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DEVELOPMENT OF GUIDANCE TO ESTABLISH A FRAMEWORK FOR DATA DISTRIBUTION AND GLOBAL IP-BASED CONNECTIVITY BETWEEN SHORE-BASED FACILITIES AND SHIPS FOR ECDIS S-100 PRODUCTS AND OPERATIONAL GUIDANCE FOR ROUTE EXCHANGE

The result of the IALA workshop on international mobile telecommunication (IMT) for marine aids to navigation

Submitted by IALA

SUMMARY

Executive summary:	This document provides information on the outcome of the IALA workshop on international mobile telecommunication (IMT) for marine aids to navigation, focusing on possible integration of real-time IP-based IMT technologies to support new maritime services and S-100 data products.
Strategic direction, if applicable:	2
Output:	2.12
Action to be taken:	Paragraph 15
Related documents:	MSC108/12/5, NCSR 10/9 and MSC109/19/3; resolutions A.1158(32) and MSC467(101); MSC.1/Circ.1610/Rev.1

Background

1 IALA has an international role in the provision of marine aids to navigation, including vessel traffic services (VTS). IALA has long-established guidance for the provision of VTS (resolution A.1158(32) refers).

2 With the advent of global digital transformation, more and more services from the domain of marine aids to navigation (AtoN), including VTS, are being investigated to be provided electronically in an appropriate digital format.

3 IALA has also taken an active role in the development of resolution MSC.467(101) on *Guidance on the definition and harmonization of the format and structure of maritime services in the context of e-navigation*, where fundamental concepts have been defined.

4 Resolution MSC.467(101), amongst other things, defines and explains the relationships between maritime services (MSs), technical services supporting their implementation and the S-100 data products assembled in the "S-100 world". More specifically, it is explained how MSs prompt technical services, which in turn prompt S-100 data product functionalities; all of them eventually call for powerful connectivity. This hierarchy relationship is called the services data connectivity (SDC) stack, accordingly.

5 The individual MSs are defined in MSC.1/Circ.1610/Rev.1 on *Descriptions of Maritime Services in the context of e-navigation*. MS1 (Vessel traffic service) provides an example of how this MS prompts certain S-100 data products, namely S-421 and S-212 specifically, and, consequently, appropriate connectivity eventually.

6 Focusing on the mobile shore-to-ship and ship-to-shore radio connectivity needed to enable MS implementation, document MSC108/12/5 (New Zealand) raised key questions regarding the actual radio systems capable of providing this connectivity as follows:

> "9 New Zealand would like to understand how the organization envisages the real-time shore-to-ship and ship-to-shore exchange of S-100 products will occur, including S-124 navigational warnings.
>
> 10 New Zealand is also of the view that the organization should determine whether:
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> .1 a standard service interface, including information security protection, is required for all S-100 products;
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> .2 if the existing shore-to-ship communication systems are intended to exchange S-100 products; and
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> .3 if these existing shore-to-ship communication systems have the capability to do so.
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> 11 Paragraph 8 of document NCSR 10/9 (Austria et al.) noted that adding the functionality of a standardized and cyber-secure method for route exchange from ship-to-shore and from shore-to-ship to support ECDIS, would require the availability of a radio link, which has not been defined.
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> 12 Amendments to SOLAS, performance standards and guidance may need to be developed, and if so, this needs to be addressed in a timely manner."

7 These questions seem not to have been answered to date, and they are therefore still valid.

8 It should be noted that the ongoing work at the NCSR Sub-Committee, commissioned by MSC 109 due to the request for "guidance to establish a framework for data distribution and global Internet Protocol (IP)-based connectivity to realize the full potential of S-100 capable Electronic Chart Display and Information System (ECDIS)" (MSC109/19/3 refers), does not seem to consider potential radio link technologies needed for any IP-based connectivity.

9 Due to their elemental role, these radio link technologies are often simply called "carriers" – they carry the data exchange loads between ships and shore, and vice versa. The IP-based connectivity ideally is to be designed to be carrier-agnostic, meaning that different capable carriers can be used.

10 IALA has studied the IMT family as it progressed from "IMT-Advanced" (aka 4G/LTE) to "IMT-2020 and beyond" (aka 5G), with a view to employing them in the maritime domain as such a capable carrier, or as the future default "working horse" for any digital radio communication, even.

11 With the advent of the "IMT-2030 and beyond" (aka 6G), IALA is expected to follow 2030. IALA has also included this latest member of the IMT family in their scope. It should be emphasized that the advent of the IMT-2030 and beyond does not mean to have to wait until 2030 to employ the IMT family technologies. The other IMT family technologies mentioned above are ready to be used in the maritime domain immediately, if so desired by the maritime domain and consequently stipulated by the organization.

IALA Workshop

12 To facilitate and promote the above-mentioned studies, IALA has conducted an IALA workshop on International Mobile Telecommunication (IMT) for marine aids to navigation. This workshop was held from 1 to 5 September 2025 in Karlsruhe, Germany.

13 The executive summary of the conclusions of the workshop is as follows:

.1 IALA should play a key role in representing marine AtoNs within the 6G development process, ensuring the maritime domain’s unique requirements are considered;

.2 engagement with 3GPP via ETSI is required to incorporate maritime perspectives, particularly for ship-to-X communications, AtoNs communication, waterway information exchange, and safety-related information;

.3 use cases, operational coverage zones, pre-conditions, service flows, post-conditions, challenges, and potential requirements must be clearly defined to guide 6G feature development;

.4 detected operational coverage zones include inland/ports (OCZ1), close to coast (OCZ2), and far from coast (OCZ3), each with distinct challenges such as coverage, service continuity, and prioritization;

.5 identified challenges for 6G implementation include ensuring continuous service across operators, service prioritization, coverage, and cost efficiency;

.6 potential maritime use cases for 6G include the support for MASS, broadcast voice communication, communication with and between AtoNs, PNT (position, navigation and timing), redundancy for the existing systems, and intelligent AtoNs with advanced positioning and data exchange capabilities;

.7 expectations for 6G network providers include sufficient Internet connectivity, gateways with quality of service (QoS), resilience to interference, cyberattacks, and authentication of providers;

.8 maritime-specific conditions, such as sea state, weather influence, and channel characteristics, must be addressed in the system design and reliability requirements;

.9 technical services like traffic clearance, route exchange, and navigational warnings were analyzed, highlighting challenges such as coverage, service availability, high ship density, and prioritization;

.10 IMT-2020 (5G) can support maritime services, including video-streaming, Internet of Things (IoT) applications, VTS, and AtoNs monitoring, but requires careful consideration of public vs non-public networks and network slicing for QoS guarantees;

.11 procurement strategies should prioritize coverage, reliability, interoperability, and service level agreements (SLAs), with phased rollouts starting with pilot areas like ports and VTS before wider coastal adoption;

.12 private and hybrid networks are recommended for critical zones and coastal coverage, balancing control, cost, and efficiency;

.13 organizational measures are essential: governance accountability, workforce capacity building, integration into national digital strategies, structured knowledge sharing, and IALA guidance;

.14 cybersecurity, legacy system interoperability, life cycle costs, and technology obsolescence must be managed through standards-based, backwards-compatible solutions;

.15 preparing for IMT-2030 (6G) requires early adoption in ports and VTS for leadership and efficiency, with phased or later adoption for wider coastal coverage; and

.16 IALA's strategic role includes strengthening the influence in standardization, endorsing pilots, supporting global training via WWA (wireless wide area), and building global capacity for 6G technologies and regulations.

14 The full report of the workshop is available to download from https://www.iala.int/product/report-on-the-on-imt-workshop-for-marine-atons-september-2025-germany/.

Action requested of the Sub-Committee

15 The Sub-Committee is invited to note the information provided.

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