BeiDou Demonstration Project in Korea
- Initial Results

November 5, 2012

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Congratulations!

- Successful launch of the 16th Beidou satellite into space at 11:33 p.m. Beijing Time, October 25, 2012
BEIDOU Demonstration Project in Korea

✓ Assessment of Beidou performance in Korea
  ■ A typical international cooperation for promoting BEIDOU
  ■ National GNSS Research Center
    In cooperation with Shanghai Jiao Tong University
  ■ Supported by Beidou office (CSNO)

✓ Three applications
  ■ Navigation using CDGPS (NGRC, KARI)
  ■ Surveying/mapping (NGRC, KASI)
  ■ Timing (NGRC, KRISS)

✓ Two-phase pilot project
  ■ 1st phase: Basic assessment including feasibility study (2012)
  ■ 2nd phase: Detail assessment (2013)
Performance Assessment of Beidou and/or GPS

Performance Evaluation of Beidou in the 1st phase

- Signal Acquisition and Performance Analysis in Urban Valley
- CDGPS using single Beidou RS
- CDGPS using Beidou RS Network
7th Meeting of the ICG

Plans for 1st Phase

End of October 2012

- H/W Setup
  - DGPS sites
  - + Equipment
  - Communications

End of November 2012

- S/W Testing
  - Raw data
  - RTCM, NTRIP
  - Processing S/W

End of December 2012 or End of January 2013

- Applications
  - Mapping/Surveying
  - Navigation/timing
System Configuration

NDGPS Reference Stations (4)

Communication Equipment
- VPN
- Router and Switch (>8 Port)
- TCP/IP Access via Internet

Server (2 or 3)
- Server for Beidou data archiving
  - For providing post-time 1Hz data to SJTU
- Server for data processing
  - RTCM data to the NTRIP Caster
- Web server
  - Data contribution to GNSS users via Web access
- Server Cabinets (or Racks)

Accessories
- UPS Rack Mount
  - to protect equipment
Planned RS Network for Field Test

- The Distance between the NDGPS Reference Stations is 71km~108km
- iGMAS site at KARI or KASI (Daejeon)

iGMAS : International GNSS Monitoring and Assessment Service
Zero baseline Test

✓ Receivers delivered on 25th October, 2012

**Receiver Spec.**

BeiDou M300 GNSS

- L1C/A, L1/L2P, B1/B2
- Single Point Accuracy (RMS): <1.5m
- Static Differential Accuracy:
  - (Horizontal) ±(2.5+1×10⁻⁶D)mm
  - (Vertical) ±(5+1×10⁻⁶D)mm
Zero baseline test: DD code quality (L1, B1)

**GPS Code Measurement**

<table>
<thead>
<tr>
<th>PRN</th>
<th>Mean [m]</th>
<th>Std. [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>14-22</td>
<td>0.023</td>
<td>0.215</td>
</tr>
<tr>
<td>14-25</td>
<td>-0.018</td>
<td>0.210</td>
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<tr>
<td>22-25</td>
<td>-0.041</td>
<td>0.191</td>
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</table>

**BeiDou Code Measurement**

<table>
<thead>
<tr>
<th>PRN</th>
<th>Mean [m]</th>
<th>Std. [m]</th>
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</thead>
<tbody>
<tr>
<td>1-7</td>
<td>0.064</td>
<td>0.245</td>
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<tr>
<td>1-10</td>
<td>0.029</td>
<td>0.287</td>
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<tr>
<td>7-10</td>
<td>-0.035</td>
<td>0.303</td>
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</table>
✓ Zero baseline test: DD CP quality (L1, B1)

**GPS Carrier Measurement**

![Chart showing GPS DD Measurements with epochs from 1 to 300, comparing PRN14-PRN22, PRN14-PRN25, and PRN22-PRN25.]

**BeiDou Carrier Measurement**

![Chart showing BeiDou DD Measurements with epochs from 1 to 300, comparing PRN1-PRN7, PRN1-PRN10, and PRN7-PRN10.]

<table>
<thead>
<tr>
<th>GPS</th>
<th>Mean [m]</th>
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<tr>
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<table>
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<th>Std. [m]</th>
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<td>0.005</td>
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<tr>
<td>1-10</td>
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<td>0.006</td>
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<tr>
<td>7-10</td>
<td>0</td>
<td>0.007</td>
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</table>
Short Baseline Test (static)

- On the roof of E2 building, CNU : about 50m baseline

Reference position (A)
- ECEF: (-3119372, 4087994, 3760895)
- LLH : Latitude : 36.3645
  Longitude : 127.3457
  Altitude : 93.7988

Rover position (B)
- ECEF: (-3119381, 4088014, 3760866)
- LLH : Latitude : 36.3642
  Longitude : 127.3456
  Altitude : 93.7988
✓ Initial result of Short Baseline Test – dual frequency
✓ All the necessary information was not extracted from receivers
Dynamic Test (urban canyon)

- Reference trajectory using NovAtel Receiver at CNU campus

✓ Real time dynamic test using BeiDou Receiver – dual frequency
✓ The elevation angle of BeiDou SVs is higher

- GPS Only
- BeiDou Only
- GPS + BeiDou

Standalone Navigation

RTK Navigation
Concluding Remarks

✓ Initial results of BeiDou demonstration in Korea
  ■ Zero baseline test → signal quality of BeiDou & GPS
  ■ Static short baseline test → positioning performance of BeiDou & GPS
  ■ Dynamic test → navigation performance of BeiDou & GPS

✓ Zero baseline test
  ■ GPS signals looked like a little bit better than BeiDou signals
    but comparable
  ■ BeiDou is well operated

✓ Static short baseline test, Dynamic test
  ■ Complete analysis was not possible since all the necessary information
    was not available from receivers
  ■ Nevertheless, benefits of BeiDou is clearly seen as expected
    due to the increased number of SV, higher elevation angle

✓ Phase 1 will be finished by December 2012
Expect contributions of BEIDOU to sustainable GNSS service through international cooperation

Thank you for listening!