The Centispace-1: A LEO Satellite-Based Augmentation System

14th Meeting of the International Committee on Global Navigation Satellite Systems

Yang Long
Beijing Future Navigation Technology Co., Ltd.

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System Description

The CentiSpace-1: A LEO Satellite-Based Augmentation System
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System Description

- **WALKER Constellation**: 120/12/0
- **Orbit altitude**: 975km
- **Inclination**: 55 degree

<table>
<thead>
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<td>(70°, 0°)</td>
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Above 2 coverages between 70 degree north and 70 degree south
System Description

The CentiSpace-1: A LEO Satellite-Based Augmentation System

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<th>ssn_no</th>
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FREQUENCY INFORMATION

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</table>
**System Description**

- Satellite weight: ≈100 kg
- Satellite life: 10 years
- Inter satellite link: High speed cross-link
System Description

★ Master station: 1
★ Gateway station: 2
★ Monitor station: 10
01 System Description

- Chips
- OEM, modules
- Receivers
- Product solutions
- ......
System Description

➢ High accuracy service

• **Dm level service**: <50cm, (cold start, 5s)
• **Cm level service**: <10cm, (cold start, 1min)
• **Number of user**: unlimited
• **Features**: high accuracy, fast convergence, low cost, low power consumption
01 System Description

➢ High accuracy service
➢ Integrity augmentation service

- Availability: 99.99%, 50cm
- Alarm time: <3s
- Number of users: unlimited
- Features: easy to get, both for professional and public users

The CentiSpace-1: A LEO Satellite-Based Augmentation System
System Description

- High accuracy service
- Integrity augmentation service
- GNSS monitoring service

- **GNSS**: BDS, other GNSS
- **Coverage**: Global
- **Features**: space based monitoring stations, real time observation data transferring with inter-satellite links

The CentiSpace-1: A LEO Satellite-Based Augmentation System
Working Principle
Working Principle

Normal Point Positioning Technique

- Accuracy: 5m~10m
- Hot Start Time: 1s
- Cold Start Time: 30s~50s

Precise Point Positioning Technique

- Accuracy: <10cm
- Convergence time: ~20min

+ LEO satellites

1min
Working Principle

Different orbit altitude

Different convergence time for PPP

<table>
<thead>
<tr>
<th>Orbit type and Altitude</th>
<th>Convergence Time</th>
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<tbody>
<tr>
<td>LEO (1000km)</td>
<td>1 min</td>
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<td>MEO (10000km)</td>
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<td>BDS GEO (36000km)</td>
<td>+∞</td>
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</table>

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Working Principle

BDS+Centispace-1: <60s

Simulations
Working Principle

GNSS constellation
More visible satellites

LEO constellation
Rapid movement

Fast convergence & High accuracy
Working Principle

- Fast convergence and high accuracy
- Interoperability and compatibility
- Low cost and low power consumption
Development Plan
Development Plan

**Second stage: 2021-2023**
- Launch of 10-20 satellites in 2021;
- Launch of 100-110 satellites from 2022 to 2023;
- Construction of ground segment;
- System final test.

**First stage: 2016-2020**
- Launch of 1 experimental satellite in 2018;
- Launch of 5 experimental satellite in 2020;
- Construction of ground segment;
- User segment researchment.

**Verification and Validation**
- Verification and Demonstration of the system performance on orbit
- Verification and Validation of key technologies

**Complete the project construction and test**
- 2023
- Launch of 10-20 satellites 2021
- Launch of another 5 experimental satellites 2019-2020
- Launch of the first experimental satellite 2018
- Found of company 2017
- Complete the project construction and test 2023
03 Development Plan

• One carrier rocket with single or double satellites in the **experimental stage** (S1 experimental satellite has been launched on 28\textsuperscript{th} Sep. 2018)

• One carrier rocket with 10-12 satellites in the **construction stage**
First stage: 2016-
Launch of 1 experimental satellite in 2018; 
Launch of 5 experimental satellites in 2020; 
Construction of ground segment; 
User segment researchment.

Second stage: 2021-
Launch of 10-20 satellites in 2021; 
Launch of 100-110 satellites from 2022 to 2023; 
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System final test.

Verification and Validation of key technologies
Development Plan

First stage: 2016 - 2020
- Launch of 1 experimental satellite in 2018;
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Second stage: 2021 - 2023
- Launch of 10 - 20 satellites in 2021;
- Launch of 100 - 110 satellites from 2022 to 2023;
- Construction of ground segment;
- System final test.

Verification and Validation of key technologies
Development Plan

- In 2020, other 5 experimental satellite will be launched.
Conclusion

➢ A LEO satellite-based augmentation system
➢ Fast convergence, high accuracy, low cost, low power, global
➢ Have a good start, progress smoothly
➢ Welcome International cooperation
Thanks for your attention and support!

14th Meeting of the International Committee on Global Navigation Satellite Systems

Email: yangl@centispace.com