2nd Joint IHO/IALA Workshop on S-100/S-200

WORKSHOP REPORT

9 to 13 September 2024

U.S. CMTS

Annapolis, United States of America

Thomas Southall
Workshop Secretary

13 September 2024

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Report of the 2nd Joint IALA/IHO workshop on S-100/200

Executive Summary

The 2nd joint IALA/IHO workshop on S-100/200 development and portrayal was held between the 9 and 13 September 2024 at the U.S. Naval Academy in Annapolis, USA.

The workshop was very well attended with 84 participants from 19 countries.

The workshop participants considered the various presentations that were given and the work conducted in the WGs and it was concluded that:

Operations

- Contents of S-101 data model should be evaluated to ensure all information once contained in S-12 has been accounted for. This should enable the data in the S-101 layer to satisfy the requirements contained in S-12 referred to as a List of Lights.
- With regards to AtoNs, S-124 is intended to be used for time-critical, navigationally-significant information, in accordance with existing S-124 definitions for Marine Safety Information (MSI).
- S-125 contains AtoN changes (in the form of Advance Notice of Changes (AC), Proposed Changes (PC), Temporary Changes (TC), and Discrepancies (DC)). S-125 is a "derivative" dataset and all features and attributes must also appear in S-201. Navigationally-significant information is included in S-125. Both S-124 and S-125 are necessary for a full operational picture. S-125 does not contain (duplicate) information on AtoNs that appears in the S-101 dataset for AtoNs that are operating in the design-state (intended) status.

Technical

- It is recommended that the IHO review the data and service provisions required by IALA for international compliance and consider recommendations for data and services for non-SOLAS vessels as well.
- The IHO-SGP lab is invited to collect test scenarios and datasets to help identify technical gaps in IHO/IALA product specifications and to develop a structured template for testing.
- It is recommended that IHO/IALA explore official testing MCP's identity management in conjunction with IHO's identity management system (focused on producer and data protection). It was further suggested that IALA provide its concerns and/or requirements related to security.
- It is recommended that IHO consider establishing a formal system to notify stakeholders of changes to S-100 standard. This would ensure that all pertinent parties are informed of updates in a timely manner and can adapt accordingly.
- An outline of the key issues related to testing S-100 data distribution, including the integration of SECOM, MCP, and the IHO registry was drafted and will contribute to a paper being prepared for submission to IHO/IALA.
- It is recommended that the IHO retain the current S-124 symbol but enhance it with cartographic markup symbols. For S-125, efforts should be made to align it with the IMO Circular letter 243 - AIS AtoN as much as applicable. Meanwhile, the S-101 symbols will remain unchanged during the dual-fuel period.

Training

- The need to identify the knowledge gaps of S-100 (S-100 itself and the forthcoming changes) within the maritime community prior to training to ensure those knowledge gaps are addressed.
- Utilize an informal process (multimedia, trade press, social media) vs and in addition to, the normal process of NTM.
- Coordinated communication and marketing from IALA and IHO – what S-100 is and what it brings to the table. A single story.

- Recommend to IMO HTW to refine the wording of STCW training requirement and include transition training to ECDIS (to include ECDIS, MSI and NAEST training)
- Technical knowledge and software knowledge are key components that needs to be trained across the entire stakeholder community, this is paramount to the entire S-100 rollout and production.
- Significant training gaps were identified in technical training amongst different users groups.
- There is need to define the different user groups across the entire maritime community.
    - Proposed User Groups -- Implementors; Software Developers of data production systems (Product Specification Developers, Data production specialists; AtoN managers, VTS Authorities; System integrators/administrators (those that are responsible for managing the system and infrastructure); Stakeholder Executives (ex. National Level policy makers) and End Users.
- Training courses need to be tailored to the specific user groups, while factoring in delivery methods, ensuring the training materials stay current as the standards and product specifications evolve.
- Ex. Shorter courses for executive/high-level; Longer courses for developers – but also built upon the prior required training as those taking the training need to understand all the elements of the specifications.
- Need to work with the overarching organizations, but equally with the Member States as they are the ones that have the most influence at IMO, IHO and IALA (ex. IHO is observer at IMO, while Members States have voting rights)
- Need to empower and support product specification developers in the implementation of remaining IHO (100 series), IALA (200 series), IEHG and WMO (400 series) and NATO (500 series) product specifications as many of them are still under active development and it would be beneficial to get them completed as soon as possible.
- Training should be available in multiple languages to make it inclusive to all member states.
- The IALA ARM Committee consider making a proposal to IHO S-100WG on the need for such reference implementations.
- The IALA ARM Committee consider adding input on defining service specific latency requirements and the need for a goal based framework for the ‘last mile’ to IHO S-100WG.

Joint Conclusions

- This workshop provided enormous benefit for the understanding and planning for the future interactions between S-101, S-124, S125, and S-201 and a future event should be planned to continue this discussion.
- The IHO and IALA to submit a joint input document to IMO to update them on S-100 / S-200 matters including possible training requirements.

Contents

Report of the 2nd joint IALA/IHO workshop on S-100/200

1. INTRODUCTION

The 2nd joint IALA/IHO workshop on S-100/200 was held between the 9 and 13 September 2024 at the U.S. Naval Academy in Annapolis, USA.

84 participants from 19 countries participated in the Workshop plus three members of the IALA secretariat.

2. SESSION 1 – OPENING OF THE WORKSHOP

This session was chaired by Dave Lewald, Chair of the Workshop. The Secretary was Thomas Southall and the logistics for the event were organized RTCM President Ed and Pam Wendlandt, RTCM Business Operations Manager. The event was kindly sponsored by the organizations depicted below.

The event was also supported by the following organizations.

2.1 Welcome from CMTS, Ashley Chappell, Director CMTS

Ashley Chappell, U.S. Committee on the Marine Transportation System Executive Director (CMTS), welcomed the participants of the 2nd Joint Workshop of the International Hydrographic Organization and the International Association of Marine Aids to Navigation and Lighthouse Authorities on S100-S200 Portrayal to the U.S. Naval Academy. She thanked the organizing committee for putting together such a robust agenda to dive deep into S100 and S200 implementation and congratulated IALA on its change in status from an NGO to an Intergovernmental Organization.

Although in a new role with CMTS, Ms. Chappell spent over 30 years at NOAA with the Office of Coast Survey, working first as a cartographer and later leading interagency coordination on many different initiatives, including metadata harmonization, CMTS activities, and ocean mapping collaborations. She provided some background on the CMTS, describing it as a Cabinet-level, interagency maritime body created to help coordinate the efforts of the many U.S. agencies with marine transportation system responsibilities on U.S. waterways.

The CMTS has been instrumental in building on the interagency relationships that have helped U.S. agencies make progress on S100 implementation, particularly through its Future of Navigation Integrated Action Team. The FutureNav team's focus is on modernizing the U.S. navigation system through e-navigation service and data integration to improve the safety, efficiency, and reliability of our waterways and ports.

This team recommended that the CMTS agencies use S-100 as the preferred data framework for digital maritime data and information exchange, and in 2014, the CMTS adopted a resolution committing the U.S. to the S100 framework. Most recently, the team is working on implementing its Navigation Information Strategic Action Plan, which puts the focus on standards and system integration, seamless data exchange, and connectivity in order to meet user needs for actionable navigation information.

U.S. maritime agencies have learned that joint decision-making is essential to best deliver navigation information services, that harmonization of interagency data is complicated, and that S100—as the common data framework—is critical to successful e-Navigation implementation. That same spirit of cooperation is mirrored between IALA and the IHO as the 2026 Phase 1 rollout nears, and conversations at this 2nd workshop will be extremely productive on S100 and S200 development, training, and outreach to the maritime community.

2.2 Welcome from IHO, John Nyberg – IHO Technical Director

John Nyberg, IHO Director, welcomed everyone to the workshop, expressing his honour to deliver the opening remarks as the event commenced. He highlighted the longstanding partnership between IHO and IALA, emphasizing their mutual respect and shared goals. He recalled his earlier involvement in regional commissions and praised the collaborative efforts of key figures like Robert Ward and Stephen Bennet in advocating for safe navigation. Looking ahead, he discussed ongoing efforts to strengthen the IHO-IALA partnership, focusing on the development and adoption of S-100 standards. John Nyberg underlined the upcoming milestones and challenges in achieving global coverage of S-100 data, stressing the importance of collaboration, training, and interoperability among stakeholders. He concluded by emphasizing the

significance of data collection and interoperability in advancing electronic navigational data services, highlighting the role of partnerships in achieving shared goals.

2.3 Welcome from IALA, Francis Zachariae – IALA Secretary-General

Francis Zachariae, IALA Secretary-General, welcomed participants to the workshop and expressed his happiness to see the interest that the event has garnered with some 84 experts and stakeholders with a keen interest in the development of S-100 / 200.

Francis then provided a status update regarding the new IALA IGO this being the first event since the transformation.

The Secretary-General hoped that all will have a fruitful week and that the outputs of this workshop will serve everybody well in the months and years to come, working to achieve harmonization in this field.

He thanked the CMTS for hosting this event, especially Dave Lewald and the Steering Committee for putting together an excellent program and of course he thanked the IHO team for cooperating and collaborating on making this workshop happen.

Francis also thanked chairs, who carry big responsibility and much work, and the sponsors who are so vital in bringing the workshop together. He noted that it is interesting to see that S-100 is now not only related to ECDIS, but has the potential to harmonize the digital future of the maritime sector.

With that, he wished all a splendid workshop and hoped that at the end of the week all will find that this was time well spent.

2.4 Administration and safety briefing, Dave Lewald – IALA Chair ARM and U.S. CG

Dave Lewald provided a safety and administrative briefing. Presentations can be found on the fileshare as PDFs. A list of participants can be found in Annex A.

2.5 Technical program for the week and expectations, Dave Lewald

Dave Lewald, Chair of the ARM Committee and U.S. Coast Guard, introduced the programme for the week (Annex B).

2.6 S-100 Implementation Update, Magnus Wallhagen - IHO

Magnus Wallhagen gave an introduction to IHO and S-100 with identified benefits. He provided an overview of the IMO regulatory framework related to S-100 and described how S-100 products support the IMO SOLAS Convention and the IMO e-Navigation Strategy. He then gave a status overview of the ongoing and planned work with different S-100 products and a timeline for the availability of operational editions of the IHO S-100 product specifications.

2.7 S-200 Implementation Update, Minsu Jeon – Technical Operations Manager, IALA

Minsu Jeon made a presentation on the updates from IALA, focusing on the development of the S-200 series PS. Since the first workshop in 2022, IALA has made significant progress. IALA, collaborating with IHO, serves as the Domain Controller for Marine Aids to Navigation, overseeing several areas, including AtoN, VTS, and communication systems.

The presentation covered various IALA publications, including guidelines for preparing S-100 Product Specifications, with a focus on updating outdated recommendations. The structure of the S-200 world was introduced, categorizing different domains like AtoN and VTS.

The development status of 10 IALA PSs, including S-201 for AtoN information and S-125 for public AtoN data, was discussed. The S-201 data, comprehensive in nature, includes features such as equipment and structure details. Additionally, S-210 series, related to VTS, and the progress of technical services, which support maritime data exchange, were highlighted.

Finally, the S-200 testbed, now in its second version which was supported by MOF and KRISO, was reviewed, with updates designed to enhance functionality and support broader PS testing, including S-210 and PNT products.

3. SESSION 2 – WORLD-WIDE UPDATES

This session was chaired by Julia Powell, Chief of the Office of Coast Survey Marine Chart Division, NOAA.

3.1 NOAA – Precision Marine Navigation - Implementation of S-100 – Darren Wright, NOAA

Darren Wright explained that the International Hydrographic Organizations (IHO) S-100 Universal Hydrographic Data Model provides a framework of components enables the building of standardized product specifications for the modelling of hydrographic data, and it allows for true interoperability between different data standards and systems. NOAA plans to offer the following navigational information, S-101 - Electronic Navigational Charts, S-102 - Bathymetric Surface, S-104 - Water Level Information, S-111 - Surface Currents, S-411 - Sea ice, S-412 - Wave and Weather Warnings, S-413 - Wave and Weather Conditions and S-414 - Wave and Weather Observations to promote safe and efficient marine transportation.

3.2 Implementation of S-100 in the Baltic Sea / Operational – Magnus Wallhagen, Swedish Maritime Authority

Magnus Wallhagen explained that in order to deploy the first layers of S-100 based navigation products in the Baltic Sea, and do so in a regionally harmonized manner, the Hydrographic Offices involved are partnering with academia and industry in the Baltic Sea e-Nav project. To unlock the full potential of the S-100 paradigm shift towards e-navigation, there is a need for transnational collaboration to build capacity and ensure seamless, harmonized products. In addition, the project will test S-100 products from an end-user perspective to ensure the most relevant and useable navigation data possible. The recently started project will continue until 2026 and is co-financed by the EU Interreg Baltic Sea Region programme..

3.3 IHO-Singapore Testbed Project for S-124 / Technical – Eivind Mong, Canadian Coast Guard

Eivind Mong presented that following the 1st Joint IHO/IALA S-100/S-200 Workshop, a testbed was organized by the IHO-Singapore Lab with KRISO, Canadian Coast Guard, Singapore MPA, Bluemap and Suresoft to test the potential of S-124 Navigational Warning and S-125 AtoN Information interaction within a navigation environment. The presentation touched on the preparation of the testbed, and detailed the execution and outcomes of the trials. Outcomes for a briefing and workshop organized by MPA following the testbed to discuss results was also shared. In summary the testbed showed that the S-124 and S-125 can act together and give the end user better information. Some work still remain on improving the portrayal of the information.

3.4 IALA S-200 / Training – Minsu Jeon, IALA

The presentation was focusing on the challenges and outcomes of the IALA S-200 pilot training course conducted in February 2024. The presentation emphasized the development and issues related to the S-200 standards, especially the need for better understanding of computer languages like GML and XML, which has posed challenges for many stakeholders involved in data production. While some Edition 1.0 PSs have been released, harmonizing legacy systems with new data models remains a critical issue.

Key findings from the preliminary S-201 testing revealed that inconsistent terminology, missing data, language, and different coordinate systems were common issues across members. To address these, a "read-me" document and converters to help adapt operational data into the S-201 format were recommended.

Minsu also discussed the pilot training course, which identified the need for modular courses, as varying levels of knowledge in computer languages created gaps. The program also highlighted the importance of training in both AtoN and VTS fields.

Lastly, Minsu touched on the importance of incorporating testbed use into training and conducting sea trials to validate the operation of products and Technical Services under real-world conditions.

3.5 PRIMAR / Training - Svein Skjeveland, PRIMAR

Svein Skjeveland explained that PRIMAR is developing services for S-100 data validation and dissemination. As part of this development capacity building on the S-100 framework has been a priority. After being launched in 2021, the PRIMAR e-learning portal now has training material available for the S-100 framework, offering specific training courses for the S-101, S-102, S-104 and S-111 Product Specifications. The presentation will be focusing on existing content, functionality and accessibility of the training portal.

3.6 Report on the Joint IHO-Singapore Innovation and Technology Laboratory - Dr Parry Oei, IHO Lab

Dr Parry Oei, IHO-SG Innovation and Technology Laboratory (IHO-SG Lab), gave an introduction to what the IHO-SG Lab is and the projects undertaken and completed. The projects included sea-demonstration of S-124/S-125, creation of a prototype S-131 portal, facilitating a S-57 to S-101 conversion guidance document review and conducted a workshop, and sea-demonstration of S-57 & S-101 ENCs on a prototype Dual-Fuel ECDIS, and exploring possibilities of land-sea datum integration.

He expressed appreciation for the support from various Member States and industry partners from both the hydrographic and AtoN communities.

4. SESSION 3 – WORLD-WIDE UPDATES

This session was chaired by Magnus Wallhagen, National Hydrographer, SMA.

4.1 Examples of implementation from Norway, technical and training challenges encountered – Guttorm Tomren, NCA

Guttorm Tomren outlined plans to update Norway's nautical production system, including all AtoN. This will be their second GIS-based production system, incorporating the latest available technology. The system will also support the transition to S-100 based product specifications once they are finalized, with adjustments expected as needed. Additionally, it will be designed to handle the 'dual-fuel' period, supporting both S-57 and S-100 standards.

4.2 Examples of implementation from Denmark, technical and training challenges encountered – Ulla Møller, DMA

Ulla Møller from the Danish Maritime Authority (DMA) presented a detailed account of Denmark's efforts in implementing various maritime technologies and standards. The presentation highlighted several key initiatives and the challenges encountered along the way.

Firstly, Denmark focused on enhancing its maritime infrastructure through the S-100 Cooperation, aiming to standardize data exchange protocols. They upgraded the Aids to Navigation Register to comply with S-201 standards, ensuring compatibility with modern systems.

Another critical aspect was the adaptation of existing systems to handle navigational warnings and Notices to Mariners. This involved adjustments to the NIORD MSI system to communicate using S-100 data exchange codes like S-124 and S-125.

The implementation process wasn't without its hurdles. Trials and testing were conducted on ships to ensure seamless integration and functionality of these new systems. Tools like the EU project MaDaMe played a pivotal role in this phase, facilitating compliance and technical readiness.

Throughout the journey, Denmark navigated technical challenges such as integrating AIS stations with VDES (VHF Data Exchange System) for improved data transmission. Additionally, implementing R-mode for resilient PNT (Positioning, Navigation, and Timing) further fortified their infrastructure against disruptions.

4.3 Examples of implementation from Korea, technical and training challenges encountered – Yunjee Kim and Taehee Kim, KRISO

KRISO explained that since the S-201 Aids to Navigation (AtoN) Information standard was established in 2019 (Version 1.0, which was approved), the revision of the S-201 standard was finalized (Version 1.1.0) at the ARM 16 and is currently undergoing a continuous revision process, leading up to the release of Version 1.3 at the ARM 19. The S-201 standard is becoming increasingly important as the international maritime digitalization trend continues. As a result, Korea is improving its AtoN information management system with the aim of implementing the S-201 standard. This presentation will describe the current status of the improvement of Korea's AtoN information management system to implement the S-201 standard, along with the newly developed system (referred to as the Smart AtoN Information Management System). Specifically, we would like to share the main features and development issues, such as major problems encountered in improving the information management system, how they were overcome, how to verify the reliability of information, and Korea's major plans for implementing the S-201 standard in the future. Furthermore, we want to attempt converting the S-201 Implementation Guidance currently contained in the Annexes into a new Technical Guideline and would like to receive comments on the draft Technical Guideline at this workshop.

4.4 S-124 /125 Implementation in the US – Modernized NtoMs – Dave Lewald, USCG

In his presentation on S-124 and S-125 implementation in the U.S., Dave Lewald from the U.S. Coast Guard discussed how federal agencies must align with IMO directives and the CMTS Strategy to support evolving maritime technology. He emphasized the use of internationally recognized frameworks like IHO's S-100 to enhance navigational services. Dave highlighted S-124 for Navigational Warnings and S-125 for Navigation Information as key components of this modernization.

Examples of supported services included AtoN information, ship reporting and route exchange, backed by agencies such as the Coast Guard. Additionally, agencies like NOAA for charting, meteorological data, bathymetry and surface currents. He explained that current methods for delivering MSI, such as posting PDFs online and broadcasting via VHF were considered outdated and inefficient.

To address this, the Coast Guard began modernizing MSI delivery by providing real-time, electronic, user-friendly formats that could eventually be integrated with charting systems. Current efforts included offering electronic formats for ATON discrepancies, temporary changes, and iceberg locations. Dave also mentioned ongoing work to modernize the Notice to Mariners and its supporting IT systems. The new NM and Light List editor would produce geo-referenced information available in both graphical and human-readable formats, aiming to fully comply with IHO S-124 and S-125 standards as part of the CMTS and IMO strategies.

This modernization effort was driven in part by NOAA's Raster Chart Sunset initiative, making the updates time-sensitive and critical.

5. SESSION 4 – INTRODUCTION TO WORKING GROUPS

This session was chaired by Dave Lewald, USCG.

5.1 Update on S-100 infrastructure systems – Julia Powell on behalf of Yong Baek, IHO

Julia Powell explained that since the publication of S-100 Edition 5.1.0 in October 2023, several proposals have been made to clarify and enhance the operational implementation of S-100, based on feedback from key stakeholders. A major update involves digital signatures and the associated algorithm, which now support longer key lengths. In response to these needs, S-100 Edition 5.2.0 was released in June 2024, and all Phase 1 product specifications outlined in the S-100 Roadmap should be baselined to this new edition.

The S-100 infrastructure systems, which enable the machine-readable functionality of S-100, have been upgraded to align with the latest edition. These systems include the GI Registry, Feature Catalogue Builder (FCB), Portrayal Catalogue Builder (PCB), Data Classification and Encoding Guide (DCEG) Composer, Symbol

Editors, and the S-100 Data Protection Application. This document details the updated procedures for system workflows and highlights key improvements, including enhancements in system management.

5.2 Identify Remaining gaps – Chairs' panel discussion

Dave Lewald led a chairs' panel discussion on identifying remaining gaps as a means to introduce the working groups on operations, technical and training. He provided background and context to the working groups, highlighting both the similarities and differences across various aspects. Key topics discussed included the need for harmonization between neighbouring countries. The relationship between S-124 and S-125 standards was also examined.

Working Groups 1, 2 and 3 were reviewed and the panel revisited the terms of reference for these groups.

Several questions were raised, including conclusions from the Digital@Sea initiative. The importance of operational and technical aspects of Seacom, particularly regarding machine-to-machine communication was emphasized. It was also stressed that training, especially for seafarers, should be a priority and broader advertisement of these efforts was suggested.

6. ESTABLISH WORKING GROUPS

The Chairs of the different working groups reminded participants of the three working groups and their suggested outcomes (Annex C). Participants then divided into three groups to begin the work.

6.1 WG1 - Operational

The full working group report can be found in Annex D

6.1.1 Executive Summary

Co-Chairs – Guttorm Tomren and Sean Legeer

Around 24 participants were welcomed to WG1.

The outcomes worked towards by WG1 were:

Review the actions identified during the first workshop and implement necessary follow-up steps.

Identify gaps relating to portrayal within various product specifications related to Aids to Navigation and VTS product specifications. Additionally, identify and document any gaps in the planned S-101 AtoN portrayal, for example – sector (complex) lights.

Define the interaction between S-101 ENCs, S-124, S-125 and S-201 and using S-201 as the source data.

The WG discussions and conclusions for each of these outcomes are addressed below.

Review the actions identified during the first workshop and implement necessary follow-up steps.

The group reviewed the 2022 report and the gap mentioned.

We reviewed the 2024 Digital@Sea North America report and the working group recommends that the report be forwarded to working committees of IALA and IHO.

Identify gaps relating to portrayal within various product specifications related to Aids to Navigation and VTS product specifications. Additionally, identify and document any gaps in the planned S-101 AtoN portrayal, for example – sector (complex) lights.

Remaining gaps in portrayal regarding AtoNs will need to be addressed when the standards are further developed and test data is available. For example complex lights (port entry lights, sector lights, and including portrayal of flash characters).

In regard to Gap analysis on the (future) portrayal of S-100 data in shorebased VTS systems the working group considered the content of IALA Guideline 1177 Edition 2.0, June 2024; portrayal of VTS information, in general.

The guideline provides confidence that there are no gaps in relation to the portrayal of S-100 based data in a VTS operational environment. The Working Group is confident that it provides sufficient baseline guidance to VTS services in development and at the same time it leaves enough flexibility for tailormade portrayal solutions where VTS management deems necessary.

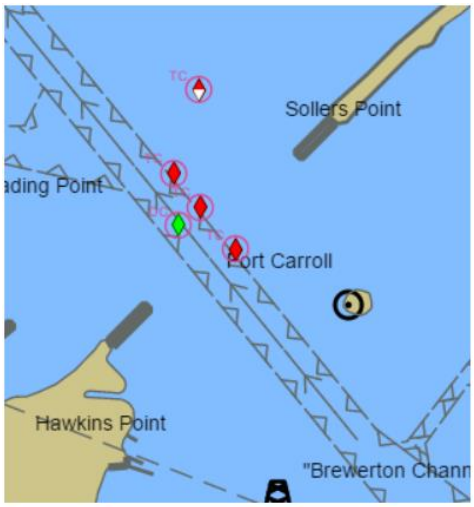
Define the interaction between S-101 ENCs, S-124, S-125 and S-201 and using S-201 as the source data.

A Task Group within Working Group 1 (Operational) was convened, to discuss and describe the relationship between S-101, S-124, S-125, and S-201. Initial WG Plenary discussions had identified that S-101 contains all of the information in the "Legacy" S-12 or List of Lights.

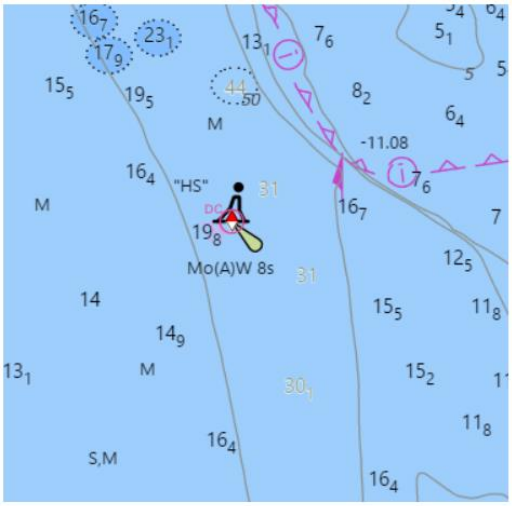
The Task Group discussed real-world scenarios where and identified the following conclusions:

- S-101 contains all AtoN information relevant for the end-user (Mariner/ECDIS) regarding a "Design State" of an AtoN.
- With regards to AtoNs, S-124 is intended to be used for time-critical, navigationally-significant information, in accordance with existing S-124 definitions for Marine Safety Information (MSI).
- S-125 contains AtoN changes (in the form of Advance Notice of Changes (AC), Proposed Changes (PC), Temporary Changes (TC), and Discrepancies (DC)). It does not contain (duplicate) Design-State information on AtoNs (that appears in S-101). S-125 is a "derivative" dataset and all features and attributes must also appear in S-201. Navigationally-significant information is included in S-125, including time-sensitive information (as authorities are able). S-125 may contain information that also appears in S-124; issuance of S-125 does not necessarily mean cancellation of an S-124 dataset.

Images below are examples of suggested portrayal of S-125.



Temp Change



Discrepancy

- S-201 is the authoritative dataset exchanged between an AtoN Authority and other responsible parties (including Hydrographic Offices). S-201 is not intended for ECDIS use.
- Further Conclusions:
- S-124 and S-125 are necessary for a full operational picture for the Mariner.
- When an AtoN is functioning according to its Design State, it does not appear in either S-124 or S-125 datasets; it is only in S-101.
- Alerts and alarms in S-125 should be filterable per the voyage and use case (planning mode or sailing mode) to prevent alarm overload.
- Geographic area of the S-124 and S-125 datasets should be determined by the responsible agency. The geographic area does not need to be tied to any other S-100 datasets.

- With regards to seasonal buoys, S-101 can include date encoding for planned seasonal changes. S-125 can address discrepancies from the planned seasonal changes. S-125 can also include date encoding, or could persist throughout the season. See use cases for examples.
- The authorities producing S-125 should be decided at a national level.

Further discussion/research (action) questions: Task Group recommends further work on these topics:

- Contents of S-101 data model should be evaluated to ensure all information once contained in S-12 has been accounted for. One or Two Member States (IHO) to review and prepare a paper for contribution to a future NIPWG Meeting (First Quarter 2025?)
- Comparison should be undertaken of S-101 data model and S-201 as all information for populating AtoN Information in S-101 should be coming from S-201 datasets. (IALA Committees)
- Since S-201 is authoritative for AtoN Design State, consider the timing issue of the maturation of those product specifications, and address any risks identified. (IHO)
- IALA Committees to define "Design State" and assist with NIPWG evaluation of S-101 content.
- Action for IHO/IALA Member States to consider preparing a paper to IHO WWNWS Sub-Committee with regards to S-124 considerations of "time-critical" and "navigationally-significant" regarding AtoNs and S-125.
- Use of MRN within S-101, S-124, S-125, S-201. Each dataset should use/include MRN wherever possible. Action on IALA ARM to verify that S-201 data model accommodate MRN use.
- IALA ARM Committee to consider including or verifying that the S-201 data model include "Authority" or "Source" information to identify the authority (or owners) of AtoNs belonging to another entity (than the S-201 issuer). This information may also appear in S-101 for Mariners (or may be simplified as "Private" or other notation). Action for Committee to consider contents of S-201 for exchange and for (S-101) portrayal to the Mariner.
- IALA Committees to consider input to CIRM for OEMS to consider something like a "log" of AtoN changes somewhere, showing changes that have occurred over time, and to ensure that product specifications within IALA's remit support such data creation.
- IALA ARM Committee and IHO NIPWG to consider further work to be undertaken to address how S-125 could be used in Route Planning versus Route Monitoring Mode, and if this is dependent on "type" (AC, PC, TC, DC) encoding.
- Ensure the Workshop Conclusions are supported by the relevant data models, through development action with IALA Committees and IHO Working Groups.
- National Authorities should consider the inter-related nature of the S-101, S-124, and S-125 datasets within ECDIS, and create training and operational instructions to address timing and implications of ensuring data consistency between the distribution of datasets.
- IALA ARM Committee and IHO NIPWG to consider technical and operational aspects of geographic footprints or extents with regards to S-124 and S-125 dataset boundaries and concerns of overlap.

Other considerations

The Working Group recommends that document (WorkshopUseCasesS124S125.pdf) with use cases be forwarded to IALA ARM Committee Working Group 2.

6.2 WG2 - Technical

The full working group report can be found in Annex E

6.2.1 Executive Summary

Co-Chairs – Eivind Mong and Yong Baek

Around 30 participants were welcomed to WG2.

The outcomes worked towards by WG2 were:

- Consider lessons identified from IHO on S-124 and S-125 test beds (review test bed report).
- Identify and document technical gaps in standards S-101, S-124, S-125 and S-201.
- Consider and document any actions to undertake to support cyber security.
- Conduct a comprehensive review of standards S-124 and S-201 and its derivative S-125 product specification.
- Develop a framework for a machine-readable environment that includes alerts and alarms, enabling machine-to-machine communication with human response triggers.
- Address and resolve any outstanding questions regarding standard S-124.
- Consider if AIS AtoN will have S-101, S-124, S-125 symbology or use existing IEC62288 symbology? Will S-124 and S-125 develop same/different symbology for non-ENC displays, i.e. radar?

The WG discussions for each of these outcomes are addressed below.

Better documentation of the intended use of the product specifications and how it all works together was requested since a number of participants who were not familiar with the intended plans noted the lack of such descriptions. It was suggested that services descriptions could be helpful to document the intended service and the business processes it would be beneficial to.

Some gaps that affect the implementation of all GML based product were discussed and interested parties were invited to submit concerns to the upcoming meeting of S-100WG. No specific gaps were raised about S-124, but there seemed to be consensus that IHO and IALA should both dedicate more efforts to facilitate testing of the S-100 based service. It was also noted that the IHO-Singapore Lab could be a good venue to collect testbed outputs for review and facilitate further testing to resolve any identified issues or gaps.

Portrayal of AIS AtoN in S-57/S-101, S-125 and S-124 was reviewed and discussed. The went full circle when considering impacts of changes and concluded that it would be best to leave portrayal of AIS AtoN in S-57/S-101 and S-124 as it currently is specified, but that in S-125 it would be best to align the portrayal with that of IMO Circular 243, as revised.

By far the most time during the last few days was dedicated to discussing SECOM and MCP. The current IHO security scheme was briefly discussed, and several concerns were noted, to which an invite to contribute to the ongoing IHO Security Scheme Project Team was extended. The benefits of SECOM and MCP's Service Registry and Identity Registry concepts were discussed, and it was noted that many of the earlier concerns could be resolved by utilizing SECOM. However, it was noted that reference implementations by IHO and IALA would be very beneficial for the implementors and greatly progress the overall progress. Two systems capable of consuming SECOM based S-100 services were demonstrated highlighting that the technology offers great promise. A comprehensive review of data distribution and associated security scheme was given by reviewing Hannu Peiponen's input paper to WENDWG14 on the expectations of provision of Electronic Navigational Data Services (ENDS). Several working group members expressed that it was very educational and helpful to better see the full picture of data dissemination.

It was also noted that a framework for improved shore to ship to shore communication will need to be specified, to permit acknowledgment between stakeholders in route exchange, and later in VTS clearances. It may also hold some benefits for MSI dissemination. The working group also noted that a goal based framework for the last mile will be needed to ensure data delivery latency is sufficient to ensure safe operation of vessels.

Concerns were also raised about cyber security that besides the digital signatures on dataproducts (on the PS level) the entire service should be resilient to cyber threats.

From these discussions it was also recommended that:

The IALA ARM Committee consider making a proposal to IHO S-100WG on the need for such reference implementations.

The IALA ARM Committee consider adding input on defining service specific latency requirements and the need for a goal based framework for the 'last mile' to IHO S-100WG.

6.3 WG3 Training

The full working group report can be found in Annex F

6.3.1 Executive summary

Co-Chairs – Heather Gilbert and Ed Kuwalek

Around 15 participants were welcomed to WG3.

The outcomes worked towards by WG3 were:

- Present and discuss pilot IALA S-200 courses, review and document observations.
- Identify training gaps in the S-100 starter course for both external (mariners/users) and internal (Hydrographic Offices and AtoN authorities) audiences in preparation of a submission for IMO MSC.
- Identify and document technical training gaps within the S-100 infrastructure that may need to be addressed by the IHO and IALA, for both external (mariners/users) and internal (Hydrographic Offices and AtoN authorities) audiences.
- Review and provide recommendations for amendment of relevant IALA and IHO documentation to determine the technical knowledge requirements for managers.

Present and discuss pilot IALA S-200 courses, review and document observations:

The delivery methods, duration, and frequency of training for the IALA S-200 courses should be tailored based on the target audience. Key audiences include implementers such as software developers and product specification developers, data production specialists like AtoN managers and VTS authorities, system administrators, executives (e.g., policymakers), and end users. A foundational course covering S-100 and S-200 standards should be developed to provide general awareness across a broad spectrum of participants. More advanced, targeted training modules should follow this foundation, with their duration informed by existing course examples. To ensure global accessibility, these training programs should be available in multiple languages.

Identify training gaps in the S-100 starter course for external and internal audiences:

Current S-100 training materials have been influenced by marketplace demand rather than a structured curriculum, highlighting the need for improvement. It is recommended that foundational S-100 training be made mandatory for all end users, with a focus on supporting product development and production teams. Hydrographic offices should also encourage educational institutions to integrate S-100 training into university and pre-university courses. The IMO HTW should consider refining STCW training requirements to include specific transition training to ECDIS, covering ECDIS itself, MSI, and NAEST training. Training delivery should be flexible, offering face-to-face, web-based, or other engaging formats.

Identify and document technical training gaps within the S-100 infrastructure:

There is a need for comprehensive training materials covering all aspects of the S-100 infrastructure, particularly for product specification development. These materials should be made available to IALA and its member states. The training should focus on essential tools such as the feature catalogue builder, portrayal catalogue builders, and DCEG composer, along with elements of the IHO Geospatial Registry and S-164 infrastructure for ECDIS test and type approval. Training for these tools is currently limited, particularly for externally managed components. Additionally, consistent use of the portrayal, feature, and DCEG catalogue builders is essential for product specification development. Providing training on the end-to-end process for developing product specifications will be critical for meeting IHO and IALA deadlines and will facilitate

smoother implementation for ECDIS developers. A communication mechanism should be established to notify stakeholders of updates to the S-100 infrastructure.

Review and provide recommendations for amendment of relevant IALA and IHO documentation:

A review of relevant IALA and IHO documentation is recommended to ensure alignment with S-100 Edition 5.2 or future versions. This includes revising the S-5 and S-8 training curriculums to ensure adequate S-100 coverage and reconsidering whether the term 'nautical cartographer' remains appropriate. Additionally, the IALA Level 1 manager course should be updated to cover S-100 and S-200 standards. To empower data production managers and teams, guidance materials should be developed for each product specification, including standard operating procedures and best practices for rolling out training programs.

These recommendations focus on enhancing the accessibility, structure, and comprehensiveness of S-100 and S-200 training, ensuring that all relevant stakeholders, from technical implementers to policymakers, have the knowledge needed to manage and implement these evolving standards effectively.

The Working Group Conclusions

- The need to identify the knowledge gaps of S-100 (S-100 itself and the forthcoming changes) within the maritime community prior to training to ensure those knowledge gaps are addressed.
- Utilize an informal process (multimedia, trade press, social media) vs the normal process of NTM?
- Coordinated communication and marketing from IALA and IHO – what S-100 is and what it brings to the table. A single story.
- Recommend to IMO HTW to refine the wording of STCW training requirement and include transition training to ECDIS (to include ECDIS, MSI and NAEST training)
- Technical knowledge and software knowledge are key components that needs to be trained across the entire stakeholder community, this is paramount to the entire S-100 rollout and production.
- Significant training gaps were identified in technical training amongst different users groups.
- There is need to define the different user groups across the entire maritime community.
- Proposed User Groups -- Implementors; Software Developers of data production systems, product Specification Developers, Data production specialists; AtoN managers, VTS Authorities; System integrators/administrators (those that are responsible for managing the system and infrastructure); Stakeholder Executives (ex. National Level policy makers) and End Users.
- Training courses need to be tailored to the specific user groups, while factoring in delivery methods, ensuring the training materials stay current as the standards and product specifications evolve.
- Ex. Shorter courses for executive/high-level; Longer courses for developers – but also built upon the prior required training as those taking the training need to understand all the elements of the specifications.
- Need to work with the overarching organizations, but equally with the Member States as they are the ones that have the most influence at IMO, IHO and IALA (ex. IHO is observer at IMO, while Members States have voting rights)
- Need to empower and support product specification developers in the implementation of remaining IHO (100 series), IALA (200 series), IEHG and WMO (400 series) and NATO (500 series) product specifications as many of them are still under active development and it would be beneficial to get them completed as soon as possible.
- Training should be available in multiple languages to make it inclusive to all member states.

7. WORKSHOP CONCLUSIONS

Operations

- Contents of S-101 data model should be evaluated to ensure all information once contained in S-12 has been accounted for. This should enable the data in the S-101 layer to satisfy the requirements contained in S-12 referred to as a List of Lights.
- With regards to AtoNs, S-124 is intended to be used for time-critical, navigationally-significant information, in accordance with existing S-124 definitions for Marine Safety Information (MSI).
- S-125 contains AtoN changes (in the form of Advance Notice of Changes (AC), Proposed Changes (PC), Temporary Changes (TC), and Discrepancies (DC)). S-125 is a "derivative" dataset and all features and attributes must also appear in S-201. Navigationally-significant information is included in S-125. Both S-124 and S-125 are necessary for a full operational picture. S-125 does not contain (duplicate) information on AtoNs that appears in the S-101 dataset for AtoNs that are operating in the design-state (intended) status.

Technical

- It is recommended that the IHO review the data and service provisions required by IALA for international compliance and consider recommendations for data and services for non-SOLAS vessels as well.
- The IHO-SGP lab is invited to collect test scenarios and datasets to help identify technical gaps in IHO/IALA product specifications and to develop a structured template for testing.
- It is recommended that IHO/IALA explore official testing MCP's identity management in conjunction with IHO's identity management system (focused on producer and data protection). It was further suggested that IALA provide its concerns and/or requirements related to security.
- It is recommended that IHO consider establishing a formal system to notify stakeholders of changes to S-100 standard. This would ensure that all pertinent parties are informed of updates in a timely manner and can adapt accordingly.
- An outline of the key issues related to testing S-100 data distribution, including the integration of SECOM, MCP, and the IHO registry was drafted and will contribute to a paper being prepared for submission to IHO/IALA.
- It is recommended that the IHO retain the current S-124 symbol but enhance it with cartographic markup symbols. For S-125, efforts should be made to align it with the IMO Circular letter 243 - AIS AtoN as much as applicable. Meanwhile, the S-101 symbols will remain unchanged during the dual-fuel period.

Training

- The need to identify the knowledge gaps of S-100 (S-100 itself and the forthcoming changes) within the maritime community prior to training to ensure those knowledge gaps are addressed.
- Utilize an informal process (multimedia, trade press, social media) vs and in addition to, the normal process of NTM.
- Coordinated communication and marketing from IALA and IHO – what S-100 is and what it brings to the table. A single story.
- Recommend to IMO HTW to refine the wording of STCW training requirement and include transition training to ECDIS (to include ECDIS, MSI and NAEST training)
- Technical knowledge and software knowledge are key components that needs to be trained across the entire stakeholder community, this is paramount to the entire S-100 rollout and production.
- Significant training gaps were identified in technical training amongst different users groups.

- There is need to define the different user groups across the entire maritime community.
    - Proposed User Groups -- Implementors; Software Developers of data production systems (Product Specification Developers, Data production specialists; AtoN managers, VTS Authorities; System integrators/administrators (those that are responsible for managing the system and infrastructure); Stakeholder Executives (ex. National Level policy makers) and End Users.
- Training courses need to be tailored to the specific user groups, while factoring in delivery methods, ensuring the training materials stay current as the standards and product specifications evolve.
- Ex. Shorter courses for executive/high-level; Longer courses for developers – but also built upon the prior required training as those taking the training need to understand all the elements of the specifications.
- Need to work with the overarching organizations, but equally with the Member States as they are the ones that have the most influence at IMO, IHO and IALA (ex. IHO is observer at IMO, while Members States have voting rights)
- Need to empower and support product specification developers in the implementation of remaining IHO (100 series), IALA (200 series), IEHG and WMO (400 series) and NATO (500 series) product specifications as many of them are still under active development and it would be beneficial to get them completed as soon as possible.
- Training should be available in multiple languages to make it inclusive to all member states.
- The IALA ARM Committee consider making a proposal to IHO S-100WG on the need for such reference implementations.
- The IALA ARM Committee consider adding input on defining service specific latency requirements and the need for a goal based framework for the 'last mile' to IHO S-100WG.

Joint Conclusions

- This workshop provided enormous benefit for the understanding and planning for the future interactions between S-101, S-124, S125, and S-201 and a future event should be planned to continue this discussion.
- The IHO and IALA to submit a joint input document to IMO to update them on S-100 / S-200 matters including possible training requirements.

7.1 Review workshop report

The report was reviewed and agreed upon.

7.2 Closing of the workshop - Francis Zachariae – IALA Secretary General

Francis Zachariae thanked the workshop organizers and participants on behalf of IALA for all their energy and hard work. He took the opportunity to present a gift from IALA to the Naval Academy Club as thanks for hosting the event. There had been many important and interesting discussions that would benefit future IALA documentation. He wished all a pleasant weekend and a safe journey home before presenting.

7.3 Closing of the workshop - Magnus Wallhagen, IHO

On behalf of the IHO Magnus Wallhagen congratulated participants on an enjoyable and productive workshop. He extended his thanks to the CMTS and presented Dave Lewald with a gift as a sign of appreciation.

8. SOCIAL EVENTS AND TECHNICAL VISIT

8.1 Workshop icebreaker - William Paca House and Gardens

On Monday evening, following the workshop's opening day, participants attended a warm icebreaker at the William Paca House and Gardens, Annapolis. As ever, this gathering was a great success, and all had the opportunity to taste a variety of different food and drink.

The history and the significance of the house was explained and it was noted that William Paca was a signatory to the Declaration of Independence. Finally, the IALA family came together to award Bill Cairns his Honorary Membership to IALA and was warmly congratulated by the Secretary-General.

8.2 Workshop dinner at Annapolis Maritime Museum

A wonderful dinner was enjoyed on Wednesday evening at the Annapolis Maritime Museum and former McNasby Oyster House. The venue was a magnificent environment enhanced by the maritime theme that

participants enjoyed in the Museum. Discussions were continued long into the night accompanied by U.S. hospitality.

8.3 Technical visit, Annapolis Harbor Cruise to Thomas Point Shoal Lighthouse

Participants had the opportunity to tour Annapolis Harbor on board the Raven and see Thomas Point Shoal Lighthouse. The tour was well received and many commented on the unusual structure of the lighthouse and beautiful scenery enjoyed.

ANNEX A WORKSHOP PARTICIPANTS

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ANNEX B **TECHNICAL PROGRAMME**

2nd Joint IHO/IALA Workshop S-100/S-200

September 9 - 13, 2024

Naval Academy Club // 2 Truxtun Rd, Annapolis, MD 21402

DAY 1 – Monday 9 September 2024

8:30 - 9:00 **Registration**

9:00 - 10:20 **Session 1 – Opening of the Workshop // Chair: Dave Lewald, Chair of IALA ARM**

Welcome
Ashley Chappell, Director CMTS

Welcome from IHO & IALA
John Nyberg (IHO), Francis Zachariae (IALA)

Administration and Safety Briefing
Dave Lewald

Technical program for the week and expectations
Dave Lewald

S-100 Implementation Update
Magnus Wallhagen, IHO

S-200 Implementation Update
Minsu Jeon, IALA

10:20 - 10:30 **Group Photo**

10:30 - 11:00 **BREAK**

11:00 - 12:45 **Session 2 – Plenary presentations – World-wide Updates // Chair: Julia Powell**

NOAA – Precision Marine Navigation - Implementation of S-100
Darren Wright, NOAA

Implementation of S-100 in the Baltic Sea [Operational]
Magnus Wallhagen, SMA

IHO-Singapore Testbed Project for S-124 [Technical]
Eivind Mong, CCG

IALA S-200 [Training]
Minsu Jeon, IALA

PRIMAR [Training]
Svein Skjeveland, PRIMAR

Report on the Joint IHO-Singapore Innovation and Technology Laboratory
Dr Parry Oei, IHO Lab

Q/A session
Julia Powell

12:45-13:30 **LUNCH**

13:30 - 14:35 **Session 3 – Plenary presentations – World-wide Updates // Chair: Magnus Wallhagen**

Examples of implementation from Norway, technical and training challenges encountered.

Guttorm Tomren, NCA

Examples of implementation from Denmark, technical and training challenges encountered.
Ulla Møller, DMA

Examples of implementation from Korea, technical and training challenges encountered.
Yunjee Kim and Taehee Kim, KRISO

S-124 /125 Implementation in the US – Modernized NtoMs
Dave Lewald, USCG

Q/A session
Dave Lewald, USCG

14:35 - 15:00 **BREAK**

15:00 - 17:00 **Session 4 – Introduction to Working Groups // Chair: Dave Lewald**

Update on S-100 infrastructure systems - IHO
Yong Baek, IHO

Identify Remaining gaps – Chairs' panel discussion
Dave Lewald

Working Group 1 – Operational Terms of Reference
Co-Chairs – Guttorm Tomren and Sean Legeer

Working Group 2 – Technical Terms of Reference
Co-Chairs – Eivind Mong and Yong Baek

Working Group 3 – Training Terms of Reference
Co-Chairs – Heather Gilbert and Ed Kuwalek

Q&A session
Dave Lewald

Day wrap up
Dave Lewald

18:00 - 20:00 **Workshop Icebreaker**
Venue: William Paca House and Gardens
(Dress code: Business casual)

DAY 2 – Tuesday 10 September 2024

9:00 - 10:30 **Session 5 – Working groups**

Introduction to the day and establish Working Groups
Dave Lewald

Working Group 1 – Operational
Co-Chairs – Guttorm Tomren and Sean Legeer

Working Group 2 – Technical
Co-Chairs – Eivind Mong and Yong Baek

Working Group 3 – Training
Co-Chairs – Heather Gilbert and Ed Kuwalek

10:30 - 11:00 **BREAK**

11:00 - 12:30 **Session 6 – Working groups**

Working Group 1 – Operational
Co-Chairs – Guttorm Tomren and Sean Legeer

Working Group 2 – Technical
Co-Chairs – Eivind Mong and Yong Baek

Working Group 3 – Training
Co-Chairs – Heather Gilbert and Ed Kuwalek

12:30 - 13:30 **LUNCH**

13:30 - 15:00 **Session 7 – Working groups**

Working Group 1 – Operational
Co-Chairs – Guttorm Tomren and Sean Legeer

Working Group 2 – Technical
Co-Chairs – Eivind Mong and Yong Baek

Working Group 3 – Training
Co-Chairs – Heather Gilbert and Ed Kuwalek

15:00 - 15:30 **BREAK**

15:30 - 17:00 **Session 8 – Working groups**

Working Group 1 – Operational
Co-Chairs – Guttorm Tomren and Sean Legeer

Working Group 2 – Technical
Co-Chairs – Eivind Mong and Yong Baek

Working Group 3 – Training
Co-Chairs – Heather Gilbert and Ed Kuwalek

1700 - **FREE TIME**

DAY 3 – Wednesday 11 September 2024

9:00 - 10:30 **Session 9 – Working groups**

Working Group 1 – Operational
Co-Chairs – Guttorm Tomren and Sean Legeer

Working Group 2 – Technical
Co-Chairs – Eivind Mong and Yong Baek

Working Group 3 – Training
Co-Chairs – Heather Gilbert and Ed Kuwalek

10:30 - 11:00 **BREAK**

11:00 - 12:30 **Session 10 – Working groups**

Working Group 1 – Operational
Co-Chairs – Guttorm Tomren and Sean Legeer

Working Group 2 – Technical
Co-Chairs – Eivind Mong and Yong Baek

Working Group 3 – Training
Co-Chairs – Heather Gilbert and Ed Kuwalek

12:30 - 13:30 **LUNCH**

13:30 - 15:00 **Session11 – Working groups**

Working Group 1 – Operational
Co-Chairs – Guttorm Tomren and Sean Legeer

Working Group 2 – Technical
Co-Chairs – Eivind Mong and Yong Baek

Working Group 3 – Training
Co-Chairs – Heather Gilbert and Ed Kuwalek

15:00 - 15:30 **BREAK**

15:30 - 17:00 **Session 12 – Working groups**

Working Group 1 – Operational
Co-Chairs – Guttorm Tomren and Sean Legeer

Working Group 2 – Technical
Co-Chairs – Eivind Mong and Yong Baek

Working Group 3 – Training
Co-Chairs – Heather Gilbert and Ed Kuwalek

1800 - 21:00 **Workshop Dinner**
Venue: Annapolis Maritime Museum
(Dress code: Business casual)

DAY 4 – Thursday 12 September 2024

9:00 - 10:30 **Session 13 – Working groups**

Working Group 1 – Operational
Co-Chairs – Guttorm Tomren and Sean Legeer

Working Group 2 – Technical
Co-Chairs – Eivind Mong and Yong Baek

Working Group 3 – Training
Co-Chairs – Heather Gilbert and Ed Kuwalek

10:30 - 11:00 **BREAK**

11:00 - 12:00 **Session 14 – Conclusion of the WGs in plenary // Chair IHO**

Working Group 1 – Operational
Co-Chairs – Guttorm Tomren and Sean Legeer

Working Group 2 – Technical
Co-Chairs – Eivind Mong and Yong Baek

Working Group 3 – Training
Co-Chairs – Heather Gilbert and Ed Kuwalek

12:00 - 13:00 **LUNCH**

14:00 - 1600 **Technical Visit**

Technical visit to:
Annapolis Harbor Cruise (Thomas Point Shoal Lighthouse)

1700 - **FREE TIME**

DAY 5 – Friday 13 September 2024

9:00 - 11:10 **Session 15 – Workshop review and conclusions // Chair IHO and Dave Lewald**

Review of working group reports and Q & A
WG Chairs

Workshop highlights – recommendations for future workshops
Magnus Wallhagen and Dave Lewald

Closing of the workshop
Francis Zachariae (IALA), Magnus Wallhagen (IHO), Director CMTS

ANNEX C WORKSHOP WORKING TERMS OF REFERENCE

Workshop Working Group Terms of Reference

2nd Joint IHO/IALA workshop on S-100/200 development and portrayal

The International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) and the International Hydrographic Organization (IHO) in association with the Committee on Marine Transportation System and Radio Technical Commission for Maritime Services (RTCM) are hosting the second joint workshop on S-100/200 development and portrayal to be held in Annapolis, Maryland, USA, from 09 to 13 September 2024.

Composition and chairs of working groups

In order to achieve the workshop objectives the participants will divide into three Working Groups (WGs) that are open to all participants of the workshop. The titles and chairs of these WGs are:

- Working Group 1 – Operational - Working Group 2 – Technical - Working Group 3 – Training	Co-Chairs – Guttorm Tomren and Sean Legeer Co-Chairs – Eivind Mong and Yong Baek Co-Chairs – Heather Gilbert and Ed Kuwalek

Working Group objectives

The outcomes that are expected from these WGs have been identified as:

Working Group 1 – Operational:

- Review the actions identified during the first workshop and implement necessary follow-up steps.
- Identify gaps relating to portrayal within various product specifications related to Aids to Navigation and VTS product specifications. Additionally, identify and document any gaps in the planned S-101 AtoN portrayal, for example – sector (complex) lights.
- Define the interaction between S-101 ENCs, S-124, S-125 and S-201 and using S-201 as the source data.
- Contribute to the proposals for the workshop conclusions.
- Submission of WG report to the Workshop Report.

Working Group 2 – Technical

- Consider lessons identified from IHO on S-124 and S-125 test beds (review test bed report).
- Identify and document technical gaps in standards S-101, S-124, S-125 and S-201.
- Consider and document any actions to undertake to support cyber security.
- Conduct a comprehensive review of standards S-124 and S-201 and its derivative S-125 product specification.
- Develop a framework for a machine-readable environment that includes alerts and alarms, enabling machine-to-machine communication with human response triggers.
- Address and resolve any outstanding questions regarding standard S-124.
- Consider if AIS AtoN will have S-101, S-124, S-125 symbology or use existing IEC62288 symbology? Will S-124 and S-125 develop same/different symbology for non-ENC displays, i.e. radar?
- Contribute to the proposals for the workshop conclusions.
- Submission of WG report to the Workshop Report.

Working Group 3 – Training:

- Present and discuss pilot IALA S-200 courses, review and document observations.
- Identify training gaps in the S-100 starter course for both external (mariners/users) and internal

(Hydrographic Offices and AtoN authorities) audiences in preparation of a submission for IMO MSC.
- Identify and document technical training gaps within the S-100 infrastructure that may need to be addressed by the IHO and IALA, for both external (mariners/users) and internal (Hydrographic Offices and AtoN authorities) audiences.
- Review and provide recommendations for amendment of relevant IALA and IHO documentation to determine the technical knowledge requirements for managers.
- Contribute to the proposals for the workshop conclusions.
- Submission of WG report to the Workshop Report.

Procedures

In order to achieve their objectives the Working Groups should:

- Keep under consideration the relevant IHO and IALA publications and documentation;
- Keep under review relevant requirements and regulations of marine navigation and aids to navigation accordingly;
- Consider the operational performance of competent authorities, the progress in relevant technologies and navigational equipment;
- Consider new relevant topics accordingly;
- Decisions and recommendations should generally be made by consensus;
- The working group report should be provided to the Workshop Secretary by the co-chairs by the end of the workshop sessions for inclusion in the Workshop Report; and
- The Working Groups should liaise with each-other to ensure coordination of work where topics overlap.

ANNEX D WG1 – OPERATIONS

1. WG1 OPERATIONAL

Co-Chairs – Guttorm Tomren and Sean Legeer

Around 24 participants were welcomed to WG1.

The outcomes worked towards by WG1 were:

Review the actions identified during the first workshop and implement necessary follow-up steps.

Identify gaps relating to portrayal within various product specifications related to Aids to Navigation and VTS product specifications. Additionally, identify and document any gaps in the planned S-101 AtoN portrayal, for example – sector (complex) lights.

Define the interaction between S-101 ENCs, S-124, S-125 and S-201 and using S-201 as the source data.

The WG discussions and conclusions for each of these outcomes are addressed below.

1.1 Review the actions identified during the first workshop and implement necessary follow-up steps.

The group reviewed the 2022 report and the gap mentioned.
We reviewed the 2024 Digital@Sea North America report and the working group recommends that the report be forwarded to working committees of IALA and IHO.

In general what was considered, any notable discussion highlights and conclusions of the working group.

1.2 Identify gaps relating to portrayal within various product specifications related to Aids to Navigation and VTS product specifications. Additionally, identify and document any gaps in the planned S-101 AtoN portrayal, for example – sector (complex) lights.

Remaining gaps in portrayal regarding AtoNs will need to be addressed when the standards are further developed and test data is available. For example complex lights (port entry lights, sector lights, and including portrayal of flash characters).
In regard to Gap analysis on the (future) portrayal of S-100 data in shorebased VTS systems the working group considered the content of IALA Guideline 1177 Edition 2.0, June 2024; portrayal of VTS information, in general.
The guideline provides confidence that there are no gaps in relation to the portrayal of S-100 based data in a VTS operational environment. The Working Group is confident that it provides sufficient baseline guidance to VTS services in development and at the same time it leaves enough flexibility for tailormade portrayal solutions where VTS management deems necessary.

1.3 Define the interaction between S-101 ENCs, S-124, S-125 and S-201 and using S-201 as the source data.

A Task Group within Working Group 1 (Operational) was convened, to discuss and describe the relationship between S-101, S-124, S-125, and S-201. Initial WG Plenary discussions had identified that S-101 contains all of the information in the "Legacy" S-12 or List of Lights.

The Task Group discussed real-world scenarios where and identified the following conclusions:

- S-101 contains all AtoN information relevant for the end-user (Mariner/ECDIS) regarding a "Design State" of an AtoN.

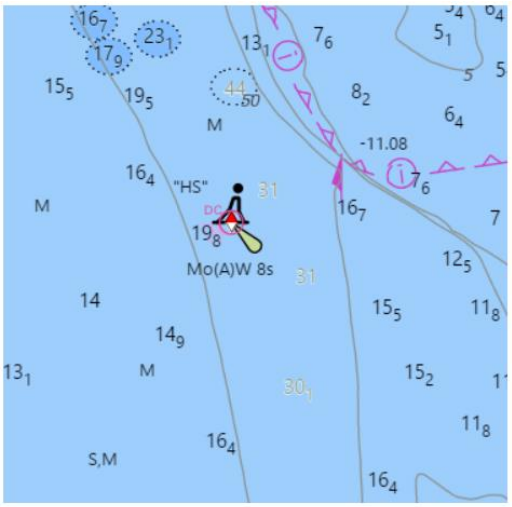
- With regards to AtoNs, S-124 is intended to be used for time-critical, navigationally-significant information, in accordance with existing S-124 definitions for Marine Safety Information (MSI).

- S-125 contains AtoN changes (in the form of Advance Notice of Changes (AC), Proposed Changes (PC), Temporary Changes (TC), and Discrepancies (DC)). It does not contain (duplicate) Design-State information on AtoNs (that appears in S-101). S-125 is a "derivative" dataset (Does this need to be defined

in this context) and all features and attributes must also appear in S-201. Navigationally-significant information is included in S-125, including time-sensitive information (as authorities are able). S-125 may contain information that also appears in S-124; issuance of S-125 does not necessarily mean cancellation of an S-124 dataset.

Images below are examples of suggested portrayal of S-125.

Temp Change



Discrepancy

- S-201 is the authoritative dataset exchanged between an AtoN Authority and other responsible parties (including Hydrographic Offices). S-201 is not intended for ECDIS use.

Further Conclusions:

- S-124 and S-125 are MSI.
- When an AtoN is functioning according to its Design State, it does not appear in either S-124 or S-125 datasets; it is only in S-101.
- Alerts and alarms in S-125 should be filterable per the voyage and use case (planning mode or sailing mode) to prevent alarm overload.
- Geographic area of the S-124 and S-125 datasets should be determined by the responsible agency. The geographic area does not need to be tied to any other S-100 datasets.
- With regards to seasonal buoys, S-101 can include date encoding for planned seasonal changes. S-125 can address discrepancies from the planned seasonal changes. S-125 can also include date encoding, or could persist throughout the season. See use cases for examples.
- The authorities producing S-125 should be decided at a national level.

Further discussion/research (action) questions: Task Group recommends further work on these topics:

- Contents of S-101 data model should be evaluated to ensure all information once contained in S-12 has been accounted for. One or Two Member States (IHO) to review and prepare a paper for contribution to a future NIPWG Meeting (First Quarter 2025?)
- Comparison should be undertaken of S-101 data model and S-201 as all information for populating AtoN Information in S-101 should be coming from S-201 datasets. (IALA Committees)
- Since S-201 is authoritative for AtoN Design State, consider the timing issue of the maturation of those product specifications, and address any risks identified. (IHO)
- IALA Committees to define “Design State” and assist with NIPWG evaluation of S-101 content.
- Action for IHO/IALA Member States to consider preparing a paper to IHO WWNWS Sub-Committee with regards to S-124 considerations of “time-critical” and “navigationally-significant” regarding AtoNs and S-125.

- Use of MRN within S-101, S-124, S-125, S-201. Each dataset should use/include MRN wherever possible. Action on IALA ARM to verify that S-201 data model accommodate MRN use.

- IALA ARM Committee to consider including or verifying that the S-201 data model include "Authority" or "Source" information to identify the authority (or owners) of AtoNs belonging to another entity (than the S-201 issuer). This information may also appear in S-101 for Mariners (or may be simplified as "Private" or other notation). Action for Committee to consider contents of S-201 for exchange and for (S-101) portrayal to the Mariner.

- IALA Committees to consider input to CIRM for OEMS to consider something like a "log" of AtoN changes somewhere, showing changes that have occurred over time, and to ensure that product specifications within IALA's remit support such data creation.

- IALA ARM Committee and IHO NIPWG to consider further work to be undertaken to address how S-125 could be used in Route Planning versus Route Monitoring Mode, and if this is dependent on "type" (AC, PC, TC, DC) encoding.

- Ensure the Workshop Conclusions are supported by the relevant data models, through development action with IALA Committees and IHO Working Groups.

- National Authorities should consider the inter-related nature of the S-101, S-124, and S-125 datasets within ECDIS, and create training and operational instructions to address timing and implications of ensuring data consistency between the distribution of datasets.

- IALA ARM Committee and IHO NIPWG to consider technical and operational aspects of geographic footprints or extents with regards to S-124 and S-125 dataset boundaries and concerns of overlap.

1.4 Other considerations

The Working Group recommends that document (WorkshopUseCasesS124S125.pdf) with use cases be forwarded to IALA ARM Committee Working Group 2.

ANNEX E WG2 – TECHNICAL

- Summary of Working Group2 discussion

Better documentation of the intended use of the product specifications and how it all works together was requested since a number of participants who were not familiar with the intended plans noted the lack of such descriptions. Some gaps that affect the implementation of all GML based product were discussed and interested parties were invited to submit concerns to the upcoming meeting of S-100WG. No specific gaps were raised about S-124, but there seemed to be consensus that IHO and IALA should both dedicate more efforts to facilitate testing of the S-100 based service. It was also noted that the IHO-Singapore Lab could be a good venue to collect testbed outputs for review and facilitate further testing to resolve any identified issues or gaps.

Portrayal of AIS AtoN in S-57/S-101, S-125 and S-124 was reviewed and discussed. The went full circle when considering impacts of changes and concluded that it would be best to leave portrayal of AIS AtoN in S-57/S-101 and S-124 as it currently is specified, but that in S-125 it would be best to align the portrayal with that of IMO Circular 243, as revised.

By far the most time during the last few days was dedicated to discussing SECOM and MCP. The current IHO security scheme was briefly discussed, and several concerns were noted, to which an invite to contribute to the ongoing IHO Security Scheme Project Team was extended. The benefits of SECOM and MCP's Service Registry and Identity Registry concepts were discussed, and it was noted that many of the earlier concerns could be resolved by utilizing SECOM. However, it was noted that reference implementations by IHO and IALA would be very beneficial for the implementors and greatly progress the overall progress. Two systems capable of consuming SECOM based S-100 services were demonstrated highlighting that the technology offers great promise. A comprehensive review of data distribution and associated security scheme was given by reviewing Hannu Peiponen's input paper to WENDWG14 on the expectations of provision of Electronic Navigational Data Services (ENDS). Several working group members expressed that it was very educational and helpful to better see the full picture of data dissemination.

It was also noted that a framework for improved shore to ship to shore communication will need to be specified, to permit acknowledgment between stakeholders in route exchange, and later in VTS clearances. It may also hold some benefits for MSI dissemination. The working group also noted that a goal based framework for the last mile will be needed to ensure data delivery latency is sufficient to ensure safe operation of vessels.

Co-Chairs – Eivind Mong and Yong Baek

Around 30 participants were welcomed to WG2.

The outcomes worked towards by WG2 were:

- Consider lessons identified from IHO on S-124 and S-125 test beds (review test bed report).
- Identify and document technical gaps in standards S-101, S-124, S-125 and S-201.
- Consider and document any actions to undertake to support cyber security.
- Conduct a comprehensive review of standards S-124 and S-201 and its derivative S-125 product specification.
- Develop a framework for a machine-readable environment that includes alerts and alarms, enabling machine-to-machine communication with human response triggers.
- Address and resolve any outstanding questions regarding standard S-124.
- Consider if AIS AtoN will have S-101, S-124, S-125 symbology or use existing IEC62288 symbology? Will S-124 and S-125 develop same/different symbology for non-ENC displays, i.e. radar?

The WG discussions and conclusions for each of these outcomes are addressed below.

8.4 Consider lessons identified from IHO on S-124 and S-125 test beds (review test bed report).

The discussion explored the potential of S-124 and S-125 through various communication channels (e.g., SECOM, VDES, NAVDAT, GMDSS) from the perspective of different stakeholders. Participants shared views on the varying interpretation requirements for chart information (S-101), nautical publications (S-124, S-125), and the interrelationships among these standards.

It was noted that, despite the technical possibilities, there are limitations in providing S-100 data due to constraints imposed by international conventions such as SOLAS. Consequently, **it was recommended that the IHO review the data and service provisions required by IALA for international compliance and consider recommendations for data and services for non-SOLAS vessels as well.**

WG2 also discussed the need for formal explanations of the relationships between S-101, S-124, S-125 and S-201, including individual services themselves, taking into account of service description from IALA G1155.

8.5 Identify and document technical gaps in standards S-101, S-124, S-125 and S-201.

It was recommended to include the data flow for S-101, S-124, S-125 and S-201 in the formal explanation document, as suggested in Item 1.1. The workshop noted that no technical gaps were identified during the meeting. However, the recommendation was made to utilize the test bed program to assist in identifying any potential technical gaps.

Additionally, **WG2 invited the IHO-SGP lab to collect test scenarios and datasets to help identify technical gaps in IHO/IALA product specifications and to develop a structured template for testing.**

8.6 Consider and document any actions to undertake to support cyber security.

WG2 discussed various aspects of securing digital data, including the use of digital signatures, S-128 for maintaining up-to-date information, secure transmission, IT-based security, SECOM distribution, and encryption for package datasets, as well as enforcing bulletin reports for S-124.

WG2 noted that the need for establishing an international framework for high-level data distribution in S-100, considering the Maritime Connectivity Platform (MCP) and its relevance to shore-based navigational services and identity management frameworks.

Additionally, **WG2 recommended that IHO/IALA explore official testing MCP's identity management in conjunction with IHO's identity management system (focused on producer and data protection). It was further suggested that IALA provide its concerns and/or requirements related to security**.

8.7 Conduct a comprehensive review of standards S-124 and S-201 and its derivative S-125 product specification.

WG2 shared information on where to access the latest product specifications, including standards S-124, S-201, and the derivative S-125 product specification. The comprehensive review aimed to ensure that all participants were informed about the most up-to-date standards.

WG2 noted that S-100 standards should be published with an expected timeline, and stakeholders should receive change notices. There should be a reliable system in place to notify relevant entities about updates to the standards.

WG2 recommended that IHO consider establishing a formal system to notify stakeholders of changes to S-100 standard. This would ensure that all pertinent parties are informed of updates in a timely manner and can adapt accordingly.

WG2 reviewed the IHO WENDWG paper about information sources for S-100 dual-fuel ECDIS, cyber security, future needs for distribution of S-100 products and SECOM implementation from OEM stakeholder perspective. Additionally, **WG2 noted that regarding push and/or pull for transfer via the communication**

channel such as SECOM, the latency from source to end user should be identified based on the regulatory requirements; for instance, national warning service for 30 minutes and water level service for 15 minutes.

WG2 noted that there was no consensus to recommend specifying a limitation on the warning period for outdated S-128 (e.g., 7 days, 30 days).

WG2 drafted an outline of the key issues related to testing S-100 data distribution, including the integration of SECOM, MCP, and the IHO registry. This outline will contribute to a paper being prepared for submission to IHO/IALA. Refer to Annex A.

WG2 noted that the validation of the S-124 GML schema (XSD), which should be processed without technical barriers by partial process. **WG2 recommended the need to validate the process of the S-100 GML schema and contribute to S-100WG input paper**.

WG2 invited the workshop participants to join S-100 stakeholders as S-100 expert contributor. WG2 discussed that the coordinate system in the S-124 GML should be specified in the S-100 GML product specification and **invited the S-124 Project Team to include clear guidance on the coordinate order**.

8.8 Develop a framework for a machine-readable environment that includes alerts and alarms, enabling machine-to-machine communication with human response triggers.

WG2 discussed the development of a machine-readable framework enabling machine-to-machine communication, with a focus on the exchange of alerts and alarms across various systems. This framework would trigger human responses when necessary, ensuring critical alerts still require human intervention.

WG2 noted that the importance of creating standardized communication protocols for alerts and alarms was emphasized, facilitating seamless integration between different systems and platforms, thereby enhancing interoperability.

WG2 noted that streamlined communication and response mechanisms would increase the efficiency of maritime operations by reducing manual processes and enabling faster responses to critical situations.

Furthermore, the system is expected to improve safety by providing real-time alerts and alarms, prompting timely human action to ensure more effective handling of potential risks.

WG2 recognized that the framework should be designed to ensure interoperability within S-100 ecosystem in general while also being user-friendly, allowing machine-readable data to be smoothly integrated into certain type of maritime systems, reporting and administrative task to trigger by action point on monitored route. However, it was suggested to investigate further considering protentional candidate systems such as planning station, monitoring systems and/or third box. WG2 recommended that the IHO consider these options in future developments.

8.9 Address and resolve any outstanding questions regarding standard S-124.

During the working group session, WG2 did not identify any significant issues with the S-124 Product Specification. However, it was recommended that any comments or suggestions be submitted the S-124PS development group for their consideration.

8.10 Consider if AIS AtoN will have S-101, S-124, S-125 symbology or use existing IEC62288 symbology? Will S-124 and S-125 develop same/different symbology for non-ENC displays, i.e. radar?

WG2 reviewed the symbology of AIS AtoN from IMO, IEC 62288, and ENC, and discussed whether the symbology for AtoN should follow a uniform shape. WG2 acknowledged the need for further discussions, considering demonstrations from various use cases.

WG2 recommends that the IHO retain the current S-124 symbol but enhance it with cartographic markup symbols. For S-125, efforts should be made to align it with the IMO Circular letter 243 - AIS AtoN as much as applicable. Meanwhile, the S-101 symbol will remain unchanged during the dual-fuel period.

8.11 Other considerations

None.

Annex A: IHO/IALA Recommendation

Introduction

During the proceedings of the 2nd Joint IALA/IHO Workshop on S-100/S-200, Working Group 2 identified and recommended the need for a federated identity management and service discovery solution to support future maritime services. This is necessary for future e-Navigation services to be realized between the relevant authorities, but also allowing secure bi-directional data communication between shore and the ECDIS.

Description of the Problem

A suitable platform that is able to provide the aforementioned benefits, is the Maritime Connectivity Platform (MCP), recently endorsed by IALA. Up to this point however, there is no internationally recognized test-bed implementation which can be used utilized by both IALA and IHO member states, as well as equipment manufacturers, to facilitate the development and testing of new S-100 services or assess the compliance the necessary equipment.

Proposal

The [Member State] invites [IALA/IHO] to consider the relevant MCP documentation, as provided by IALA, such as G-1161 and G-1183. In addition [IALA/IHO] is invited to establish and maintain, for the purposes of further development and testing, a reference instance of the MCP platform.

The prototype of the reference implementation of the MCP platform is completely opensource and free to use and can be found in the relevant Github repositories:

https://github.com/maritimeconnectivity

The MCP platform has been developed and is governed by the Maritime Connectivity Platform Consortium (MCC). A public demonstrator environment is already made available, hosted by members of the MCC.

The most direct deployment method is the Kubernetes Helm script available in this online location:

https://artifacthub.io/packages/helm/mcp-charts/mcp

This software has been developed by the Digital Incubator Initiative and is currently maintained by the GLA Research & Development Directorate (GRAD). Any alternative methodology and/or implementation, however, can be utilized, as long as it conforms to the relevant IALA guidelines.

ANNEX F WG3 - TRAINING

Co-Chairs – Heather Gilbert and Ed Kuwalek

Around 15 participants were welcomed to WG3.

The outcomes worked towards by WG3 were:

- Present and discuss pilot IALA S-200 courses, review and document observations.
- Identify training gaps in the S-100 starter course for both external (mariners/users) and internal (Hydrographic Offices and AtoN authorities) audiences in preparation of a submission for IMO MSC.
- Identify and document technical training gaps within the S-100 infrastructure that may need to be addressed by the IHO and IALA, for both external (mariners/users) and internal (Hydrographic Offices and AtoN authorities) audiences.
- Review and provide recommendations for amendment of relevant IALA and IHO documentation to determine the technical knowledge requirements for managers.

The WG considerations and conclusions for each of these outcomes are addressed below.

8.12 Present and discuss pilot IALA S-200 courses, review and document observations.

Recommendations:

- **Means of delivery, and duration and regularity of training to be determined based on target audience. Recommend target audience is:**
    - **Implementors**
        - **Software Developers of data production systems**
        - **Product Specification Developers**
    - **Data production specialists**
        - **AtoN managers**
        - **VTS Authorities**
    - **System integrators/administrators (those that are responsible for managing the system and infrastructure)**
    - **Stakeholder Executives (ex. National Level policy makers) – brief to the point, awareness of benefits – time, cost, etc.**
    - **End Users**
- **Develop S-100 AND S-200 foundation training that is intended for general awareness of the standards that targeting a wide audience that covers the broad subjects.**
- **Post foundational, specific targeted training hosted for different modules with the duration of training TBD (to be informed by examples of existing training course lengths)**
- **Training should be available in multiple languages.**

8.13 Identify training gaps in the S-100 starter course for both external (mariners/users) and internal (Hydrographic Offices and AtoN authorities) audiences in preparation of a submission for IMO MSC.

Recommendations:

- **S-100 Training materials developed so far influence by market place demand, vs based on curriculum established by IALA and IHO**

- Add that any end users involved in using S-100 data, they undergo foundation training of S-100 and whatever scope of the training is still TBD
- The prioritization is in the training to support the production and product support developers
- Make sure hydro offices are encouraging schools to take up this training
    - Integrate at the university level, pre level courses

- Recommend to IMO HTW to refine the wording of STCW training requirement and include transition training to ECDIS (to include ECDIS, MSI and NAEST training)
- Consider the full range of delivery methods – face to face, web based, etc.– and work to make the training engaging.

8.14 Identify and document technical training gaps within the S-100 infrastructure that may need to be addressed by the IHO and IALA, for both external (mariners/users) and internal (Hydrographic Offices and AtoN authorities) audiences.

Recommendations:

- Develop comprehensive training materials related to all S-100 infrastructure components for product specification development and make them available to IALA and all member states.
    - IHO S-100 infrastructure consists of S-100 standard toolkit which includes feature catalogue builder, portrayal catalogue builders, and DCEG composer. The IHO resources which effectively links all S-100 products specifications and product packages available in the marketplace. The IHO Geospatial Registry and S-164 Infrastructure for ECDIS test and type approval.
    - What training is required for the infrastructure components – predominately the toolkit; ECDIS approval security and S-164; registry is all to a general degree.
    - Very little training related to most of the infrastructure pieces. Some of the infrastructure components do not need external training as they are being manged by FTE but the external pieces do not have training materials.
- Use of portrayal/feature/DCEG catalogue Builders for product specification development to ensure consistency of resulting components.
- For product specifications it would be beneficial to have training courses for end-to-end development to IHO specifications. What does it take to form a team to have them develop a product specification would be highly desirable. There are key IHO and IALA deadlines that need to meet. This will make life easier for ECDIS developers later on.
- Recommend IHO inform S-100 community/stakeholders (ex. domain control body) of infrastructure updates – establish some sort of communication mechanism to issue notices.

8.15 Review and provide recommendations for amendment of relevant IALA and IHO documentation to determine the technical knowledge requirements for managers.

Recommendations:

- Upon review of relevant IALA and IHO documentation (as listed above) the WG documents are reviewed and updated to align with S-100 ed. 5.2 or superseding editions.
- Review and update S-5 and S-8 training curriculums to include proper S-100 coverage, and review whether 'nautical cartographer' is still the applicable term for the user/operator.
- Review and update IALA Level 1 manager course to include proper S-100 and S-200.

- **Develop data production development guidance for each product specification to empower all data production managers/data production teams. Examples include developing standard operating procedure, and best practices on how to roll-out training.**

WG Conclusions

- The need to identify the knowledge gaps of S-100 (S-100 itself and the forthcoming changes) within the maritime community prior to training to ensure those knowledge gaps are addressed.
- Utilize an informal process (multimedia, trade press, social media) vs the normal process of NTM?
- Coordinated communication and marketing from IALA and IHO – what S-100 is and what it brings to the table. A single story.
- Recommend to IMO HTW to refine the wording of STCW training requirement and include transition training to ECDIS (to include ECDIS, MSI and NAEST training)
- Technical knowledge and software knowledge are key components that needs to be trained across the entire stakeholder community, this is paramount to the entire S-100 rollout and production.
- Significant training gaps were identified in technical training amongst different users groups.
- There is need to define the different user groups across the entire maritime community.
- (Proposed User Groups -- Implementors; Software Developers of data production systems (Product Specification Developers, Data production specialists; AtoN managers, VTS Authorities; System integrators/administrators (those that are responsible for managing the system and infrastructure); Stakeholder Executives (ex. National Level policy makers) and End Users.
- Training courses need to be tailored to the specific user groups, while factoring in delivery methods, ensuring the training materials stay current as the standards and product specifications evolve.
- Ex. Shorter courses for executive/high-level; Longer courses for developers – but also built upon the prior required training as those taking the training need to understand all the elements of the specifications.
- Need to work with the overarching organizations, but equally with the Member States as they are the ones that have the most influence at IMO, IHO and IALA (ex. IHO is observer at IMO, while Members States have voting rights)
- Need to empower and support product specification developers in the implementation of remaining IHO (100 series), IALA (200 series), IEHG and WMO (400 series) and NATO (500 series) product specifications as many of them are still under active development and it would be beneficial to get them completed as soon as possible.
- Training should be available in multiple languages to make it inclusive to all member states.

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International Organization of Marine Aids to Navigation