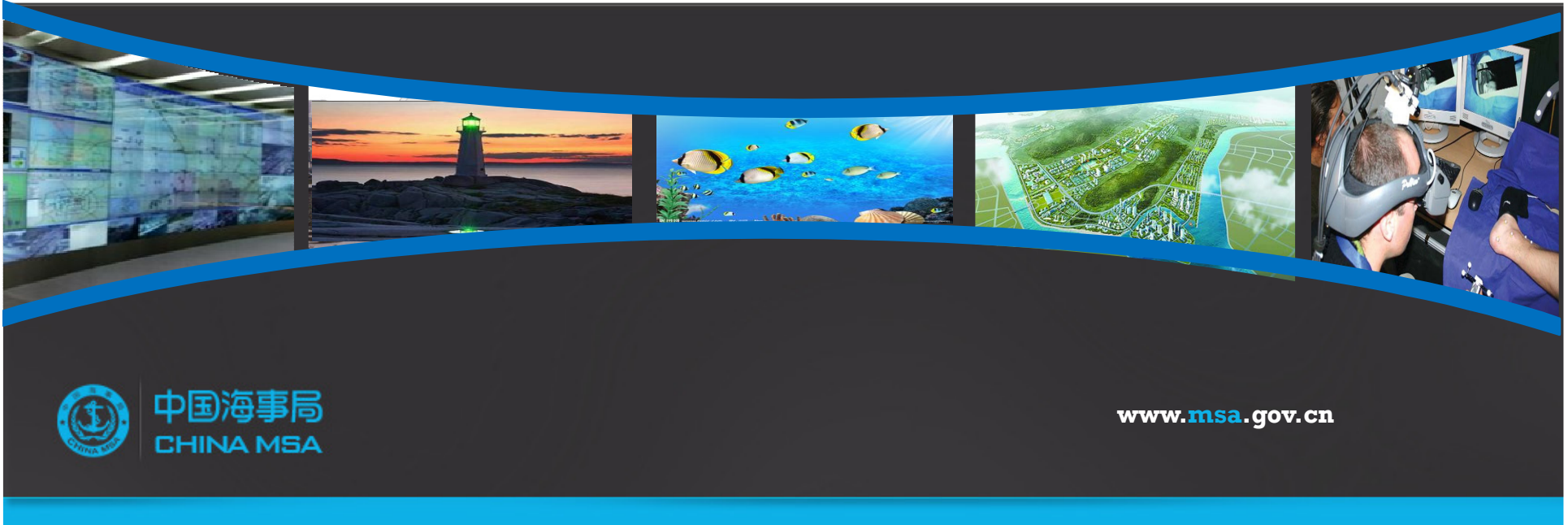




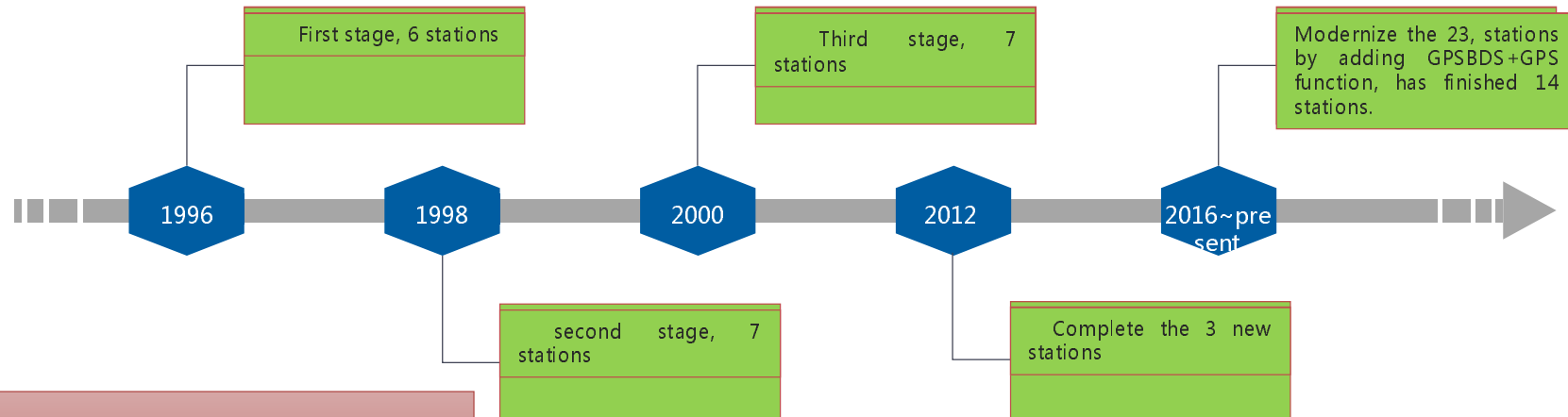
Introduction on the modernization of RBN-DGNSS in China



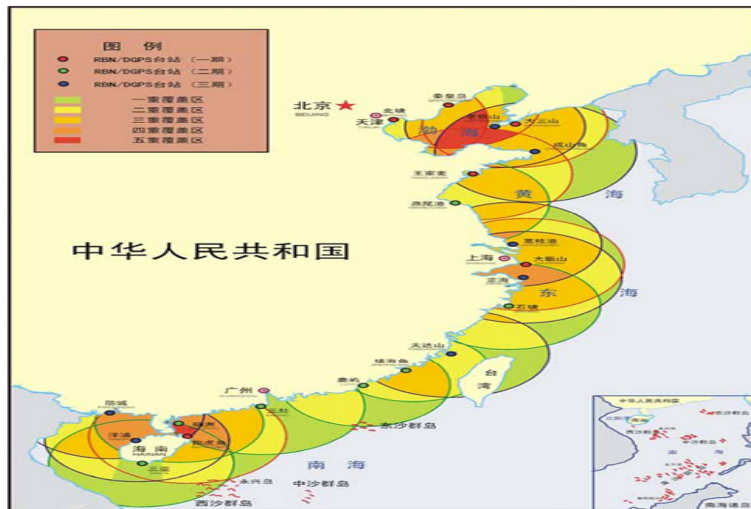
1, The construction of RBN-DGNSS differential station

www.msa.gov.cn

Constructing process



Coverage



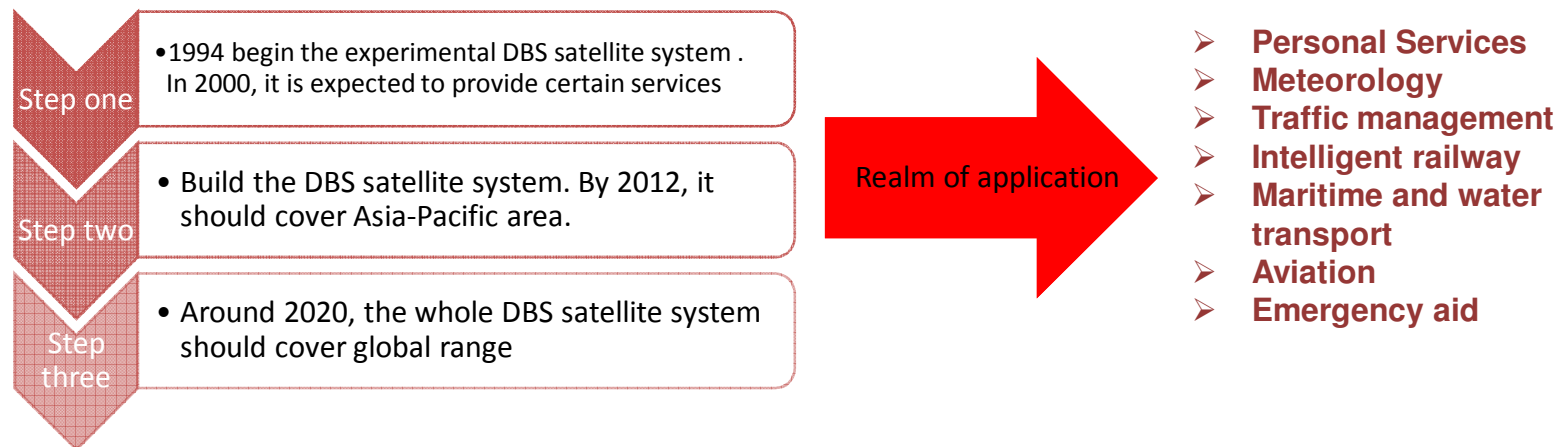
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Development of BDS system in China

Following GPS, GLONAS and GALILEO, China has come up with BDS. The system consists of space end, terrestrial end and user terminal. It can provide high accuracy and high reliability positioning service, navigation service, timing service and message service to different types of users around the world in any time.



RBN-DGNSS

The BDS system provides compatibility for RBN-DGPS

- WWRNS has recognized BDS as its part
- IMO has recognized the performance standard of BDS ship-borne transponder
- IEC has made test standards for BDS receiver according to these performance objectives

The disadvantages of previous RBN-DGPS system

- (1)Old equipment of 90s
- (2)difficult to upgrade
- (3)Maintainance cost
- (4) not comply with BDS

To solve these issues, the old system was upgraded in 2016.
Now it support for GPS+BDS double mode operation.



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RBN-DGNSS

2, Introduction to the modernization of RBN-DGNSS in China

Main technical features

- Compliant with the CSSA (Common Shore based System Architecture) technical infrastructure, under e-Nav;
- Compliant with IALA R-135 Recommendations ;
- Based on SDR ;
- Software differential ;
- Virtual center(reference station) ;



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Reference

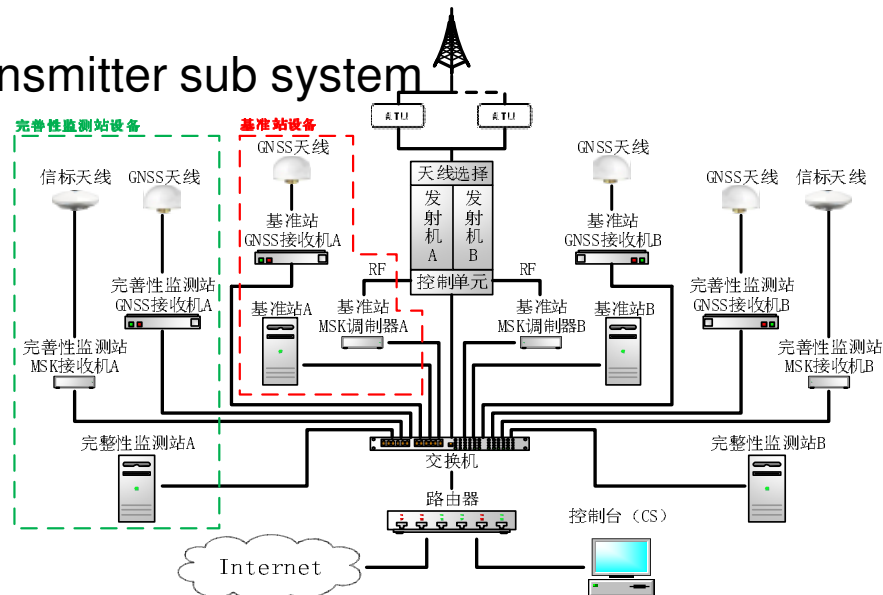
- 1、RTCM 10402.3 RTCM Recommended Standards for Differential GNSS (Global Navigation Satellite Systems) Service, Version 2.3 with Amendment 1 (May 21, 2010)
- 2、RTCM 10401.0, Standard for Differential Navstar GPS Reference Stations and Integrity Monitors (RSIM)
- 3、RTCM 10401.2, Standard for Differential Navstar GPS Reference Stations and Integrity Monitors (RSIM)
- 4、RTCM RSIM 1.3 Draft: RTCM 10401.3 for Differential Global Satellite Systems Reference Stations and Integrity Monitors (DGNSS RSIM)– Version 1.3
- 5、IALA Recommendation R-135 On The Future of DGNSS Edition 2 December 2008
- 6、IALA World Wide Radio Navigation Plan Edition 2 December 2012
- 7、GNSS receiver differential data form (1) China second generation satellite navigation system standard BD 410002-201



RBN-DGNSS

RBN-DGNSS broadcast station system:

- 1, base station
- 2, Integrity monitoring
- 3, Managing station
- 4, Transmitter sub system



Real product



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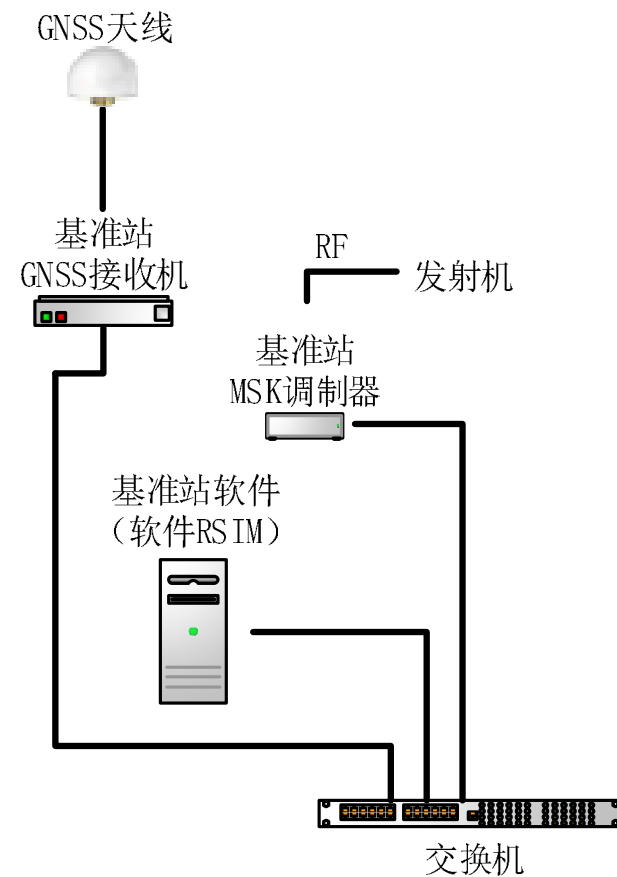


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RBN-DGNSS

Base station

GNSS receiver receives BDS/GPS/GLONASS satellite signal, and transmits raw data to base station's differential algorithm module in the server via network. RTCM data is produced through processing, and reaches the reflector after MSK modulator.



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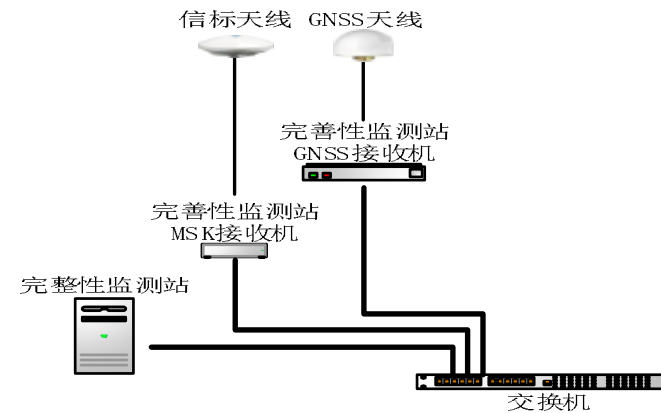
RBN-DGNSS

Integrity monitoring

It transmits the raw data and RTCM data to the demodulation module of IM in the server via network. It can separately produce positioning information based on BD, GPS, GLONASS and integrated systems(after joint correction) .While analyzing the position, it will send alert information back into base station.

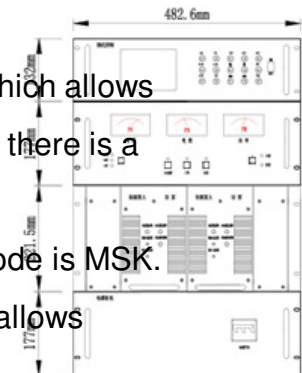
Managing station

Managing station will receive abnormal report of the system, and troubleshoots the problem. It will do corrections and resets, such as temperature and humidity. Additionally, it controls power supply of different broadcast stations.



Transmitter sub system

The medium wave transmitter applies modified design. It consists of two separate power amplifying units, which allows switching between each other when there is a failure. The operating frequency is 283kHz~325kHz, and operating mode is MSK. It supports TCP/IP interface, which allows remote monitoring.

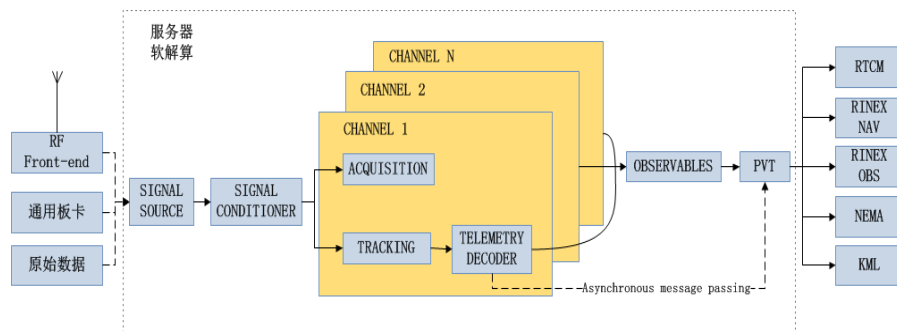


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1, Based on SDR



3, High accuracy GNSS receiver compatible with triple systems

Implement BD B1/B2/B3、GPS L1/L2/L5、GLONASS L1/L2 receiver

GPS、GLONASS、BD Multiple satellite tracking technology
Positioning accuracy

Stationary demodulation accuracy

Plain: $\pm (2.5\text{mm} + 0.5 \times 10^{-6}D)$

Height: $\pm (5\text{mm} + 0.5 \times 10^{-6}D)$

Dynamic demodulation accuracy

plain: $\pm (10\text{mm} + 1 \times 10^{-6}D)$

height: $\pm (20\text{mm} + 1 \times 10^{-6}D)$

Initiated reliability: 99.9%

2, Compliant with international RTCM and RSIM standards

Support RTCM2.1、2.2、2.3, as well as GNSS receiver differential data form(1) version 2.4.

Support international RSIM1.2 standards



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4、Generate and demodulate Differential data by software RSIM

Getting rid of conventional hardware RSIM, all differential data is processed by software in the server. Base station receiver and integrity monitoring receiver are only responsible for getting raw satellite data and beacon data.

5, medium wave transmitter

The medium wave transmitter consists of two separate power amplifying units, which allows switching between each other when there is a failure. The operating frequency is 283kHz~325kHz, and operating mode is MSK. It supports TCP/IP interface, which allows remote monitoring.



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Thank you !



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