Input paper: [[1]](#footnote-1) ENG12-3.1.15

Input paper for the following Committee(s): check as appropriate Purpose of paper:

**□** ARM **🗹** ENG **□** PAP **🗹** Input

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Agenda item [[2]](#footnote-2) 3.1

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Author(s) / Submitter(s) CHINA MARITIME SAFETY ADMINISTRATION

Information update of BDS and BDSBAS

# Summary

The BDS constellation deployment was accomplished on June 23 and was formally commissioned for global service On July 31st.

The BeiDou Satellite Based Augmentation System (“BDSBAS”) is an important part of BDS, and provides the Single Frequency (SF) service through BDSBAS-B1C signal and the Dual-Frequency Multi-Constellation (DFMC) service through BDSBAS-B2a signal for users in China and surrounding areas. “BeiDou Navigation Satellite System Signal In Space Interface Control Document Satellite Based Augmentation System Service Signal BDSBAS-B1C” has been released in July,2020.

## Purpose of the document

The purpose of the document is providing updated information for the Committee to review and consider the applications of BDS and BDSBAS in maritime.

## Related documents

[1] The Application Service Architecture of BeiDou Navigation Satellite System (Version 1.0), December, 2019

http://www.beidou.gov.cn/xt/gfxz/201912/P020191227333024390305.pdf

[2] Development of the BeiDou Navigation Satellite System (Version 4.0), December 2019

http://www.beidou.gov.cn/xt/gfxz/201912/P020191227430565455478.pdf

[3] BeiDou Navigation Satellite System Signal In Space Interface Control Document Satellite Based Augmentation System Service Signal BDSBAS-B1C (Version 1.0), July, 2020

http://www.beidou.gov.cn/xt/gfxz/202008/P020200803362065480963.pdf

# Background

China has submitted “ENG10-3.1.15 The Development Status and Plan of BeiDou and BeiDou Satellite-based Augmentation System ”in ENG 10 to introduce the BDS and BDSBAS status . on July 31 2020, BDS-3 was formally commissioned to provide global services. BDS will continue to actively participate in international satellite navigation affairs, push forward the multisystem compatibility and sharing, carry out international exchanges and cooperation, promote international BDS applications according to the needs of the people around the world, and share the latest BDS development achievements.

# Discussion

## BDS Development Status

The construction and development of the BeiDou Navigation Satellite System is divided into three phases: BDS-1, BDS-2, and BDS-3 in sequence. Initiated in November 2009, the BDS-3 project has gone through five stages, including key technologies breakthroughs, experimental satellites engineering, the minimum system, the preliminary system and the completed system. On June 23, the 55th BDS satellite, the last BDS-3 constellation satellite, was successfully launched on board a Long March-3B rocket at the Xichang Satellite Launch Centre. It marked that the full completion of the BDS constellation deployment was accomplished a half year ahead of schedule. On July 31st, General Secretary XI Jinping of the CPC Central Committee announced to the world that BDS-3 was formally commissioned, marking the completion of the “three-step” BDS development strategy. All kinds of the BDS services are available right now.

## BDSBAS Development Status

The BeiDou Satellite Based Augmentation System (“BDSBAS”) is an important part of BDS, and is mainly comprised of space segment, ground segment and user segment. The space segment includes 3 Geostationary Earth Orbit (GEO) satellites. The first GEO satellite was launched in October 2018, and the other two were launched in 2019 and 2020. The 3 GEO satellites operate in orbit at an altitude of 35,786 kilometres and are located at 80°E, 110.5°E, and 140°E, which are using Pseudo Random Noise (PRN) code 144, 143 and 130, respectively. BDSBAS provides the Single Frequency (SF) service through BDSBAS-B1C signal and the Dual-Frequency Multi-Constellation (DFMC) service through BDSBAS-B2a signal for users in China and surrounding areas, in accordance with the International Civil Aviation Organization (ICAO) standards.

3.2.1 System performance

* The coordinate system of BDSBAS is WGS-84.
* The BeiDou Navigation Satellite System Time (BDT) is adopted by the BDS as time reference. The deviation of BDSBAS SF service network time ( SNT=BDT+14s ) to GPS Time (GPST) is within 50 nanoseconds (｜SNT- GPST｜≤50ns ).
* Service Coverage: 10°N~55°N；75°E~135°E.
* Augmentation Object: BDS and GPS will be augmented. Galileo E1C/E5a and GLONASS L1/L3 will be considered if recommended by ICAO SARPs.
* Service mode: Single Frequency (SF) mode using GNSS L1 signals only with augmentation on SBAS L1 as identified by DO-229 (or equivalent); Dual-Frequency Multi-Constellation (DFMC) mode using GNSS L1 and GNSS L5 signals with augmentation on SBAS L5.
* Service Level: APV-I in SF mode and CAT-I in DFMC mode.
* Table 1 The Performance of BDSBAS

|  |  |  |  |
| --- | --- | --- | --- |
| **Performance** | | **BDSBAS** | |
| **SF** | **DFMC** |
| **Service Coverage** | | 10°N~55°N；75°E~135°E | 10°N~55°N；75°E~135°E |
| **Augmentation Constellation** | | BDS B1C  GPS L1C/A | BDS B1C/B2a  GPS L1C/A/L5  GALILEO E5a/E1  GLONASS L1/L2或L3 |
| **Signal** | **Frequency** | 1575.42MHz | 1176.45MHz |
| **Signal Structure** | SBAS L1 C/A | DFMC SBAS L5 |
| **Accuracy（95%）** | | H：2.5m  V：4m | H：1.5m  V：2m |
| **Integrity** | **Time To**  **Alarm** | 10s | 6s |
| **Integrity Risk** | 2×10-7/150s | 2×10-7/150s |
| **Alarm Threshold** | HAL：40m  VAL：50m | HAL：40m  VAL：10m |
| **Continuity** | | 1-8×10-6/15s | 1-8×10-6/15s |
| **Availability** | | Better than 99% | Better than 99.9% |
| **Compatibility** | | SF SBAS ICD | DFMC SBAS ICD |
| **User capacity** | | Unlimited | |

3.2.2 Current Work and Near-term Goals

BDSBAS is now under system integration test, the system will be upgrade and solidification within 2023.

System design and construction:

Developing and testing scheme design based on L1 C/A PRN

Carrying out SF / DFMC SBAS test

International Cooperation:

participating in the international SBAS standard formulation and revision work

ongoing international coordination of the frequency

carrying out SBAS L1 C/A, L5 PRN application

# Action requested of the Committee

The Committee is invited:

.1 to consider the information provided in the paper

.2 and to propose some comments so that could help BDS and BDSBAS update some information in some related documents

.3 and be included as an input paper for the work item on GNSS or GNSS augmentation.

1. Input document number, to be assigned by the Committee Secretary [↑](#footnote-ref-1)
2. Leave open if uncertain [↑](#footnote-ref-2)