High Precision Applications with BeiDou

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Background

• BeiDou: Full Operational Capability for China and surrounding area since Dec 27, 2012.
Background

• BeiDou System Contributions
  – Support tri-frequency applications
  – New services on communications
    • Short Message Service (RDSS function)
  – More satellites and better frequency diversity
    • 14 more satellites
    • more signal components and more modulations
    • GEO satellites can improve availability and TTFF
Overview of BeiDou high precision products

- BDS B1/B2/B3
- GPS L1/L2/L5
- GLONASS L1/L2
- GALILEO E1/E5a/E5b

Surveying
- CORS
- GIS

RTK
- Heading
- DGNSS

GIS
- DGNSS
Overview of BeiDou high precision products

- BDS B1/B2/B3
- GPS L1/L2
- GLONASS L1/L2

- BDS RNSS / RDSS
- GPS L1
- DGNSS

RTK Rx
CORS Rx

GIS Products
Overview of BeiDou high precision products

Unicore Rx Architecture

Signal Receiving
- Any 4 (or more) GNSS satellites

Baseband
- Unified and configurable baseband architecture
  - Code generation unit to support all types of PRN codes
  - Support BPSK, QPSK, BoC, mBoC, AltBoC, etc.

PVT
- Unified GNSS coordinate and time system
- PVT with Embedded RAIM for security and integrity
Applications of BeiDou high precision products

• Surveying, Mapping & GIS
• Continuously Operating Reference Stations
• Meteorological Applications
• Heading & Positioning
• Deformation monitoring
• ......
Applications of BeiDou high precision products

- Surveying, Mapping & GIS
  - Giving full play to the multi-constellation combined positioning accuracy advantage and BDS tri-frequency application advantages, it can provide more accurate, more reliable performance.
Applications of BeiDou high precision products

• CORS: BeiDou Ground Base Enhancement System
  - Consisting of 30 ground base stations
  - GNSS Receiver: Unicore UR370 (BDS B1B2B3, GPS L1L2, GLONASS L1L2)
  - CORS software: WHU PowerNetwork
  - Positioning accuracy: Horizontal < 2cm; Vertical <5cm (RMS)
Applications of BeiDou high precision products

- CORS: BeiDou Ground Base Enhancement System
Applications of BeiDou high precision products

- CORS: BeiDou Ground Base Enhancement System
Applications of BeiDou high precision products

- Meteorological Applications: water vapor monitoring & measurement system
  - User: 中国气象局 (China Meteorological Administration)
  - Requirements
    - BDS B1/B2/B3 & GPS L1/L2 & GLONASS L1/L2
    - Range noise < 10cm RMS
    - Carrier noise < 1mm RMS
    - > 16GB flash for data storage
    - Remote control and upgrade over TCP/IP
  - Quantity
    - 12 sets so far
    - >200 sets in the coming years

Unicore UR370
Applications of BeiDou high precision products

- Meteorological Applications: water vapor monitoring & measurement system
Applications of BeiDou high precision products

• Heading & Positioning: Driving test
  – The market vehicle positioning and heading market in China has great potential, especially in the field of driving test, due to the government requirements of layout specifications for driving test fields and facilities.
  – With the use of dual-frequency or tri-frequency RTK and heading technology, BeiDou high precision receiver can achieve a position accuracy of 2cm, heading accuracy of 0.2°, and a velocity accuracy of 0.03m/s, fully meet the requirement of driving test applications.
Applications of BeiDou high precision products

- Heading & Positioning: Driving test
Applications of BeiDou high precision products
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- Deformation monitoring: Hanyuan, Sichuan
Applications of BeiDou high precision products

- Deformation monitoring: Hanyuan, Sichuan
Applications of BeiDou high precision products

- Deformation monitoring: Bazhong, Sichuan
Applications of BeiDou high precision products

- Before and after the earthquake

A 7.0-magnitude earthquake hit Lushan county of Ya'an city in southwest China's Sichuan Province, April 20, 2013
Summary

- BeiDou navigation system provides significant enhancements to GNSS.
- The BeiDou receivers have been already developed and also comprehensively used in high precision applications, such as surveying & GIS, CORS network, driving test system and deformation monitoring system, etc.
- Taking the advantages of BeiDou system and GNSS interoperability, wider applications will be explored not only in China and also worldwide.
Thank you!

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