Input paper: [[1]](#footnote-1) ENG18-3.2.2.6

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

**□** ARM X ENG **□** PAP X Input

**□** DTEC **□** VTS **□** Information

Agenda item [[2]](#footnote-2) n.n

Technical Domain / Task Number 2 …………………………………

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Discussion on Procedures and Requirements for the Recognition of Augmentation Systems in the WWRNS

# Summary

IMO MSC 107 Committee (31st May - 9th June 2023) considered the document MSC 107/17/7 co-sponsored by IALA, proposing a new output to develop minimum performance standards for dual frequency multi-constellation satellite-based augmentation systems (DFMC SBAS) and advanced receiver autonomous integrity monitoring (ARAIM) in shipborne radionavigation receivers. The IMO MSC committee noted that:

1. radionavigation systems and global navigation satellite systems (GNSS) were assessed and recognized by the Organization following the procedures and criteria set out in resolutions A.1046(27) and A.915(22), as appropriate, and on this basis performance standards for receiver equipment were developed.
2. **procedures and/or criteria for the recognition of augmentation systems as part of the Worldwide Radionavigation System were not clearly established by the Organization;** and
3. augmentation systems were proposed as new functionalities or capabilities for GNSS shipborne receiver equipment.

The Committee agreed to include in its post-biennial agenda:

1. **an output on "Development of procedures and requirements for the recognition of augmentation systems in the World-wide radionavigation system", with one session needed to complete the item; and**
2. an output on "Development of performance standards for dual frequency multi-constellation satellite-based augmentation systems (DFMC SBAS) and advanced receiver autonomous integrity monitoring (ARAIM) in shipborne radionavigation receivers", with two sessions needed to complete the item, assigning the NCSR Sub-Committee as the associated organ. In doing so, the Committee agreed that the performance standards for DFMC SBAS and ARAIM in shipborne radionavigation receivers should be developed only after the **approval/adoption of the necessary procedures and requirements for the recognition of augmentation systems**.

In this sense, it is proposed to produce an input paper endorsed by IALA covering the **Development of procedures and requirements for the recognition of augmentation systems in the World-wide radionavigation system** to be presented in IMO NCSR 12th session in 2025 as a meaningful input to for the Member States to agree on the procedures and/or criteria to recognize the augmentation systems as part of the Worldwide Radionavigation System (WWRNS) by IMO. This first accomplishment will facilitate the Member States to work at IMO in the development of performance standards for DFMC SBAS and ARAIM in shipborne radionavigation receivers in accordance with the two sessions required in doing so.

To that purpose, and due to their relevance as a baseline for the standard development, it is recalled the status of the DFMC SBAS and ARAIM standards in the aviation domain, these are the EUROCAE ED-259A MOPS and ICAO SARPS Amend 93 both recently published in 2023 as well as the EUROCAE ED-259B for H-ARAIM planned by end of 2025. Those standards and their publication timing fit perfectly with the proposed schedule of the development of IEC standard that could be launched in 2026 while being completed and published in 2028 (expected date when DFMC SBAS and ARAIM would be operational worldwide)

## Purpose of the document

The purpose of the document is to continue the discussion started in previous IALA ENG17 committee on the input paper presented and titled “Development of Procedures and Requirements for the Recognition of Augmentation Systems in the WWRNS” on the resolution from IMO and to work in ENG Committee in the development and consolidation/endorsement of an input paper for the IMO NCSR 12th session in in 2025, with the objective of initiating the “**Development of procedures and requirements for the recognition of augmentation systems in the World-wide radionavigation system**” based on already existing elements from IMO standards and IALA guidelines.

The new input paper should consider:

1. elements already existing for recognition of GNSS systems in IMO resolutions A.1046, A.915 and MSC.401(95), IMO SOLAS Consolidated Edition 2014
2. elements existing in IALA Recommendations and Guidelines related to augmentation systems e.g. R‑1022 on recognition of augmentation services, G-1112 on performance monitoring of DGNSS services and G-1152 on SBAS Maritime Service, G1180 on Resilience Position, Navigation and Timing (PNT), G1129 on The Retransmission of SBAS corrections using MF-Radio beacon and AIS.

## Related documents

ENG17 input paper: “Development of Procedures and Requirements for the Recognition of Augmentation Systems in the WWRNS”

# Background

In 2017, a process with IMO was initiated with the proposal of EGNOS recognition within IMO WWRNS, being this process supported by all EU Council Member states. Even though this proposal was not agreed in MSC 98th session (2017), IMO concluded that indeed the “recognition of augmentation system would not be needed as the WWRNS Resolution A.1046(27) was intended for standalone systems, not augmentations”.

The topic of recognition of augmentation systems were further discussed in the IMO MSC107. Among the conclusions, the committee noted that:

* radionavigation systems and global navigation satellite systems (GNSS) were assessed and recognized by the Organization following the procedures and criteria set out in resolutions A.1046(27) and A.915(22), as appropriate, and on this basis performance standards for receiver equipment were developed;
* procedures and/or criteria for the recognition of augmentation systems as part of the Worldwide Radionavigation System were not clearly established by the Organization;
* augmentation systems were proposed as new functionalities or capabilities for GNSS shipborne receiver equipment.

# Discussion

It is considered that IMO Resolutions already include elements that could support this work (e.g. IMO resolutions A.1046[3] and A.915[4]). Furthermore, IALA Recommendations and Guidelines (noted above) would be very valuable inputs for the discussion as well.

Consequently, it is proposed that IALA ENG continue working on an input paper for the next IMO NCSR referring to such existing material and the conclusions extracted from there in terms of common requirements to initiate the discussion on augmentation systems so that they are considered part of the WWRNS.

GNSS systems can be used for navigation in ocean waters while augmentation systems aim at supporting phases of navigation more stringent than ocean waters. The suggested input paper could refer to the operational requirements that should be met by an augmentation system for navigation in harbour entrances/approaches and coastal waters, as set out in IMO Resolution A.1046(27) and even for sole selected navigation phases or operations as described in IMO Resolution A.915(22). Operational requirements could include accuracy, integrity, availability, continuity and coverage as stated in both resolutions.

Given IALA’s status as an observer within the IMO, consideration should also be given to seeking co‑sponsorship of the paper by an IMO member state.

The following topics are proposed as a base to work in this input paper for IMO:

## Navigation Requirements.

* Resolution A.1046 (27) describes the operational requirements for a worldwide radionavigation system in terms of accuracy, availability, update rate and integrity. In this regard, this resolution remarks that the requirements may be met by individual radionavigation systems or by a combination of such systems[3]. The resolution is now more than a decade-old;
* Resolution A.915 (22) (now two decades-old) reflects on the need of augmentation systems:
  + Without augmentation, GNSS standalone navigation solution does not meet the accuracy requirements for navigation in harbour entrances and approaches or restricted waters.
  + GNSS does not provide instantaneous warning of system malfunction;
  + augmentation provisions should be harmonised worldwide to avoid the necessity of carrying more than one shipborne receiver or other devices.
  + Integrity at user level can be provided by Augmentation Systems or by autonomous integrity monitoring using redundant observations from either GNSS or other (radio) navigation systems, or both.
  + External integrity monitoring can be provided by augmentation systems, using external stations.
  + Integrity is introduced considering additional concepts (alert limit, time to alarm and Integrity risk) that are compatible with augmentation systems.
* It should consider the fact that the different augmentation systems already available can meet the requirements of these old regulations for some navigation phases and positioning operations (as addressed in IALA guidelines G1112 and G1152);
* As indicated in IALA guidelines (G1112), in case of using augmentation in combination with other systems there could be a relaxation in the required performance parameters.

## Receiver standards.

* The performance standards of receiver equipment are recommended to be not inferior to those stated in the performance standards for multi-system shipborne radionavigation receivers MSC401(95) (this topic is discussed in IALA G1129 section 3.1). However, those requirements should be reviewed to ensure that the augmentation systems are able to meet them. Stringent requirements (i.e., position acquisition) may use as reference the performance standards for shipborne GPS receiver equipment MSC.112(73). Regarding this topic, guideline G1152 (in section 5.1) also mentions that the regulatory status of any receivers needed should be considered;
* In accordance with SOLAS in its Chapter V, it is required for the navigational systems and equipment a type-approved receiver conformed to appropriate performance standards not inferior to those adopted by the Organization.

## Other topics.

* The radionavigation system should be resilient and consider quality monitoring requirements of data validity, plausibility, and integrity for the system to be robust, reliable and dependable. Requirements for redundancy, particularly in relation to position fixing systems, should be considered. (IALA G1180 and IMO. (2008) MSC 85/26/Add.1, Annex 20, Strategy for the Development and Implementation of e-Navigation);
* Augmentation systems could be used in combination if needed to achieve better performances, results, and increased robustness;
* Resolution A1046(27) defines the list of service parameters required for a complete characterisation. It also requires a Maritime Safety Information (MSI) is promulged. Regarding augmentation systems, this topic has been discussed in 2021 in the IHO sub-committee on the World Wide Navigation Warning Service (WWNWS13 section 3.5.2);
* IALA Guidelines G1112, G1129 and R1022 recommend to the GNSS augmentation service provider to comply with following operational aspects:
  + Operation and maintenance, being recommended to the service provider to continuously monitor the service offered and so to detect potential service disruptions and anomalies;
  + Verification of the service performance in accordance with the service specifications;
  + Publication of information, including description of the augmentation service (coverage area, typical performance), up-to-date information of scheduled maintenance activities, etcetera;
* Additionally, R1022 shows additionally IALA recommendations for the information provided by service provider:
  + Confirmation that:
    - the service offered is operational and available for use by maritime stakeholders;
    - the service will be provided continuously until further notice;
    - any future changes in the GNSS augmentation service should not affect legacy users of the service.
  + Identification and contact details of the GNSS augmentation service provider.
  + Any terms and conditions to access the Service.
* Worldwide harmonization of maritime Services based on Augmentation System will be a key element to ensure interoperability. The introduction the maritime services based on the augmentation systems in the Maritime Service Portfolio can be a useful tool for this purpose.

## Schedule

It is proposed to work in the refinement of this input paper through both IALA committees ENG18 and ENG19 such as a final version that shall be mature to be reviewed and agreed in IALA ENG19 in October 2024. After the formal approval at IALA, the input paper shall be proposed to IMO NCSR 12th session (2025).

## Future work

As part of the agreements reached in IMO MSC 107 Committee, the **approval/adoption by IMO of the proposed procedures and requirements for the** **recognition of augmentation systems it is a pre-requisite to** start the necessary activities (at IMO) for the development of performance standards for DFMC SBAS and ARAIM in shipborne radionavigation receivers.

DFMC SBAS and ARAIM are expected to be operational worldwide starting in 2028. To ensure there is an IEC test standard in place by then, an IMO performance standard should be finalized by 2026 which shall enable IEC standard can start not later than 2026 with the aim to be completed by 2028.

Considering that IMO expects to dedicate two sessions to the development of this performance standards, proposing the recognition of augmentation systems in IMO NCSR 12th session in 2025 would fit within the global schedule of the activities.

# References

1. IMO MSC 107-20 - Report Of The Maritime Safety Committee On Its 107Th Session (Secretariat)
2. IMO MSC 107-20-Add.1 - Report Of The Maritime Safety Committee On Its 107Th Session (Secretariat)
3. IMO MSC-107-17-7 - Proposal for a new output to develop minimum Performance Standards for Dual Frequency Multi-Constellation Satellite-Based Augmentation Systems (DFMC SBAS) and Advanced Receiver Autonomous Integrity Monitoring (ARAIM) in shipborne radionavigation receivers.
4. IMO Resolution MSC 401(95), <https://wwwcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/MSCResolutions/MSC.401(95).pdf>
5. IMO Resolution A.1046(27) (2011), <https://wwwcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/AssemblyDocuments/A.1046(27).pdf>
6. IMO Resolution A.915(22) (2001), <https://wwwcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/AssemblyDocuments/A.915(22).pdf>
7. IMO MSC 85/26/Add.1, Annex 20 (2008), <https://wwwcdn.imo.org/localresources/en/OurWork/Safety/Documents/enavigation/MSC%2085%20-%20annex%2020%20-%20Strategy%20for%20the%20development%20and%20implementation%20of%20e-nav.pdf>
8. IALA Guidelines 1112, https://www.iala-aism.org/product/g1112/
9. IALA Guidelines 1152, <https://www.iala-aism.org/product/g1152/>
10. IALA Guidelines 1180, <https://www.iala-aism.org/product/g1180/>
11. IALA Guidelines 1129, https://www.iala-aism.org/product/g1129/
12. IALA Recommendation 1022, <https://www.iala-aism.org/product/r1022/>
13. 13th Meeting of the IHO sub-committee on the World-Wide Navigational Warning Service
14. IMO SOLAS Consolidated Edition 2014
15. EUROCAE ED-259A - Minimum Operational Performance Standard (MOPS) for Dual-Frequency Multi-Constellation Satellite-Based Augmentation System Airborne Equipment 2023 <https://eshop.eurocae.net/eurocae-documents-and-reports/ed-259a/>
16. ICAO SARPS Amendment 93 to Annex 10 —Aeronautical Telecommunications, Volume I —Radio Navigation Aids cont (2023).

# Action requested of the Committee

The Committee is requested to:

1. Note the information provided in this paper and specifically the analysis done on the common requirements any augmentation system shall be complied with for the recognition by IMO;
2. Support the process of “**Development of procedures and requirements for the recognition of augmentation systems in the World-wide radionavigation system**” by preparing an input/information paper for submission to IMO NCSR 12th session in 2025 based on the analysis provided in the original input paper presented in ENG17, the current one as well as the work done in Committees ENG18 and ENG19 among the interested IALA members, potentially in collaboration with an IMO Member State.

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