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| SUB-COMMITTEE ON NAVIGATION, COMMUNICATIONS, AND SEARCH AND  RESCUE  12th session  Agenda item 8 | NCSR 12/8  1 February 2025  Original: ENGLISH  Pre-session public release: |

**WORK PROGRAMME**

**DEVELOPMENT OF** **PROCEDURES AND REQUIREMENTS FOR THE RECOGNITION OF AUGMENTATION SYSTEMS IN THE WORLD-WIDE RADIONAVIGATION SYSTEM (WWRNS)**

**Submitted by [Australia], [China], [Finland], [IALA], [Japan], [list all EU nations as listed alphabetically below, if there is agreement to cosponsor], [New Zealand], [Republic of Korea], [Russian Federation], [The Netherlands], [United Kingdom], [United States]**

**Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Kingdom of the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, EC**

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| **SUMMARY** | |
| *Executive summary:* | This paper contains draft procedures and requirements for the recognition of augmentation systems in the World-Wide Radio Navigation System (WWRNS). |
| *Strategic direction, if applicable:* | SD2 |
| *Output:* | XX |
| *Action to be taken:* | Paragraph XX |
| *Related documents:* | MSC 107/17/7 and MSC 107/20 paragraph 17.58. Resolutions A.1117(33), A.1174(33), A.915(22), A.1046(27), MSC.112(73), MSC.113(73), MSC.114(73), MSC.115(73), MSC.233(82), MSC.379(93), MSC.401(95), MSC.432(98), MSC.449(99), MSC.480(102) and MSC.74 (69). SN.1/Circ.340 and SN.1/Circ.341. |

**Background**

1. Following consideration of a proposal from Australia et.al (MSC 107/17/7), MSC 107 agreed to include in its post-biennial agenda (MSC 107/20 paragraphs 17.58.1 and .2 refer):

* 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
* 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.

1. The Committee assigned NCSR as the associated organ. It also agreed 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.
2. This document is submitted in accordance with the provisions of the *Organization and Method of Work of the Maritime Safety Committee and the Maritime Environment Protection Committee and their Subsidiary Bodies* (MSC-MEPC.1/Circ.5/Rev.5), taking into account resolution A.1111(30) on *Application of the Strategic Plan of the Organization* andresolution A.1173(33) on the *Strategic Plan for the Organization for the six-year Period 2024 to 2029*.

**Global Navigation Satellite Systems (GNSS)**

1. Since their introduction some decades ago, the use of Global Navigation Satellite Systems (GNSS) has grown globally, in almost every sector. The maritime industry is no exception. Global availability, high accuracy and fast position updates has meant GNSS has become the primary means of obtaining Positioning, Navigation and Timing (PNT) information for the maritime sector.
2. The Organization has, over the years, recognised different GNSS constellations (e.g. GPS, GLONASS, Galileo, Beidou) and Regional Navigation Satellite Systems (RNSS) (e.g. Indian Regional Navigation Satellite System (IRNSS), Quasi-Zenith Satellite System (QZSS)) as components of World-Wide Radionavigation System (WWRNS).
3. PNT services from GNSS and RNSS are now used widely by the international ships to fulfil carriage requirements for radionavigation, as required by SOLAS chapter V, Regulation 19-2.6.
4. Increased reliance on GNSS has also led to concern for the integrity of the navigation information, the continuity of service and the vulnerability of systems to external influences.

**Augmentation systems**

1. GNSS and RNSS meet the requirements (e.g. accuracy, availability, integrity) for navigation in ocean waters, in accordance with the operational requirements in resolutions A.1046(27) and A.915(22). However, without augmentation, standalone systems do not meet the more stringent operational requirements for navigation in harbour entrances, harbour approaches and coastal waters (e.g. horizontal accuracy, integrity warning and service continuity).
2. The main concern is their lack of ability to meet IMO requirements for navigation in harbour entrances, harbour approaches and coastal waters, due to lack of assurance of continuity (99.97% over the required three-hour period).
3. IMO Resolution A.915(22) foreshadowed different augmentation techniques and their evolution by early 2000s; either local, wide area (e.g. SBAS) or receiver-based augmentation. Resolution A.915(22) makes references to augmentation systems.
   * + - *Without augmentation, GPS accuracy does not meet the requirements for navigation in harbour entrances and approaches or restricted waters* (para 2.1.1.4)
       - *Without augmentation, GLONASS accuracy is not suitable for navigation in harbour entrances and approaches* (para 2.1.2.4)
       - *Augmentation provisions should be harmonised worldwide to avoid the necessity of carrying more than one shipborne receiver or other devices* (para 3.1.3).
4. Over the year, IMO has already agreed performance standards for shipborne receiver equipment, for individual GNSS and for multi-system receivers (resolution MSC.401(95)), which identify augmentation systems and Receiver Autonomous Integrity Monitoring (RAIM).
5. However, there is no recognition of augmentation systems and no performance standard for receivers that support augmentation systems. For reasons outlined in MSC 107/17/7 (Australia et al) and paras 22 to 30 below, it is now imperative IMO recognises augmentation systems as components of the World-Wide Radionavigation System (WWRNS).
6. There are several augmentation systems (ground-based and satellite-based) being used by the maritime community. Notably Radiobeacon Differential GNSS (DGNSS), SBAS (Satellite Based Augmentation System), RAIM (Receiver Autonomous Integrity Monitoring). Others are under development (e.g. PPP (Precise Point Positioning) and Advanced RAIM). More information on augmentation systems is available in Chapter 6 of the IALA NAVGUIDE Edition 9.

**Performance standards for augmentation systems**

1. Over the years, the Organization has developed performance standards for shipborne receiver equipment for individual GNSS and, more recently, for multi-system receivers. These performance standards apply to radio navigational equipment ships carry, to comply with SOLAS V/19-2.6.
2. The Organization also recognises in some of these performance standards (e.g. Resolution MSC.401(95)), the capability of the receiver to use current and future radionavigation systems, as well as augmentation systems, for the provision of position, velocity and time data.
3. Additionally, there are performance and test standards developed either by the Organization, or by other international standardisation bodies (e.g. RTCM, ITU, IEC…), that allow manufacturers to build shipborne equipment capable of using ground-based and/or satellite-based augmentation systems. However, these standards are not based on any IMO performance standard.
4. The Organization has also developed performance standards (e.g. MSC.113(73), MSC.114(73), MSC.115(73), MSC.233(82), MSC.379(93)) that can use augmentation data provided by Radiobeacon DGNSS. They also refer to the internationally accepted data transmission standards for DGNSS defined by RTCM SC-104, as well as ITU recommendations.
5. Regarding SBAS, although the Organization has not developed a specific performance standard for such augmentation systems, it recognizes its use (Resolution MSC.401(95)) as a system to augment GNSS, once the relevant standards are in place.
6. IEC has recently developed and published *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) – Part 7: Satellite Based Augmentation System (SBAS) L1 – Receiver equipment – Performance standards, methods of testing and required test result*s.
7. Additionally, IALA describes all elements of an SBAS relevant to maritime Administrations in their publications *G1152 SBAS Maritime Service* and *G1129 The Retransmission of SBAS corrections using MF-Radio Beacon and AIS*.
8. RAIM is already considered by the Organization as a mechanism to provide integrity monitoring, being identified in the performance standards developed for each GNSS system/constellation, as a minimum capability for the receiver (Resolutions MSC.232(82), MSC.379(93), MSC.401(95)).

**Need for IMO recognition of augmentation systems**

1. The cosponsors of this proposal consider the lack of IMO recognition of augmentation systems, particularly SBAS, to be a major impediment to its uptake for the many new and emerging maritime activities that could be made safer by using augmentation services.
2. The increasing use of electronic navigation on board ships, growing needs for high accuracy in some operations (e.g. large cruise ships needing highly precision positioning to manoeuvre in confined harbours), increased competition for limited water space due to the proliferation of offshore renewable electricity infrastructure and the introduction of ship operations performed autonomously, all demand high levels of position accuracy and assurance of continuity and integrity.
3. This increasing reliance on GNSS highlights the importance of resilient PNT and an objective consideration of areas of vulnerability and measures to reduce or mitigate such effects. Resilient PNT means, among other things, recognition by the Organization of different PNT sources, and their augmentation systems.
4. Some Member States, such as Australia, New Zealand and European Union nations, have recently declared their SBAS available for maritime use. Their systems provide wide area or regional augmentation and enhance marine navigation in ocean waters, harbour entrances, harbour approaches and coastal waters, with operational parameters in accordance with IMO Resolution A.1046(27).
5. EGNOS, the European Union’s SBAS, has been providing Safety of Life (SoL) services to maritime users since April 2024. SouthPAN, the Australian and New Zealand SBAS, commenced the provision of three early open services in 2022.
6. Some operators of SBAS services have declared their services to IALA (<https://www.iala-aism.org/gnss-register/>) as recommended by normative IALA Recommendation *R-1022 provision of GNSS augmentation services for maritime navigation applications*.
7. Thus, there is need that these (and any other) SBAS are recognised by IMO and internationally accepted. This recognition, as stated in IMO Resolution A.1046(27), would mean that *“the Organization recognizes that the system is capable of providing adequate position information within its coverage area and that the carriage of receiving equipment for use with the system satisfies the relevant requirements of the 1974 SOLAS Convention”*, providing assurance to the maritime community on the use of these systems and related services provided.
8. Without augmentation, a GNSS standalone navigation solution does not meet the operational requirements for navigation in harbour entrances, harbour approaches and coastal waters. It also does not provide near-instantaneous warning of system malfunction.
9. Without recognition by the Organization, there is risk of lack of harmonization and interoperability among these systems, with an impact on shipboard equipment.

**Conclusion**

1. The Annex contains draft procedures and requirements for the recognition of augmentation systems in the WWRNS. The format aligns with the current operational requirements for radionavigation systems, as in IMO Resolution A.1046(27).

**Action requested of the Sub-Committee**

1. The Sub-Committee is invited to consider this proposal, review the Annex and decide as appropriate.

**ANNEX**

**PROCEDURES AND REQUIREMENTS FOR THE RECOGNITION OF AUGMENTATION SYSTEMS IN THE WORLD-WIDE RADIONAVIGATION SYSTEM (WWRNS)**

**PROCEDURES AND FUNCTIONS OF IMO**

1. As a precondition, IMO shall recognise, based on Resolutions A. 1046(27) and A.915(22), the radionavigation system(s), which will be augmented by the system(s) which are the object of these procedures.
2. IMO recognition of an augmentation system at the worldwide level means the Organization recognizes the system is capable of providing information to improve accuracy and provide integrity warning to enhance the positioning, navigation and timing performance of a radionavigation system already recognised by the Organisation. And the carriage of receiving equipment for use with the system satisfies the relevant requirements of the 1974 SOLAS Convention, as amended.
3. IMO should not recognize an augmentation system without the consent of the Government or organization which has provided it and is operating the system.
4. In deciding whether to recognize an augmentation system, IMO should consider whether:
   * the Government or organization providing and operating the system has formally stated that the system is operational and available for use by commercial shipping;
   * its continued provision is assured;
   * it is capable of providing augmentation information within the coverage area declared by the Government or organization operating and providing the system with performance not less than that in Appendix “Operational Requirements” of Resolution A.1046(27); and
   * adequate arrangements have been made for publication of the characteristics and parameters of the system and of its status, including amendments, as necessary.
5. If there are any changes to a recognized system, the criteria listed in previous paragraph should be applied when deciding whether the system should continue to be recognized.

**RESPONSIBILITIES OF GOVERNMENTS OR ORGANIZATIONS**

1. The provision and operation of an augmentation system is the responsibility of the Governments or organizations concerned.
2. Governments or organizations desirous of having their augmentation system recognized by IMO, should formally notify IMO that the system is operational and available for use by commercial shipping. They should also declare the coverage of the service area of the system and provide as much other information as practicable, to assist IMO in its consideration of the factors identified in previous paragraphs.
3. Augmentation system operators should provide the Organization with at least the following information:
   * A description of the service being offered.
   * Confirmation that the service offered is operational and available for use by maritime users.
   * Confirmation that the service will be provided continuously, until further notice.
   * Identities of GNSS/ RNSS augmented by the system.
   * Confirmation that any future changes in the GNSS augmentation service should not affect legacy users of the service.
   * Expected or planned changes to the services are to be notified to maritime users in advance (two years notice is recommended whenever possible).
   * Identification and contact details of the GNSS augmentation service provider.
   * Advice on where information relating to the service can be found, along with relevant references to standards and specifications that the service complies with.
   * Any terms and conditions to access the service.
4. Governments or organizations that have an IMO-recognized augmentation system should not make changes to the operational characteristics of the system without notifying IMO (see resolution A.577(14)).

**SHIPBORNE RECEIVER EQUIPMENT**

1. To avoid the need to carry more than one receiving equipment, shipboard receiving equipment should be able to receive augmentation (e.g. SBAS) information from different service providers (e.g. EGNOS, SouthPAN, BDSBAS) at worldwide level and within the coverage area of each system in which the ship trades.
2. Shipborne receiving equipment should conform to relevant performance standards, not inferior to those adopted by the Organization.
3. Augmentation systems should make it possible for shipboard receiving equipment to automatically select the appropriate components (either ground-based and/or satellite-based) for determining the ship's position, with the required performance.
4. Shipboard receiving equipment should have at least one output from which position and integrity information can be supplied in a standard format to other equipment.

**OPERATIONAL REQUIREMENTS**

1. As an augmentation system by itself does not provide a positioning solution, compliance with operational requirements is only achieved by the combination of a radionavigation system (at least one) with an augmentation system, in the coverage area of the later.
2. The same operational requirements listed for radionavigation systems in IMO Resolution A.1046(27), (for ocean waters as well as for harbour entrances, harbour approaches and coastal waters), shall be required of augmentation systems for their recognition by the Organization as part of the WWRNS.
3. The operation requirements for augmentation systems are as follows.

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|  | **Horizontal Accuracy 95%** | **Signal availability** | **Service continuity (over 15min)** | **Position update rate** | **Integrity warnings1** | **System coverage** |
| **Ocean waters** | 100m | 99.8% | - | 2s | To be provided to users as soon as practicable by Maritime Safety Information (MSI) systems | Adequate2 |
| **Harbour entrances, harbour approaches and coastal waters** | 10m | 99.8% | 99.97% | 2s | To be provided to users within 10s | Adequate2 |
| 1Generation of integrity warnings in cases of system malfunctions, non-availability or discontinuities. | | | | | | |
| 2Taking into account the radio frequency environment, the coverage of the system should be adequate to provide position-fixing throughout this phase of navigation. | | | | | | |

Table 1 – Operational requirements for augmentation systems used in combination with GNSS for Navigation in Ocean waters as well as for Harbour entrances, Harbour approaches and Coastal waters,

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