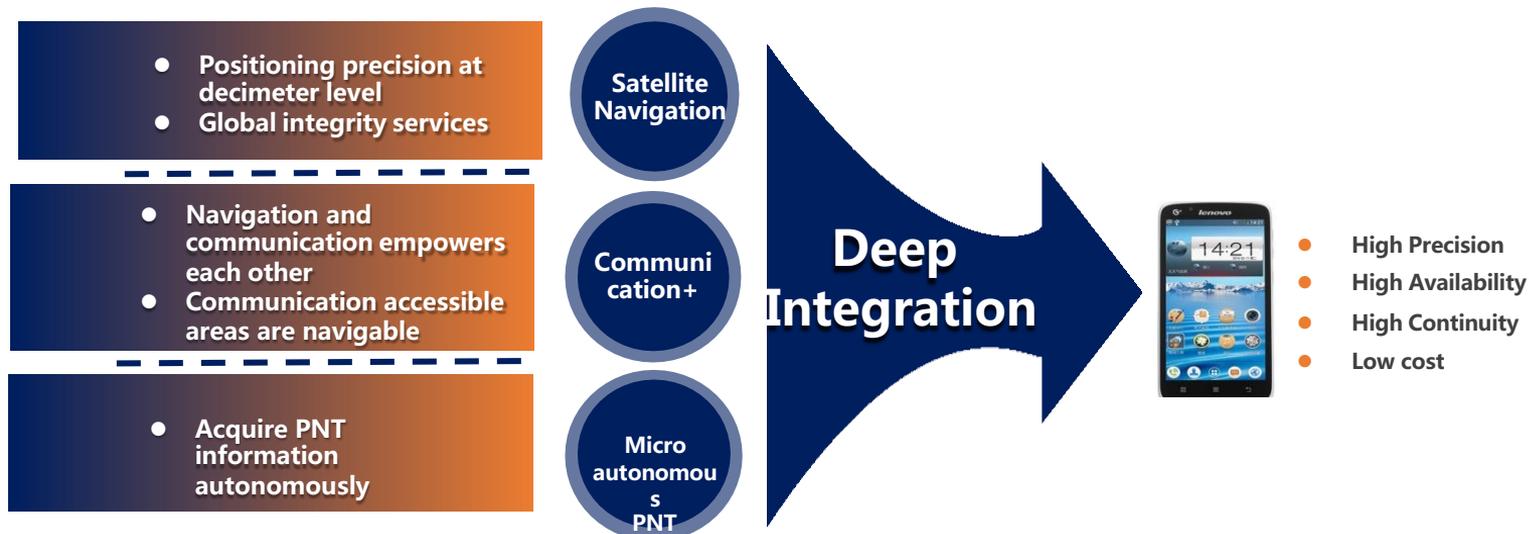
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Future Visions



3 Future Visions

1. Research, development, optimization, launch of backup satellites in accordance with requirements, Insurance of stable and continuous operation of the System, Upgrade on System Performances, and Provision of High Stable, High Reliable, High Secure, and High Quality Space-time Information Services
2. Acceleration of Integration with Newly-Emerging Technologies to Meet the Maximized Needs of PNT System
3. A Comprehensive PNT System will be Established with BDS as the Core





**Thanks for your continuous attention
and support to the BDS development.**

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