10 Application Scenarios of BDS in Africa

China Satellite Navigation Office
2021.11

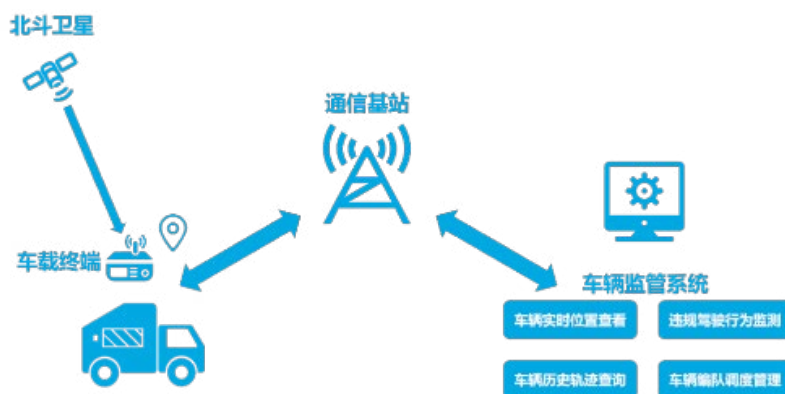# Content

01

Scenario I:

Application of BDS in Road Transport Vehicle Management

① Scenario Overview

For vehicles such as tourist buses, dangerous goods transport vehicles and heavy cargo transport vehicles, BDS positioning and navigation services, combined with Internet communication technology, are used to achieve safe driving management and vehicle scheduling , which effectively reduce the risk of road accidents, and improve the level of road transport management and vehicle scheduling capability.

② Solutions

The BDS vehicle-mounted terminal is installed on the vehicle to obtain key driving data such as real-time location information and operating status, and transmit it back to the system platform in real time through internet communication technology. The vehicle safety management system uses the vehicle location data obtained by the terminal, so that the real-time viewing and management of vehicles' dynamic location data, historical trajectory query, formation scheduling management and other functions can be realized. Through the system-terminal linkage alarm function, the occurrence of over-speed driving, fatigue driving and other violations can be warned in real time.

③ Applications

Case 1: Key Operation Vehicle Supervision in China

More than 7 million vehicle terminals have been promoted and installed in China, realizing the management of all cross-provincial tourist buses, dangerous goods transport vehicles and heavy cargo transport vehicles of more than 12 tons. According to statistics, since it was put into use in 2012, the number of major road transportation accidents and casualties in China have shown an obvious downward trend.

Case 2: Fleet Scheduling Management

In 2018, China and Russia launched a trial operation of China-Russia international road transport. The BDS /GLONASS vehicle-mounted terminal was installed on the international road transport buses and trucks, which realized the scheduling management and orderly operation of the trial operation fleet.

Case 3：Cross-border Vehicle Monitoring for South Africa Logistics Company

BRISK FAST, which is a South Africa company, adopted the solution of "BDS high-precision positioning device plus Internation IoT SIM card", to realize its fleet integrated information management such as whole journey location monitoring and real-time scheduling along the transport route DR Congo → Zambia → Botswana → South Africa → Zimbabwe(or Botswana) → Zambia → DR Congo, and effectively improved its fleet management ability and efficiency.

Case 4：The Safety Monitoring System of Dangerous Goods Transport Vehicle in Zambia

Wideway is a company specializing in sulphuric acid transportation in Zambia. To ensure the safety of dangerous goods transportation, it adopted the monitoring system which contained the basic function of BDS high-precision positioning technology, and extended functions such as remote photographing, voice prompt for driving offence etc. This system tracked and monitored the statues of transport vehicles, drivers and dangerous goods in real time. Working with the safety management regulations, it effectively prevented and controlled the risk of dangerous goods transportation for the fleet.

④ **Vision for Cooperation**

To provide technical solutions for road transport vehicle safety management for African traffic management departments; To provide technical solutions for vehicle fleet management and safety tracking for African transportation enterprises.

⑤ **Case Provider**

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02

Scenario 2:

Application of BDS in Railway Industry

① Scenario Overview

The various stages of railway, including survey, design, construction, operation and maintenance, require satellite positioning, navigation and timing function. BDS navigation satellite system can provide security solutions for railway infrastructure construction and maintenance, time synchronization, passenger and freight transportation scheduling, track deformation monitoring, safety protection of operators on the operation line, train operation control and other fields, which can bring practical benefits for railway cost reduction, quality improvement, efficiency and safety.

② Solutions

BDS has formed a mature solution in the field of railway engineering construction, transportation scheduling, traffic safety and other fields. Firstly, for railway survey and design requirements, precision engineering surveys and geological surveys can provide high-precision position reference for railway surveys，which can improve the efficiency and quality of railway survey and design. Secondly, for railway construction requirements, BDS based geological hazard monitoring, railway track measurement and track irregularity detection can reduce construction safety operations risks and promote the fine management level of construction. Thirdly, for railway operation and maintenance requirements, train approaching alarming protection, safety protection of operators on the operation line, and train control are provided to promote scientific and technological innovation in the field of railway operation organization and transportation services.

③ Applications

## Case 1: Beijing-Shenyang High-speed Rail Track Measurement in China

Based on BDS high-precision positioning technology, on the Beijing-Shenyang high-speed railway, the BDS track inspection device was used to carry out rapid mobile precision measurement of the geometric shape and

position of the railway track. The efficiency of track measurement was improved by dozens of times, and the risk of safe production of railway online operations was greatly reduced.

Case 2: Train Approaching Warning Protection in the Special Railway Line of China PingMei ShenMa Group

Based on BDS high-precision positioning and other technologies, the application of train approaching alarming protection is carried out in the special railway line of China PingMei ShenMa Group. The position information of train and construction workers is tracked in real time, and the approaching early warning protection for construction workers and trains is realized, which effectively improves the safety guarantee ability for workers on the railway operation line.
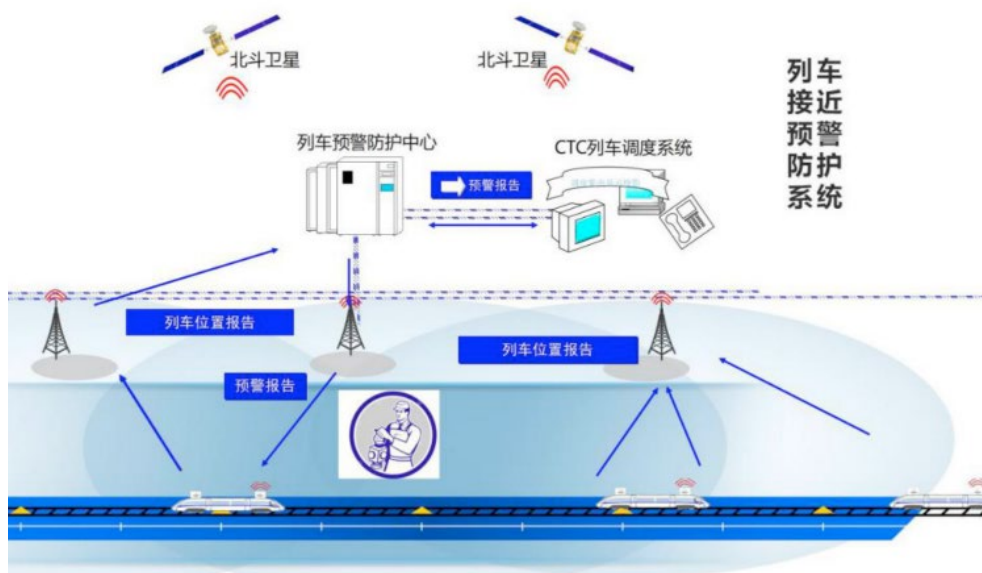
④ Vision for Cooperation

To provide BDS based track measurement, infrastructure deformation monitoring, train approaching alarming and other solutions for African railways, such as the Addis Ababa–Djibouti Railway.

⑤ Case Provider

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03

Scenario 3:

Application of BDS in Precision Agriculture

① Scenario Overview

BDS has three large-scale applications in the field of precision agriculture. First, the application of auto-steering of agricultural machinery improves the operation accuracy and realizes cost saving, energy saving and efficiency increasing; Second, remote maintenance application of agricultural machinery, which will improve the service capacity for enterprise and the quality of agricultural machinery products; Third, the application of big data of agricultural machinery. It helps to grasp the operation efficiency and optimize the development policies of agricultural machinery.

② Solutions

(1) BDS /GNSS Auto-steering System

BDS/GNSS auto-steering system takes the place of driver operation, directly driving the steering system of agricultural machinery to realize auto-steering or unmanned driving. The system has been widely used in sowing, pesticide spraying, targeting, ploughing, intertillage, harvesting, seedling transplanting, ditching and ridging. It can also work normally under the conditions of low visibility, such as windy days, sandy days and night.

(2) BDS /GNSS Remote Agricultural Machinery Operation and Maintenance System

By adopting technologies including BDS positioning, Internet of Things and mobile communication, data of location, operation and working conditions for agricultural machinery are collected and returned in order to carry out fault warning, after-sales service and "Three Guarantees" (repair, replacement and refund) services, which improve the quality of agricultural machinery products.
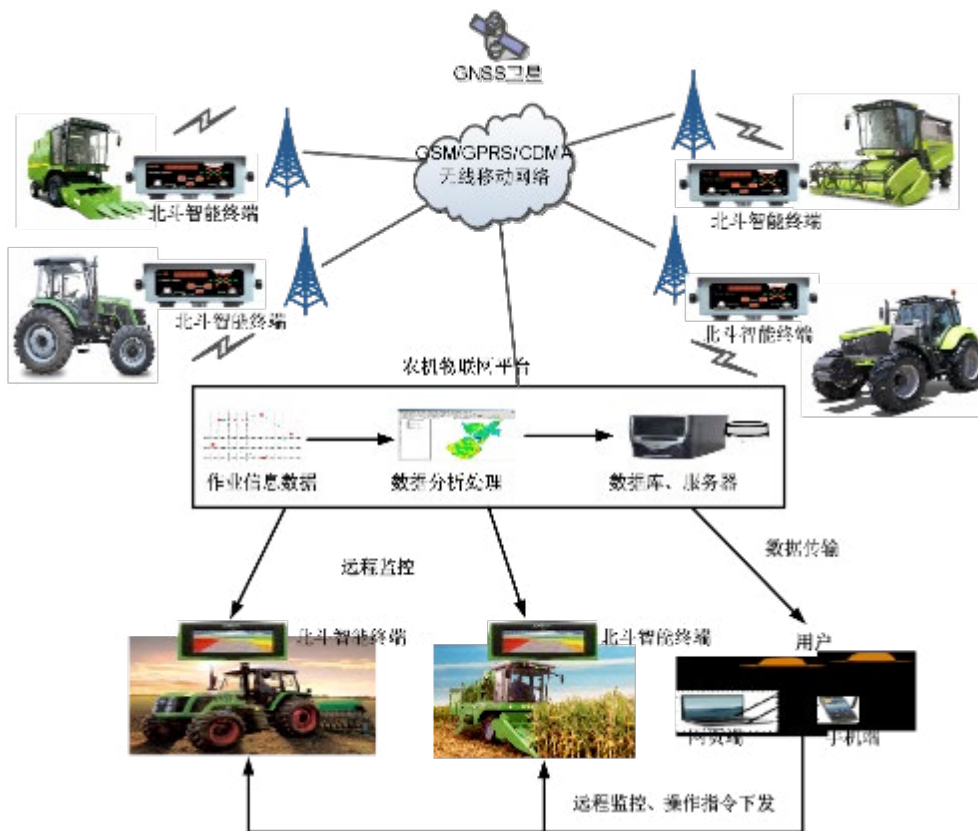
③ Applications

Case 1：The Application of BDS Based Plant Protection UAV in Mozambique, Central Africa

The project is located in Saisai City, Gaza Province, Mozambique, covering an area of 20000 hectares. It is the largest rice cooperative planting project in Mozambique and even in Africa. By adopting BDS based plant protection UAV, the pesticides spraying efficiency is greatly improved; The auto-steering system installed in all kinds of large and medium-sized tractors, has been applied during the entire process of agricultural cultivation, management and harvesting, thus improving the operation efficiency.

Case 2：BDS/GNSS Based Auto-steering System for Cotton Planting

The connection error of BDS/GNSS based auto-steering technology is less than ± 2.5 cm, which can not only meet the accuracy requirements of cotton picker for sowing connection, but also replace skilled operator to achieve cost saving,

efficiency increasing, land usage optimizing and operation time prolonging.

Case 3: BDS/GNSS Remote Maintenance Application

The BDS /GNSS remote maintenance system realizes the operation data management during the whole process of agricultural cultivation, management and harvesting, provides users with accurate agricultural machinery positioning and acreage service, and supports enterprises to realize both accurate and efficient "Three Guarantees" services so as to continuously improve product quality.

Case 4： **The Big Data of National Agricultural Machinery Operation**

The BDS big data center for China's agricultural machinery operation, which has collected more than 280,000 sets of dynamic data from 32 enterprises, has been established to realize nationwide large-scale agricultural machinery data sharing and big data applications.

④ **Vision for Cooperation**

To provide BDS based precision agriculture technology and equipment solutions for agricultural management departments and agricultural cooperatives in Africa.

⑤ **Case Provider**

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Scenario 4:

Application of BDS in International Search and Rescue

① Scenario Overview

The COSPAS-SARSAT satellite system is a worldwide public welfare satellite distress alarm system. It aims to provide accurate, timely and reliable distress alarm and positioning service, and help search and rescue agencies obtain distress information to improve the success rate of the search and rescue of vessels, aircraft and people in distress. The BDS MEOSAR system provides international search and rescue (SAR) services which conforms to the COSPAS-SARSAT standard, and has the BDS return link service (RLS) by the BDS B2b signal.
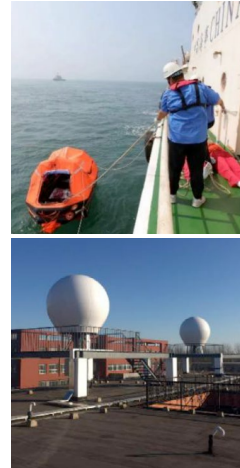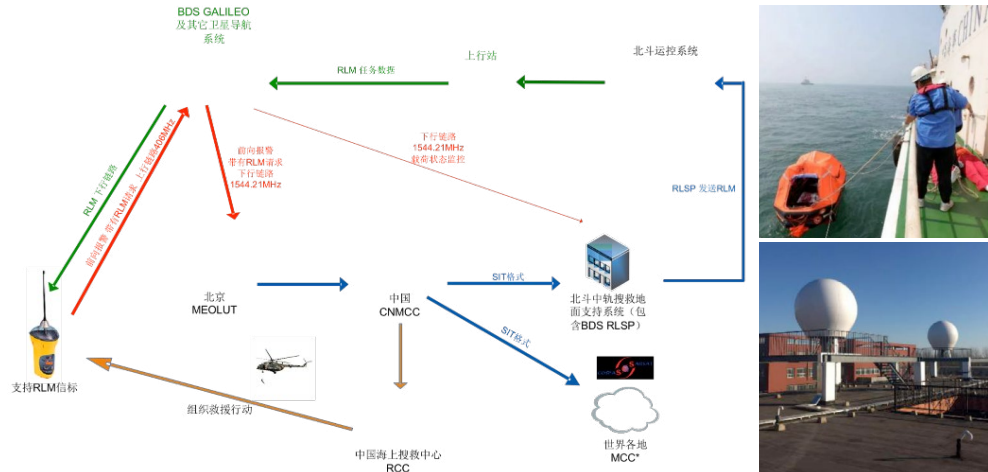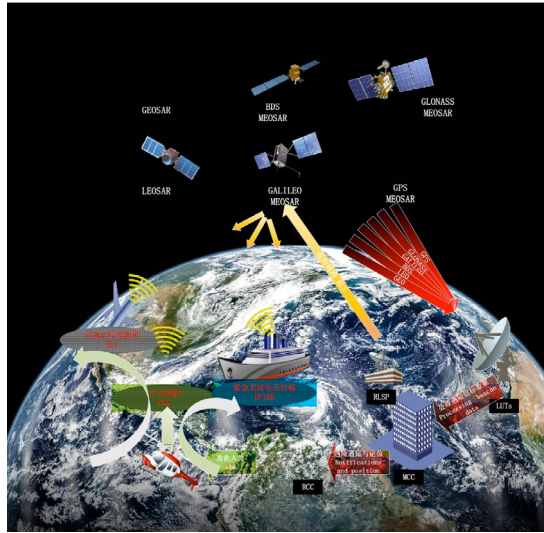
② Solutions

When a ship, aircraft, or person is in distress, the distress beacon can be triggered manually or automatically to send out alarm information. The signal is forwarded by the SAR payload on the BDS satellite, and is received and processed by the BDS SAR service ground segment. The alarm information will be forwarded to the corresponding search and rescue coordination center where provides final rescue according to the distress area and country identification on the beacon. If the search and rescue beacon supports BDS return link function, it can also send confirmation information to users in distress through this return link service, so as to enhance the confidence of people in distress and better protect the safety of human life and property.

③ Applications

Since BDS international SAR service was launched on July 31, 2020, the BDS

SAR payload has operated stably, the international SAR service and specific return link service have operated normally as well. By October 2021, a total of 67085 test signals within 1352 beacons had been received and successfully applied to China's first unscripted maritime SAR exercise in September 2021.

④ Vision for Cooperation

To provide beacon technical solutions supporting BDS return link service to African maritime search and rescue management departments, and improve the success rate of distress rescue; To cooperate in the ground segment construction of MEOSAR, and improve the ground network of the COSPAS-SARSAT satellite system; To jointly carry out the global test and verification of

BDS return link, and lead the construction of international search and rescue return link system.

5 Case Provider

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Scenario 5:

Application of BDS in Land Surveying

① Scenario Overview

Using the high-precision positioning technology provided by BDS/GNSS ground-based augmentation system(also known as Continuously Operating Reference Stations, CORS) with the combination of communication technology, the requirements of different users on the positioning accuracy, real-time and anti-jamming performance across different applications can be satisfied, such as city planning, land surveying and mapping, cadastral management, urban and rural construction, environmental monitoring, disaster prevention, traffic monitoring, mine surveying and others.

② Solutions

BDS/GNSS receiver of Reference Station continuously tracks all the visible satellites and sends differential correction data to the Rover Station（User） through the communication system. GNSS receiver of Rover Station（User） collects these differential correction data, which are sorted and analyzed to obtain the high-precision position of the mobile station（User） in real time. Compared with traditional surveying and mapping technology, GNSS based surveying and mapping is more accurate, convenient and less affected by external interference.

③ Applications

Case 1：High-precision and Rapid Measurement of Hospital Construction in Burkina Faso

In April 2021, The Burkina Faso government used BDS/GNSS high-precision technology to provide basic survey data for the construction of a hospital. The

land security and topographic surveying task were completed within only six days, saving at least half the time than scheduled. It played an important role in rapidly hospital building and fighting against infectious diseases including covid-19.

Case 2：National CORS Construction in Uganda

Nationwide CORS consisting of 30 reference stations have been built in Uganda to provide all-weather high-precision positioning services, which better satisfied the needs of land surveying.


Case 3：GNSS Based Technology Safeguard the Civil Construction in Saudi Arabia

In August 2020, BDS /GNSS technology was applied in metro system construction, topographic surveying and water supply system surveying in Riyadh, the capital of Saudi Arabia, which greatly improved operational efficiency and received highly praise and recognition from local users.

Case 4： **Application of Harbors Reconstruction in Lebanon**

In June 2020, BDS/GNSS high-precision technology provided strong technical support to Beirut Port Reconstruction Project in Lebanon, which was used in accurate topographic surveying of harbors and surrounding waters. The success of the project opened up a new approach for the implementation of faster, efficient and high-precision marine surveying, which has gained appreciation from users.
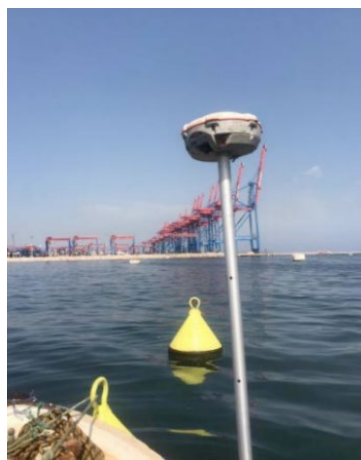
④ Vision for Cooperation

To provide the construction of BDS/GNSS ground-based augmentation system and high-precision positioning technology solutions for land, cadastre and natural resource management departments in Africa; To provide GNSS/BDS based high-precision positioning solutions for African construction enterprises.

⑤ Case Provider

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Scenario 6:

Application of BDS in Digital Construction

① Scenario Overview

Based on BDS positioning technology, Internet of Things, communication and other technologies to realize the scientific control and management of the construction process in an feature of all-round, three-dimensional, multi-level and fine supervision, which help reduce the labor and material cost, and effectively improve the safety factor, so as to enhance the efficiency and quality of the construction of highway and other infrastructure , and realize finally informationization for construction project management.

② Solutions

Engineering machinery vehicle is installed with BDS/GNSS receiver which is also combined with other sensors integration through intelligent control and remote monitoring of construction machinery, realizes the construction process control and scientific management. This technology has been widely used in railway bed and highway construction, water conservancy excavation, dam filling, airport construction and so on.

③ Applications

Case 1：Construction of the Thiès-Touba Highway in Senegal

Using BDS/GNSS based high-precision positioning technology to participate in the whole process control of pavement construction, from mixing material transportation, asphalt paving to road rolling, its real-time supervision and data transmission can effectively improve the quality of pavement construction.

Case 2：Digital Construction Application for Newly Built Shuangtao High Speed in Jilin Province, China

The BIM technology based on BDS high-precision positioning data is combined with other "Internet of things" equipment in field construction such as intelligent roller, paver and mixing station can improve the rolling quality. By retaining 100% of the rolling data , the digitalization, visualization and intelligence of highway construction can be realized.

Case 3：3D Intelligent Paving at Bosch Test Court

The German Bosch Summer Automobile Test Site located in Lianyungang city, Jiangsu Province, China，requires the paving flatness of asphalt concrete surface to be ±2 mm, which is a rare case. However, the 3D intelligent paving system based on BDS/GNSS technology has achieved satisfactory results.

4 Vision for Cooperation

To provide solutions of advanced digital construction management system based on BDS/GNSS positioning technology, which can be applied in the scenario of road, bridge , airports, ports, water conservancy,power dam as well as large urban buildings construction projects in African countries.

5 Case Provider

CHCNAV

Make your work more efficient

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Scenario 7:

### Application of BDS in Intelligent Mining

① Scenario Overview

Based on BDS /GNSS high-precision positioning technology, the mine monitoring system, personnel security system and asset management system are constructed to realize the whole process supervision of mining-storage-transport-sales.

② Solutions

Relying on BDS/GNSS high-precision positioning, high-precision map and other technical methods, connecting vehicle terminals and handheld terminals, an integrated intelligent monitoring platform for mines with an architecture of systematic "cloud-network-terminal" can be constructed. This platform has the capabilities of 3D mine map construction, mine safety monitoring, transportation vehicle dispatching, and mine asset management, so as to realize the centralized supervision of spatiotemporal data in the whole process of minerals from mining to transportation, customs clearance, warehousing and sales.
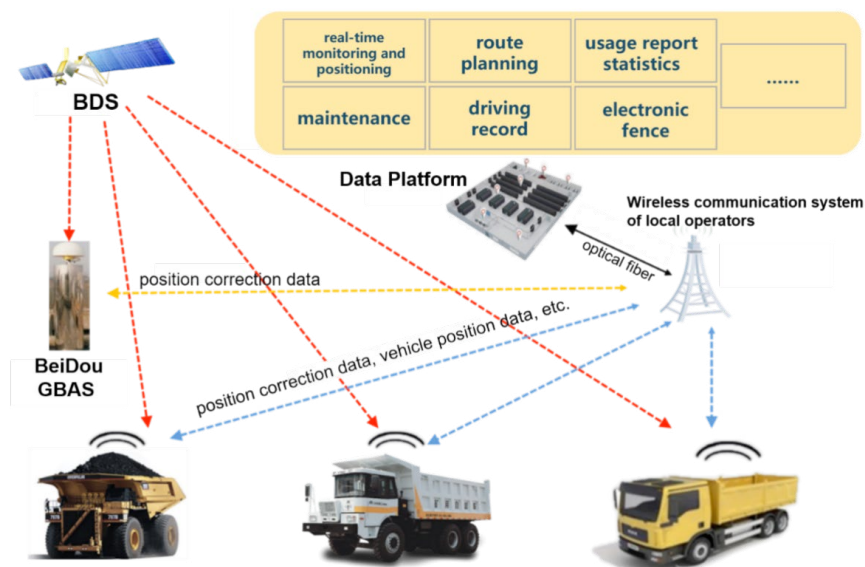
③ Applications

The China-Mongolia Economic Corridor Mine Integration Project refers to the development of the Tavan Tolgoi Mine in the South Gobi Province of Mongolia. In the project, the Integrated Intelligent Supervision Platform based on BDS high-precision service was introduced. The first phase plans to install 100 sets of BDS high-precision positioning terminals to provide integrated mining services such as coal mining, road transportation within Mongolia, customs clearance at bilateral ports, warehousing logistics, and coking coal export sales, etc.

④ Vision for Cooperation

To provide the whole process of integrated intelligent supervision solution for mining areas based on BDS/GNSS high-precision technology for African mines. Currently, we are negotiating cooperation with a number of mines in the DR Congo and Sudan.

⑤ Case Provider

NORINCO Equipment Co.,Ltd

NORINCO International Co.,Ltd

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Scenario 8:

Application of BDS in Public Safety

① Scenario Overview

The visualized system based on BDS/GNSS, coupled with the front-end BDS intelligent terminal, can be used for central command and dispatch. In the event of emergency, information on site location and videos can be transmitted back to the command center at the first time, so that the command center can make targeted and timely decisions, both accuracy and efficiency will be ensured.

② Solutions

The visualized command and dispatch system fulfils functions such as BDS/GNSS real-time positioning, voice intercom, one-key video upload, audio & video calls, high-definition video recording and so on. Commanders can quickly respond to emergencies in a short time and therefore adopting appropriate countermeasures. Meanwhile, the front-end and the command centers are linked to share data, which will minimize the impact and loss caused by emergencies.

③ Applications

Law enforcement officers in Guangdong, Sichuan, Zhejiang, etc. in China have been equipped with applications such as BDS based real-time positioning, trajectory playback, real-time audio & video transmission, voice intercom and so on, with a view to realizing comprehensive information aggregation, dynamic location monitoring, real-time situation reporting and timely dispatching.

④ Vision for Cooperation

To provide solutions of visual command and dispatch management system based on BDS technology for Public safety and urban security in Africa, so as to meet the needs of targeted and unified personnel management as well as emergency command and dispatch, etc.

⑤ Case Provider

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Scenario 9:

Application of BDS in Wildlife Conservation

① Scenario Overview

Combined BDS high-precision positioning with satellite remote sensing technology, research activities including wildlife habitat survey ,wildlife tracking and monitoring can be carried out.
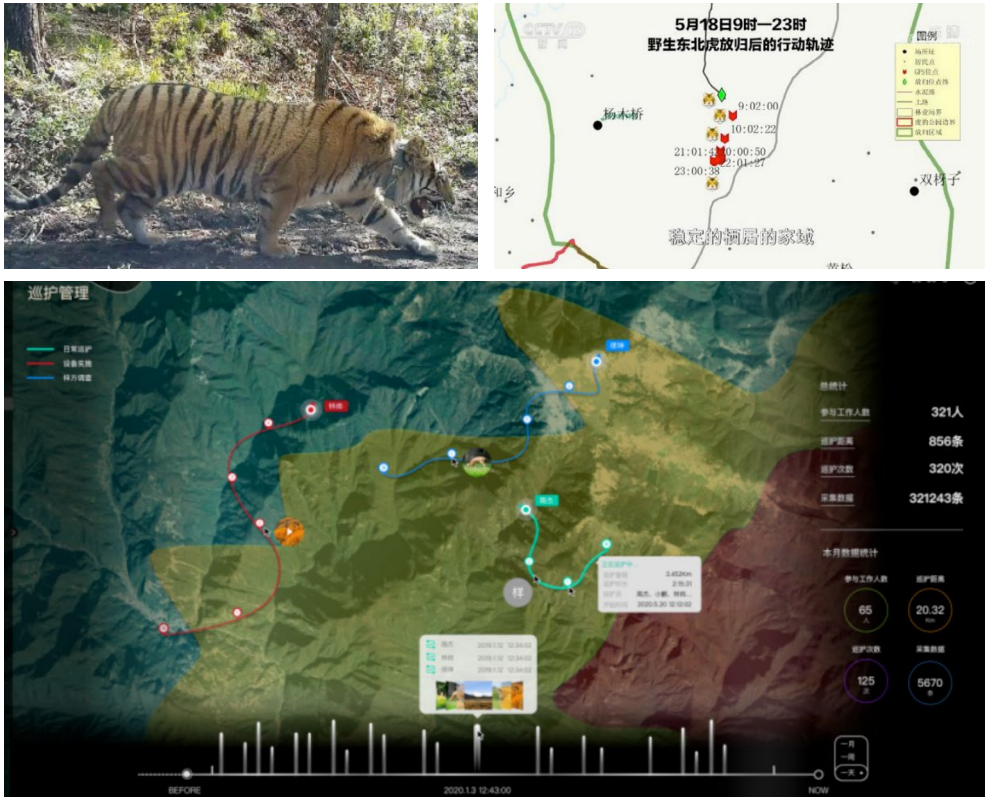
② Solutions

BDS locator marker is used to identify the real-time location of animals and send back their physiological information such as temperature, pulse and movement status timely. Through tracking and analyzing the living habits of wild animals, it supports for wildlife protection and scientific research.

③ Applications

In May 2021, the Siberian tiger "Wandashan No.1" was returned to nature. The BDS tracking collar sends back information about its location every hour for scientists studying the living habits of Siberian tigers.

④ Vision for Cooperation

To provide technical solutions such as wildlife tracking, monitoring, patrol and investigation and so on for African wildlife management departments.

⑤ Case Provider

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Institute of Forest Resource Information Techniques, Chinese Academy of Forestry

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Scenario 10:

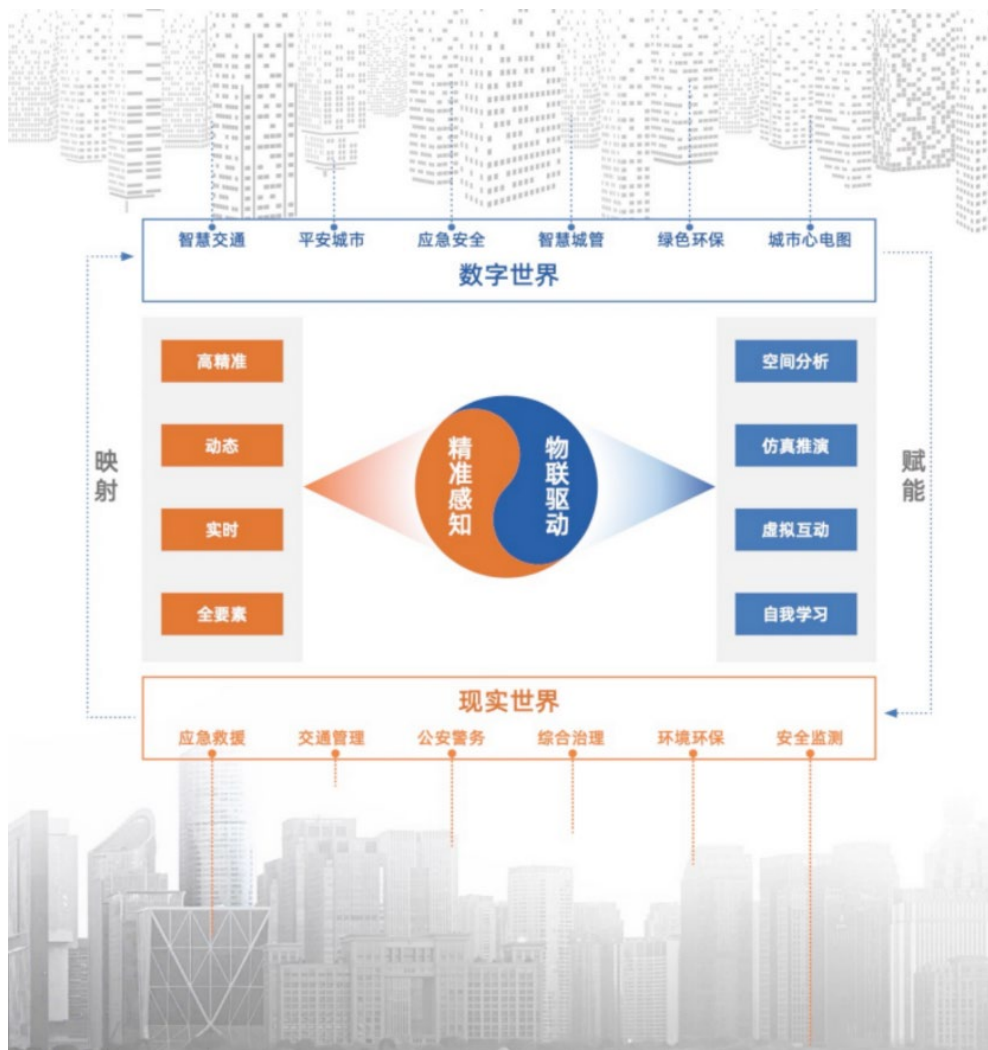## Application of BDS in Precise Space–time Smart City

① Scenario Overview

It uses a unified time and space benchmark to converge and integrate various data in the real world, and map it into a high-precision, real-time, dynamic, and full-element digital twin world to drive a large number of smart devices to perceive the city. It will empower the creation and upgrade of smart applications for fine management of the city.

② Solutions

Focusing on the direction of urban governance, it is supported by a high-precision space-time common service system to implement scenarios such as traffic operation, safety monitoring, and green urban management. Therefore, it applies precise spatial-temporal capabilities to urban management, gathers various spatial-temporal related data, and enhances the level of intelligent application of spatial-temporal data.

智慧交通　平安城市　应急安全　智慧城管　绿色环保　城市心电图

数字世界

高精准　　　　　　　　　　　　　　空间分析

动态　　　精准感知　物联驱动　仿真推演

实时　　　　　　　　　　　　　　虚拟互动

全要素　　　　　　　　　　　　　　自我学习

映射　　　　　　　　　　　　　　　　赋能

现实世界

应急救援　交通管理　公安警务　综合治理　环境环保　安全监测

③ Applications

Case 1：The "City Brain" of Deqing, Zhejiang Province, China

By drawing a high-precision map covering the main urban area of Deqing
County , which integrates with the data resource platform and AI algorithm
service platform of "ET City Brain" , can provide innovative application
scenarios covering transportation, traffic management, tourism, urban
management and big data of industrial enterprises. It has become a new
infrastructure for the construction of Deqing Smart City.

Case 2：High-precision Location Management of Public Service System in Changshou, Chongqing Province, China

Through the application of BDS smart terminal in precise traffic operation management, safety monitoring, friendly urban management and intelligent water area inspection, the system perceives the dynamic changes of urban operation, supports the development of various intelligent and innovative applications in the direction of urban governance, and realizes urban operation interconnection of related data in time and space.

④ Vision for Cooperation

To provide an overall solution for the construction of BDS precise space-time smart cities for the construction of cities in Africa.

⑤ Case Provider

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