



3rd Joint IHO/IALA Workshop on S-100/S-200

WORKSHOP REPORT 1 to 4 September 2026 Istanbul, Türkiye

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International Organization for Marine Aids to Navigation

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Report of the 3rd Joint IALA/IHO workshop on S-100/200

Executive Summary

The 3rd joint IALA/IHO workshop on S-100/200 development and portrayal was held between the 1 and 4 September 2026 at the InterContinental Hotel in Istanbul, Türkiye.

The workshop was well attended with 70 participants from 22 countries.

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

- The implementation and operational phase of S-100 and S-200 is underway. As a result, there is a need for increased collaboration, potentially through an annual event involving IALA, IHO and their members to support this phase.
- Future IHO/IALA meetings should consider the provisions of SOLAS relating to carriage requirements for nautical publications, including the List of Lights.

Operations

- Validation procedures should be developed for all Product Specifications (PS). Service providers should consider using data confidence qualifications, such as CATZOC, to describe data quality. Methods for validating manually entered data should be included within these procedures.
- Product Specifications require routine maintenance to ensure continued interoperability. Member States should consult IHO C-615 and relevant IALA Guidelines for Product Specification maintenance advice and best practices.
- When referring to AtoN, the AtoN MRN should be used across domains to avoid confusion and potential negative impacts on S-124 and S-125.
- S-201 and S-125 remain misaligned with S-101 and require further alignment.
- The S-101 Product Specification has reached a mature state and should not be reopened to support the development of S-201 and S-125 Product Specifications. IALA should coordinate with IHO after 2030 regarding any new recommendations relating to AtoN within the S-101 Product Specification.
- Workflows between AtoN Authorities and Hydrographic Offices for the exchange of S-201 data should be agreed at the national level.
- The requirement for two types of AIS AtoN portrayal remains necessary.
- The future of the List of Lights remains unclear. Further consideration of the role of this nautical publication is required within the AtoN and hydrographic communities.
- It was noted that IHO NIPWG has drafted a description of the relationship between S-101, S-201, S-124 and S-125. The draft should be further developed at the next NIPWG meeting.

Technical

- The S-100 framework is now being applied beyond the traditional IHO ENC/ECDIS environment. The framework does not adequately support streaming, real-time and service-based data exchange, or message-based services such as S-210, S-212 and S-421. Further IHO-IALA discussion is recommended on how such services, and other non-ECDIS applications, fit within the S-100 framework and how interoperability should be addressed and reflected in S-97, S-98 and/or S-100. Working Group 2 requested that the IALA VTS Committee prepare an Information Paper on S-210 and S-212, detailing the issues for consideration at the IHO S-100 Test Strategy Meeting in March 2027, in order to initiate cross-organisational dialogue that can be taken forward within the S-100 Working Group.

- The relationship between IHO and IALA Maritime Connectivity Platform instances remains unresolved. It was noted that IALA is currently undertaking a feasibility study on the MCP concept. Multiple interoperable trust domains could improve resilience, but certificate governance, mutual recognition, revocation, liability and organisational responsibilities require agreement. Certificate interoperability is primarily a governance challenge rather than a purely technical one.
- The Working Group identified a need for stronger schema quality assurance and business rule validation, noting that S-100 schemas can allow semantically invalid data to pass basic validation. The IHO Infrastructure Centre aims to provide support in this area.
- AtoN authorities, particularly smaller organisations, require clearer guidance and shared tools for producing, validating and distributing S-201 and S-125 data. RENCs, or similar intermediary organisations, may be able to provide S-125 validation, quality assurance and distribution support where individual authorities lack the necessary infrastructure or expertise.
- Working Group 2 discussed the development, ownership and approval of Technical Service Specifications. It was recommended that S-100 Part 14 be updated and aligned with IALA Guideline G1128 to provide practical guidance for modern service-based implementations. IHO requires a clear process for the approval, publication and maintenance of Technical Service Specifications, with appropriate references to IALA Guideline G1128 and related IALA documents. IHO will add a link to IALA Technical Services within the GI Registry.
- Validation (S-258) should combine standardised S-100 and product-specific checks with additional national or organisational rules where required.

Training

- Greater emphasis should be placed on training at future Joint Workshops. The Training Working Group requires representation from all stakeholder groups, including IHO, IALA and industry.
- There remains a lack of awareness of available S-100 and S-200 training and knowledge-sharing resources. Information explaining what training is available, why it is important and where it can be accessed is required for all users.
- Core courses should not be tailored to specific roles, as there are too many to address individually. Instead, different levels of training should be established: Base (fundamental), General (intermediate) and Super (advanced/technical).
- Existing courses and training materials, including those developed by UKHO, PRIMAR and others, should be reviewed. Consideration should be given to cooperation agreements that support information sharing. Consideration should also be given to the development of simulator tools for educational purposes and to promoting the benefits of S-100 to end users.
- There is a need to ensure that senior leadership across stakeholder organisations has access to the information required to support the transition to S-100 and S-200.

Contents

Executive Summary	3
1. Introduction	8
2. Session 1 – Opening of the Workshop	8
2.1 Welcome from Directorate General of Coastal Safety, Serhat Aytugel – Deputy Director General, Türkiye	8
2.2 Welcome from IALA, Omar Eriksson – Deputy Secretary-General	8
2.3 Welcome from IHO, Yong Baek - Assistant Director	9
2.4 Administration and safety briefing, Selay Turan – Directorate General of Coastal Safety	9
2.5 Technical program for the week and expectations, Guttorm Tomren – IALA ARM Chair	9
2.6 Report IALA, Minsu Jeon – Technical Operations Director	9
2.7 Report IHO, Nathalie Leidinger – IHO HSSC Vice Chair	10
3. Session 2 – Alignment of international standards	10
3.1 IHO - work on S-100 and product specifications - Stefan Engström – IHO NIPWG Chair, Finland	10
3.2 IALA AtoN work (S-201) - Sewoong Oh – KRISO, Republic of Korea	11
3.3 Development of S-212: When S-100 meets technical services and secure data exchange to support VTS operations - Wim Smets - Technical Manager, Flemish Agency for Maritime and Coastal Services (MDK), Belgium	11
3.4 Updates from IMO regarding S-100 implementation and the S-100 capable ECDIS - Cafer Ozkan Istanbulu - Technical Officer, IMO	11
3.5 IEC 61174 IEC 62288, ECDIS Standards - Antti Kukkonen – IEC, Furuno	12
4. Session 3 – Operational data domain	12
4.1 Data modelling, maintenance and production workflows: From IALA S-201 to IHO S-101 - Stefan Engström - IHO	12
4.2 S-125 Progress and Interoperability Update - Caroline Johansson – IHO S-125 Task Lead, Sweden	12
4.3 Status of S-98 Ed.3.0.0 and its next phase, Ed Kuwalek – IIC	13
4.4 Training to support operational implementation - Vincent Denamur, IALA WWA Dean	13
5. Session 4 – Data Quality and Validation	13
5.1 Quality assurance process of machine-readable IHO standard -Yong Baek - IHO	13
5.2 PRIMAR Services and S-100 Validation - Svein Skjæveland – ECC/PRIMAR	14
5.3 Development of the IALA S-201 Validation Rules - Sewoong Oh – KRISO	14
5.4 Data Quality and Validation in the Transition to S-100 Su Marks – IC-ENC	14
6. Session 5 – Secure exchange	14
6.1 Cybersecurity internal & Cyber Hygiene external, Alison Contreras – UKHO	14
6.2 IMO guideline on IP delivery (available methods), Caroline Johansson – IHO S-125 Task Lead, Sweden	15
6.3 S-100 Infrastructure Centre (MCP/SECOM), Yong Baek – IHO	15

6.4	Application Process for IHO Security Scheme and SECOM Service Test, Yong Baek – IHO	15
7.	Session 6 – Experience and use cases	16
7.1	Implementation US S-101/201 S-124/125, Dave Lewald – USCG	16
7.2	Implementation S-124, Ed Stacey - S-124 Project Chair, NGA, US	16
7.3	First implementations of S-100-200 digital services in Finland, Juho Pitkänen - Head of Digital Services, Fintraffic, Finland	16
7.4	Lessons learned from seven IHO S-100 Sea Trials Areas, Nathalie Leidinger – SHOM, France	17
8.	Establish Working Groups	17
8.1	WG1 - Operational	17
8.1.1	Executive Summary	17
8.2	WG2 - Technical	18
8.2.1	Executive Summary	18
8.3	WG3 Training	18
8.3.1	Executive summary	18
9.	Workshop conclusions	19
9.1	Review workshop report	20
9.2	Closing of the workshop – Omar Eriksson – IALA Deputy Secretary-General, Yong Baek – IHO, Serhat Aytugel - Directorate General of Coastal Safety, Türkiye	21
10.	Social events and technical visit	21
10.1	Workshop icebreaker - Intercontinental Hotel Istanbul	21
10.2	Workshop dinner at Fener Balık Lokantası	21
10.3	Technical visit - Bosphorus Tour	21
11.	DAY 1 – Tuesday, 1st September 2026	26
12.	DAY 2 – Wednesday, 2nd September 2026	26
13.	DAY 3 – Thursday, 3rd September 2026	27
14.	DAY 4 – Friday, 4th September 2026	27
	Working Groups	28
	Working Group Objectives	28
	Working Group 1 – Operational	28
	Working Group 2 – Technical	28
	Working Group 3 – Training	28
	Working Methods	29
	Outputs	29
	Reporting Back	29
15.	1. Key Findings and Observations	31
3.	Recommendations	31
4.	Proposed Actions or Tasks	31
5.	Headline Points	32
1.	Key Findings and Observations	33

2. Identified Gaps, Challenges or Issues 33

3. Recommendations..... 34

4. Proposed Actions or Tasks..... 35

5. Headline Points..... 36

6. Additional Notes 36

1. Key Findings and Observations..... 38

2. Identified Gaps, Challenges or Issues 38

3. Recommendations..... 38

4. Proposed Actions or Tasks..... 39

5. Headline Points..... 39

6. Additional Notes 39

Report of the 3rd joint IALA/IHO workshop on S-100/200

1. INTRODUCTION

The 3rd joint IALA/IHO workshop on S-100/200 was held between the 1 and 4 September 2026 at the InterContinental Hotel in Istanbul, Türkiye.

70 participants from 22 countries participated in the Workshop including six members of the Secretariat.



2. SESSION 1 – OPENING OF THE WORKSHOP

This session was chaired by Guttorm Tomren, Chair of the Workshop. The Secretary was Thomas Southall and the logistics for the event were organized by Selay Turan and Ahmet Oztekin of the Directorate General of Coastal Safety, Türkiye. The event was kindly sponsored by ASELSAN and HAVELSON.

2.1 Welcome from Directorate General of Coastal Safety, Serhat Aytugel – Deputy Director General, Türkiye

Serhat Aytugel welcomed participants to Istanbul and the Third Joint IHO/IALA Workshop. He highlighted the significance of the Istanbul Strait as a major international waterway and noted the role of maritime pilots, VTS and marine aids to navigation in supporting the safe and efficient movement of vessels through the area.

He noted the progress made since the previous Joint IHO/IALA Workshop and described the event as an opportunity to advance cooperation between the hydrographic and aids to navigation communities. The presentation emphasised the role of digital transformation in supporting maritime safety, resilience and cooperation.

Serhat Aytugel thanked IHO, IALA, the organisers and participants for their contribution to the workshop and formally declared the workshop open.

2.2 Welcome from IALA, Omar Eriksson – Deputy Secretary-General

Omar Eriksson, Deputy Secretary-General of IALA, welcomed participants to the Third Joint IHO/IALA Workshop on S-100 and S-200 implementation and thanked the Directorate General of Coastal Safety of Türkiye for hosting the event.

He emphasised the increasing integration of hydrographic information, aids to navigation, vessel traffic services and other digital maritime services within a connected maritime environment. He noted that the S-100 framework provides the foundation for this integration and highlighted the close cooperation between IALA and IHO in developing internationally harmonised standards that support the delivery of interoperable maritime services.

The Deputy Secretary-General stated that the implementation of S-100 and the associated S-200 standards represents a significant step towards a more connected maritime information environment, enabling data to be shared and utilised across multiple applications. He noted that this transformation is intended to enhance safety of navigation, improve operational efficiency, support sustainability and enable better decision-making throughout the maritime domain.

He highlighted that successful implementation requires cooperation between hydrographic offices, aids to navigation authorities, vessel traffic service providers, industry, regulators and training organisations. He noted that the workshop provided an opportunity to examine operational, technical and training aspects of implementation through presentations, discussion and working group activities.

He encouraged participants to actively share experience and lessons learned during the workshop. He identified interoperability, operational effectiveness and capacity building as key challenges that will require continued cooperation as implementation of S-100-based services progresses and reaffirmed IALA's commitment to working with IHO, IMO, national administrations and other stakeholders to support the safe, efficient and interoperable delivery of digital maritime services..

2.3 Welcome from IHO, Yong Baek - Assistant Director

Yong Baek welcomed participants to the Third Joint IHO/IALA Workshop on S-100/S-200 and thanked IALA and the Directorate General of Coastal Safety of Türkiye for hosting the event.

He reflected on the progression of the joint workshop series, noting that early discussions had focused on concepts and future possibilities, while attention has increasingly shifted towards implementation, interoperability and operational experience. Yong Baek highlighted the cooperation between IHO and IALA in developing the S-100 and S-200 frameworks and noted the importance of ensuring that maritime information can be used together effectively within the wider digital maritime environment.

The presentation highlighted the transition towards S-100-based ECDIS implementation and the increasing importance of issues including data quality, validation, secure exchange, interoperability, portrayal, equipment, training and user experience. Yong Baek encouraged participants to share implementation experience and lessons learned to support the continued development and operational use of S-100 and S-200 standards.

2.4 Administration and safety briefing, Selay Turan – Directorate General of Coastal Safety

Selay Turan 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, Guttorm Tomren – IALA ARM Chair

Guttorm Tomren, Chair of the ARM Committee and Norwegian Coastal Administration, introduced the programme for the week (Annex B).

2.6 Report IALA, Minsu Jeon – Technical Operations Director

Minsu Jeon provided an update on developments within IALA following its transition from an association to an intergovernmental organisation on 22 August 2024. He noted the approval of the IHO–IALA Cooperation Agreement.

The presentation reviewed IALA's role as an IHO Submitting Organization and Domain Control Body for the S-200 series of product specifications. The IALA domain covers Marine Aids to Navigation, VTS, communication systems, AIS/ASM/VDES and positioning systems.

He then provided an update on the status of S-200 development activities. This included ongoing work on S-201, S-210 and S-212, approval of S-125 Edition 1.0.0 at HSSC18, introduction of S-258 validation rules for IALA product specifications and initial development of the new S-241 and S-242 PNT product specifications.

The presentation also highlighted development of the IALA S-200 Test and Validation Tool (SIREN), updates to technical service specifications, and delivery of S-200 training and capacity-building activities during 2026.

2.7 Report IHO, Nathalie Leidinger – IHO HSSC Vice Chair

Nathalie Leidinger provided an update on IHO activities supporting the transition from the development of S-100 standards to their operational implementation. The presentation highlighted the increasing importance of S-100 within the Organisation's strategic objectives for digital navigation and outlined the role of IHO in developing and maintaining international hydrographic standards.

The presentation identified 2026 as a significant milestone in implementation. The revised IMO ECDIS Performance Standards permit the voluntary use of S-100-capable ECDIS from 1 January 2026, with mandatory compliance for new installations from 1 January 2029. This transition will expand ECDIS from an ENC-centric environment towards an ecosystem of interoperable S-100 data layers, with S-101 ENC remaining the primary navigational layer.

An overview was provided of the status of key S-100 Product Specifications, including operational Phase 1 products and recent endorsements and approvals. It was noted that implementation activities are increasingly focused on interoperability, validation, type approval, operational testing and sea trials involving hydrographic offices, equipment manufacturers, distributors and mariners.

The presentation also highlighted the challenge of providing reliable and timely distribution of increasingly dynamic S-100 data. Current work within IMO and IHO is examining trusted IP-based connectivity and supporting infrastructure to enable the effective delivery of future digital maritime services. The period from 2026 to 2029 was identified as marking the transition from technical readiness to coordinated operational deployment of the S-100 ecosystem.

3. SESSION 2 – ALIGNMENT OF INTERNATIONAL STANDARDS

This session was chaired by Nathalie Leidinger – SHOM, France.

3.1 IHO - work on S-100 and product specifications - Stefan Engström – IHO NIPWG Chair, Finland

Stefan Engström, Chair of the IHO NIPWG, presented an overview of current IHO activities relating to the development and maintenance of the S-100 framework and associated product specifications. He noted that increasing attention is being given not only to individual product specifications, but also to the broader operational ecosystem required to support their implementation, including interoperability, testing, validation and supporting infrastructure.

He outlined ongoing work to support the introduction of the first generation of S-100 ECDIS, while continuing the development of future editions of the S-100 framework. He described efforts to establish interoperability, validation and testing arrangements to ensure that S-100 products can operate together effectively within the ECDIS environment.

The presentation also addressed developments relating to the Electronic Navigational Data Service (ENDS) concept and the role of S-128 in supporting product catalogues and data completeness checking. Stefan noted that work continues on implementation guidance and service-related use cases to support the effective management and delivery of S-100 products.

Updates were provided on a number of IHO product specifications, including S-101, S-102, S-104, S-111 and S-129, which together form the initial operational navigation data stack. Progress was also reported on

publication-related product specifications, including S-122, S-123, S-127 and S-131, as well as on S-124 Navigational Warnings and S-125 Navigational Services and Aids to Navigation Information. He highlighted the importance of test data, interoperability testing and cross-product guidance to support consistent implementation across the S-100 framework.

In concluding, Stefan emphasised the need to develop specifications, services and end-user systems as parts of a coherent operational ecosystem and encouraged continued cooperation between IHO and IALA in addressing implementation challenges and supporting the transition to S-100-based maritime services.

3.2 IALA AtoN work (S-201) - Sewoong Oh – KRISO, Republic of Korea

Sewoong Oh, Korea Research Institute of Ships and Ocean Engineering (KRISO), provided an update on ongoing work within the IALA ARM Committee relating to the maintenance and development of the S-201 Aids to Navigation Product Specification. He reported that discussions had focused on updates to the product specification and the development of data validation requirements aligned with the IHO S-158 Validation Checks standard.

As part of this work, a draft set of validation rules for S-158:S-201 had been developed to support the quality assurance of AtoN datasets within the IHO S-100 validation framework. The proposed validation rules are intended to provide a consistent approach to verifying the accuracy and integrity of S-201 data.

He also presented the IALA S-201 Test and Validation Tool, which has been developed to support testing and implementation activities. The tool is being used to validate S-201 datasets and assess the effectiveness of the proposed validation rules.

The presentation reviewed the outcomes of validation rule development activities, including verification results obtained through use of the validation tool and lessons identified during IALA World-Wide Academy S-200 training courses. These findings are intended to support the further refinement and implementation of the S-201 validation framework.

3.3 Development of S-212: When S-100 meets technical services and secure data exchange to support VTS operations - Wim Smets - Technical Manager, Flemish Agency for Maritime and Coastal Services (MDK), Belgium

Wim Smets presented an overview of the development of S-212 and its role in supporting digital technical services for VTS within the S-100 and S-200 framework. He explained that, unlike many S-100 product specifications that focus on the standardised exchange and portrayal of maritime information, S-212 has been developed to support operational information exchange required for VTS services. The current data model supports the Traffic Clearance Service, Under Keel Clearance Service, VTS Information Service, VTS Reporting Service and VTS Navigation Support Service.

The presentation reviewed the evolution of S-212 and the challenges encountered when applying the S-100 framework to near real-time, bidirectional communications between ships and VTS centres. Wim Smets highlighted that operational services require rapid information exchange, acknowledgements, status updates and other interactions between ship and shore systems. As a result, certain design principles commonly used in other S-100 product specifications are not always suitable for operational service delivery and may require alternative approaches.

Particular attention was given to cybersecurity and the need to establish trust in ship-shore communications. The presentation examined secure data exchange requirements, including authentication, integrity protection and the reliable delivery of safety-critical information. Wim Smets concluded by highlighting lessons learned from the ongoing development of S-212 and their relevance for the future alignment and implementation of international maritime standards supporting digital maritime services.

3.4 Updates from IMO regarding S-100 implementation and the S-100 capable ECDIS - Cafer Ozkan Istanbulu - Technical Officer, IMO

Cafer Ozkan Istanbulu provided an overview of recent developments within the IMO regulatory framework supporting the implementation of S-100 data products at sea. The presentation highlighted the role of e-
[Report of the 3rd Joint IALA/IHO workshop on S-100/200](#)

navigation in establishing a harmonised digital infrastructure for the collection, exchange and use of maritime information to enhance safety, security and environmental protection. Within this framework, the IHO S-100 standard was identified as a key enabler for future digital maritime services.

The presentation focused on the introduction of S-100 capability within ECDIS. It was noted that, from 1 January 2029, S-100-capable ECDIS will become a mandatory carriage requirement for certain types and sizes of ships engaged on international voyages. This development represents an important step in the transition towards the operational use of S-100-based products and services.

He also outlined ongoing work to establish an IP-based connectivity framework to support the real-time exchange of S-100 data between ships and shore authorities. Particular attention was given to the exchange of digital route plans through S-421, which is expected to support safer navigation, improved voyage planning and compliance with environmental requirements.

The presentation concluded with an overview of the actions required by IMO, international organisations, maritime administrations and industry to support the effective implementation of S-100 data products. Continued coordination between stakeholders was identified as essential to achieving a smooth, successful and timely transition to the future S-100 operational environment.

3.5 IEC 61174 IEC 62288, ECDIS Standards - Antti Kukkonen – IEC, Furuno

Antti Kukkonen provided an update on the IEC standards supporting the implementation of S-100-capable ECDIS. He explained that IEC Technical Committee 80 (TC 80) develops and maintains standards used for the type approval of maritime navigation and radiocommunication equipment required to comply with IMO performance standards, IHO publications and ITU recommendations.

The presentation reviewed the ongoing revision of key standards related to S-100 implementation, including IEC 61174 for ECDIS, IEC 63173-1 for S-421 route plans and IEC 63173-2 for the Secure Exchange of Maritime Information (SECOM). These revisions are intended to support the requirements contained in IMO MSC.530(106)/Rev.1 and the relevant IHO S-100 product specifications, which will apply to new ECDIS installations from 1 January 2029. The revised standards will also provide mechanisms for the exchange of route plans between ECDIS and SECOM terminals, supporting route exchange between ship and shore.

Antti Kukkonen noted that the revised standards are expected to be published in 2027, enabling their incorporation into national regulatory frameworks during 2028. He also highlighted the continued importance of the IEC 61162 series for ensuring interoperability between onboard systems and providing cybersecurity requirements for navigation and radiocommunication equipment.

The presentation further examined IEC 62288, which specifies the presentation of navigation-related information on shipborne navigational displays. Antti Kukkonen noted that the current edition, published in 2021, is based on multiple IMO resolutions and circulars and is referenced by numerous IEC standards, demonstrating its importance in supporting both regulatory requirements and evolving operational needs within the maritime sector.

4. SESSION 3 – OPERATIONAL DATA DOMAIN

This session was chaired by Dave Lewald - USCG.

4.1 Data modelling, maintenance and production workflows: From IALA S-201 to IHO S-101 - Stefan Engström - IHO

Stefan Engström presented work relating to the use of IALA S-201 data as a source for the production of IHO S-101 datasets. The presentation focused on the associated requirements for data modelling, production processes and maintenance workflows.

He described considerations relating to the use of S-201 source data within S-101 production workflows and outlined the data management requirements necessary to support this approach.

4.2 S-125 Progress and Interoperability Update - Caroline Johansson – IHO S-125 Task Lead, Sweden

Report of the 3rd Joint IALA/IHO workshop on S-100/200

Caroline Johansson provided an update on progress made within the S-125 Task Group since the 2024 Joint IHO/IALA Workshop. She reported that the respective roles of S-101, S-124, S-125 and S-201 had been carried forward, Maritime Resource Names (MRNs) had been implemented in S-125 and five change types had been developed, with Proposed Change reassigned to Permanent Change. Alignment between S-125 and S-201 has been strengthened, although further work remains. Alerts and alarm filtering remain open issues, while the role of the List of Lights has been deferred.

The presentation introduced the new AtonStatusIndication feature type as an interim solution to support ECDIS portrayal while retaining the full S-125 data model. This approach allows status information to drive portrayal without obscuring S-101 information and was presented as a pragmatic first step rather than the final S-125 solution.

Caroline Johansson also outlined draft interoperability guidance describing the roles and relationships between S-101, S-124, S-125 and S-201, including six goal-based operational scenarios and the inclusion of S-128 within the delivery chain. It was noted that S-125 Edition 1.0.0 was approved at HSSC18, while the interoperability guidance was noted as a framework for further discussion and cross-product collaboration.

4.3 Status of S-98 Ed.3.0.0 and its next phase, Ed Kuwalek – IIC

Ed Kuwalek provided an update on the status of S-98 and interoperability within S-100 ECDIS. He reported that S-98 Edition 3.0.0 and S-164 Edition 2.0.0 have been approved by HSSC and will form the basis for mandatory type approval of ECDIS from 2029. S-98 specifies the mandatory requirements for implementation of S-100 ECDIS, which are tested through S-164.

The presentation reviewed the interoperability provisions currently included within S-98. It was noted that S-98 interoperability is distinct from the broader S-100 interoperability framework and currently supports the construction of enhanced safety contours from S-102, aggregation of S-102 and S-104 values, and the suppression and replacement of selected S-101 features using S-102 and S-104 data.

Ed Kuwalek highlighted that the original interoperability framework proposed in earlier editions of S-98 was withdrawn due to limited practical testing and integration challenges. He noted that further work is required before a more comprehensive interoperability capability can be incorporated into a future S-98 Edition 4.0.0.

4.4 Training to support operational implementation - Vincent Denamur, IALA WWA Dean

Vincent Denamur, Dean of the IALA World-Wide Academy, presented the development of the S-201 Data Production Course between 2024 and 2026 and described implementation and capacity-building activities undertaken in the Caribbean region. The presentation reviewed lessons identified through successive deliveries of the course, feedback from participants and consultations with technical experts and maritime administrations.

The Dean reported that the course had evolved from an initial focus on theory towards increased practical training, including use cases, dataset production exercises and validation activities. He also described capacity-building activities conducted in Santo Domingo and Veracruz during 2026, which examined implementation challenges associated with S-100 and S-200 standards.

The presentation concluded with observations from training and regional capacity-building activities, including the need for implementation roadmaps, clearly defined roles and responsibilities, practical production experience and continued follow-up activities to support implementation.

5. SESSION 4 – DATA QUALITY AND VALIDATION

This session was chaired by Guttorm Tomren.

5.1 Quality assurance process of machine-readable IHO standard -Yong Baek - IHO

Yong Baek presented draft quality assurance procedures for machine-readable S-100 components. The presentation reported on the establishment of the IHO Infrastructure Centre and the development of quality assurance procedures for feature catalogues, portrayal catalogues and GML schemas.

Report of the 3rd Joint IALA/IHO workshop on S-100/200

He explained that the procedures define review and validation processes for machine-readable components and are intended to support quality assurance activities associated with the implementation of S-100 standards. He noted that the procedures are being developed with input from multiple organisations and that some elements remain under development and refinement.

The presentation also highlighted the need to balance standardisation and flexibility within quality assurance processes and emphasised the importance of stakeholder feedback in the further development of the procedures.

5.2 PRIMAR Services and S-100 Validation - Svein Skjæveland – ECC/PRIMAR

Svein Skjæveland provided an update on PRIMAR activities supporting S-100 implementation. He explained that PRIMAR is developing services for the validation and dissemination of S-100 data and currently offers a range of validation services to its members.

The presentation highlighted that quality assurance and dissemination remain core elements of PRIMAR's operations. Particular emphasis was placed on the development of flexible and efficient solutions to support the quality assurance and distribution of rapidly changing S-100 data.

Svein also noted that PRIMAR considers the established RENC model to provide a basis for future cross-domain quality assurance and service provision within the evolving S-100 environment.

Further on, the presentation also raised the potential for facilitating RENC services for S-125 dissemination, as a first step towards investigating further the potential RENC value for the IALA domain.

5.3 Development of the IALA S-201 Validation Rules - Sewoong Oh – KRISO

Sewoong Oh provided an update on the development of validation rules for IALA S-201. The presentation noted that work on updating the S-201 Product Specification has been undertaken in parallel with a review of validation requirements based on the IHO S-158 Validation Checks standard. A draft set of S-258:201 validation rules has been prepared to support the quality assurance of AtoN information datasets within the IHO S-100 validation framework.

The presentation also introduced the IALA S-201 Test and Validation Tool, which has been developed to validate S-201 datasets and assess the proposed validation rules. Validation results obtained using the tool, together with lessons learned from IALA World-Wide Academy S-201 training courses, were presented to support further refinement and implementation of the S-201 validation framework.

5.4 Data Quality and Validation in the Transition to S-100 Su Marks – IC-ENC

Su Marks provided an overview of IC-ENC's activities supporting the implementation of S-100, with a particular focus on data quality, validation and readiness assessment. The presentation drew on IC-ENC's experience working with Hydrographic Offices, undertaking S-100 assessment and validation activities and developing supporting services.

The presentation highlighted the growing importance of validation processes as organisations transition towards operational S-100 production. Particular attention was given to the use of automated validation and analysis capabilities to identify data, metadata and catalogue issues before products are released to end users.

She also described the use of CATALOG.XML analysis within IC-ENC's Readiness Service to support implementation readiness assessment and improve data quality. The presentation concluded by sharing implementation experience and lessons learned from S-100 validation activities.

6. SESSION 5 – SECURE EXCHANGE

This session was chaired by Hamdi Erkan - ASELSAN, Türkiye.

6.1 Cybersecurity internal & Cyber Hygiene external, Alison Contreras – UKHO

Alison Contreras provided an overview of current IHO activities related to cyber security and the protection of digital navigational information. The presentation reviewed existing IHO standards, including S-63 and S-66, and outlined developments within S-100 Part 15, which defines mechanisms for encryption, authentication, digital signatures and key management for S-100 products.

The presentation also described the work of the IHO Security Scheme Project Team, which was established to support the administration and modernisation of the IHO security scheme. Current activities include the development of an online application process for scheme participants, new legal agreements, API-based delivery of security information and guidance supporting the implementation of S-100 Part 15.

She noted that increasing cyber security threats and developments in technology, including quantum computing, have highlighted the need for the continued evolution of IHO security measures. It was reported that the IHO Security Scheme Project Team has recommended, and Council has agreed, that HSSC establish an appropriate working group to review future IHO security measures and support updates to relevant standards.

6.2 IMO guideline on IP delivery (available methods), Caroline Johansson – IHO S-125 Task Lead, Sweden

Caroline Johansson, IHO S-125 Task Lead, presented the IMO guidance on data distribution and global IP-based connectivity between shore-based facilities and ships for ECDIS S-100 products. She outlined the components identified within the guidance, including communication bearers, Internet Protocol transport, service exchange, identity and trust arrangements, and service discovery mechanisms.

She highlighted several areas requiring further consideration, including ship-side connectivity performance standards, testing, identity and service registry governance, shore-side operational roles and human factors.

The presentation also reviewed possible IP-based connectivity methods, including satellite communications, VSAT, 4G/5G networks and VDES, and outlined proposed next steps relating to performance standards, governance arrangements, digital identities, trusted services and further testing.

6.3 S-100 Infrastructure Centre (MCP/SECOM), Yong Baek – IHO

Yong Baek provided an update on the establishment of the IHO Infrastructure Centre. He reported that the Centre was formally approved by the fourth session of the IHO Assembly in April 2026 and has been established to support the development, operation and management of IHO standardised products and associated services through a common infrastructure.

The presentation outlined the Centre's scope, which includes support for the S-100 standards framework, management of the IHO Geospatial Information Registry, support for S-100 product specification lifecycles, management of the IHO S-100 security scheme, support for navigation system type approval activities and support for secure S-100 data service distribution.

He noted that the Infrastructure Centre is located in Busan, Republic of Korea, and reported that the inauguration ceremony is scheduled for 10 November 2026.

6.4 Application Process for IHO Security Scheme and SECOM Service Test, Yong Baek – IHO

Yong Baek provided an overview of the IHO S-100 security scheme and the associated application process for data producers, data servers and equipment manufacturers. The presentation outlined the role of S-100 Part 15 in supporting piracy protection, selective access and authentication of S-100 products, and described the responsibilities of scheme participants within the security framework.

The presentation also reviewed the application process for participation in the IHO data protection scheme, including organisation registration, producer code allocation, maintenance of product coverage information and use of API services. It was noted that an online application process is planned.

He further reported on the IHO SECOM Service Test, which is intended to evaluate an IP-based service supporting SECOM prior to operational deployment. The testing programme includes Identity Register and Service Register functions and is designed to identify areas for improvement before implementation of a full-

[Report of the 3rd Joint IALA/IHO workshop on S-100/200](#)

scale service. Two test phases have been established. Phase 1, involving establishment of Service Register and Identity Register services using open-source MCP technology, has been initiated and was reported as operational since mid-April. Phase 2, involving integration with security scheme tools, is planned for the second half of 2026.

7. SESSION 6 – EXPERIENCE AND USE CASES

This session was chaired by Okan Kanyilmaz - ASELSAN, Türkiye.

7.1 Implementation US S-101/201 S-124/125, Dave Lewald – USCG

Dave Lewald presented an overview of the U.S. Coast Guard's implementation of S-100-based products and the resolution of key decisions during programme development. He reported that the initiative originated from discussions within the IALA ENAV Committee in 2012 and has since evolved into a U.S. Coast Guard programme of record.

Lewald noted that delivery of the S-124 product was achieved in February 2026. He also reported that S-201 services are expected to commence in early 2027, with S-125 services anticipated shortly thereafter.

7.2 Implementation S-124, Ed Stacey - S-124 Project Chair, NGA, US

Ed Stacey provided an update on the implementation of S-124 Navigational Warnings. He reported that S-124 Version 2.0.0 was adopted through IHO Circular Letter 31/2025 and that the S-124 Project Team continues to maintain the product specification and supporting guidance documentation under the oversight of the World-Wide Navigational Warning Service Sub-Committee (WWNWS-SC). He also noted that S-158:124 Version 1.0.0 validation checks had been submitted to WWNWS-SC and were expected to be submitted to HSSC19.

The presentation reviewed current implementation activities, including development of a Navigational Warning Technical Service Specification, participation in testbeds, liaison with related IHO groups and the ongoing review of proposed data model revisions.

He reported that WWNWS-SC has agreed implementation targets for S-124 services, with NAVAREAs aiming for 40% implementation by 2028, 70% by 2030 and 100% by 2032. Corresponding targets for EGC Coastal Warning Areas and NAVTEX coverage areas are 40% by 2029, 70% by 2031 and 100% by 2033. He also noted that the initial approach to S-124 promulgation will mirror existing NAVAREA and coastal warning procedures and that S-124 producers are expected to maintain consistency between S-53 and S-124 products during the transition period.

The presentation highlighted the introduction of S-158:124 validation checks, ongoing development of S-124 capacity development programmes, and the role of the IHO Infrastructure Centre and Security Scheme in supporting implementation. As of 25 August 2026, 53 entities held S-124 producer codes, comprising 42 official and 11 non-official producers.

7.3 First implementations of S-100-200 digital services in Finland, Juho Pitkänen - Head of Digital Services, Fintraffic, Finland

Juho Pitkänen presented the implementation of S-100/200-based digital services developed by Fintraffic and the Finnish Transport Infrastructure Agency (FTIA) through the EU Interreg MaDaMe project. The implemented services include Navigational Warnings (S-124), Aids to Navigation (S-125) and the VTS Traffic Clearance Service (S-212). Support for these services was implemented on top of an S-100 capable 7Cs ECS core, and the services were registered through Fintraffic's Maritime Connectivity Platform (MCP) for digital certificates and service discovery.

The presentation also described Fintraffic's implementation of a VTS Traffic Clearance Service based on the IALA service specification and SECOM design. It was noted that the service is registered through Fintraffic's MCP and that a separate user interface was developed to support testing because the current VTS system does not yet support the new digital services.

He reported on testing activities conducted in Finland during 2025, including simulator trials and onboard testing of S-124, S-125 and S-212 services. Technical testing included secure bi-directional information exchange using MCP and SECOM. The presentation reported that the digital Traffic Clearance Service functioned successfully during testing and that implementation experience was gathered from both mariners and VTS operators.

7.4 Lessons learned from seven IHO S-100 Sea Trials Areas, Nathalie Leidinger – SHOM, France

Nathalie Leidinger presented lessons identified through IHO S-100 Sea Trial Area initiatives and outlined the structured framework established by IHO to support sea trials. The framework includes minimum requirements, common assessment areas and a standardised reporting process intended to provide evidence-based feedback on standards, systems and implementation.

The presentation noted that sea trial activities have been conducted in several regions and assessed product specifications, data quality, system performance, user experience and operational impact.

Reported findings indicated that S-101 supports the transition from S-57, while the combination of S-102 and S-104 improves situational awareness and navigation planning. S-111 was reported to provide value in strong-current environments, S-124 improves situational awareness and reduces manual workload, and S-129 demonstrates potential for supporting decision-making in confined waters.

The presentation also identified several areas requiring further attention, including display readability, user interface design, metadata visibility, interoperability, connectivity, real-time data delivery and training. It was noted that successful operational deployment depends on an end-to-end ecosystem supporting data, services, integration and user interaction.

8. 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.

8.1 WG1 - Operational

The full working group report can be found in Annex D

8.1.1 Executive Summary

Working Group 1, co-chaired by Dave Lewald and Selay Turan, considered the operational interaction between S-101, S-124, S-125 and S-201, including portrayal, data exchange, validation, product maintenance and the future role of the List of Lights.

The Working Group concluded that validation procedures should be developed for all Product Specifications, including methods for validating information entered manually. It also identified a need to define confidence and data integrity levels for AtoN information. Product Specifications require routine maintenance to preserve interoperability, with IHO C-615 and relevant IALA guidance identified as sources of maintenance practice. The Working Group recommended that IALA consider developing corresponding guidance for its Product Specifications.

The Working Group agreed that the IALA AtoN Maritime Resource Name should be used across relevant domains, including within S-101 products, to provide consistent identification of AtoN. It also found that S-201 and S-125 remain misaligned with the current edition of S-101. The S-101 Product Specification should not be reopened to accommodate their development and further work should instead align S-201 and S-125 with the current S-101 edition. The workflow for exchanging S-201 data between AtoN authorities and hydrographic offices should be agreed at the national level.

The requirement for two forms of AIS AtoN portrayal was retained. The Working Group also noted continuing concern about portrayal and the potential for cluttered displays, which should be addressed through training and appropriate Product Specification layer development.

The future role of the List of Lights remained unresolved. The Working Group recommended that the AtoN and hydrographic communities consider its future use and that the subject be included on the agenda for the fourth joint workshop. IHO NIPWG had prepared draft guidance describing the relationship between S-101, S-201, S-124 and S-125 and was requested to develop it further and forward it to the ARM Committee for review.

The Working Group supported the continuation of the joint workshops and called for continued discussion within the relevant IHO and IALA committees and working groups to complete outstanding actions identified during the first three workshops. It also identified a continuing need for greater training and awareness of S-100.

8.2 WG2 - Technical

The full working group report can be found in Annex E

8.2.1 Executive Summary

Working Group 2, co-chaired by Alison Contreras and Sewoong Oh, considered technical issues relating to S-100 and S-200 implementation, including real-time services, technical service specifications, SECOM, the Maritime Connectivity Platform, cybersecurity, validation and the relationship between S-124, S-125 and S-201.

The Working Group found that the S-100 framework does not adequately address streaming, short-lived messages and bidirectional service interactions used by services such as S-210, S-212 and S-421. It recommended further IHO/IALA discussion on how these services and other non-ECDIS applications should be accommodated within the framework. The IALA VTS Committee was requested to prepare an information paper describing the issues for consideration at the IHO S-100 Test Strategy Meeting in March 2027.

The relationship between IHO and IALA Maritime Connectivity Platform instances remained unresolved. The Working Group noted that multiple interoperable trust domains could improve resilience, but that certificate governance, mutual recognition, renewal, revocation, liability and organisational responsibilities require agreement. Completion of the IALA Maritime Connectivity Platform feasibility study and development of an interoperable trust model were proposed as follow-up actions.

The Working Group also identified a need to improve schema quality assurance and business-rule validation. Shared tools and clearer guidance were considered necessary to support authorities producing and validating S-201 and S-125 data, particularly where authorities have limited resources or technical capacity. It was recommended that validation combine common S-100 and product-specific checks with additional national or organisational rules where required.

Technical service specification development, ownership and approval arrangements also require clarification. The Working Group recommended updating S-100 Part 14 and aligning it with IALA Guideline G1128 to provide practical guidance for service-based implementations. It also called for clear arrangements for the approval, publication, maintenance and version control of technical service specifications.

The Working Group noted that its discussions were exploratory and that many of the proposed actions, responsibilities and timelines had not been formally agreed.

8.3 WG3 Training

The full working group report can be found in Annex F

8.3.1 Executive summary

Working Group 3, co-chaired by Heather Gilbert and Ulla Møller, considered training requirements for the implementation of S-100 and S-200, including existing courses, differing levels of knowledge, access to materials and the information required by operational, technical and management audiences.

The Working Group identified a general lack of awareness of available S-100 and S-200 training and knowledge-sharing resources. It recommended that existing courses and materials be reviewed and brought together in a single, easily accessible location. Training should be simplified and standardised according to

[Report of the 3rd Joint IALA/IHO workshop on S-100/200](#)

the level of knowledge required rather than developed separately for every role. A three-level structure was proposed, comprising base or fundamental training, general or intermediate training and advanced technical training.

Access, cost and the time required away from normal duties were identified as barriers to training. The Working Group also noted the need to accommodate different languages and training cultures and to clarify whether training would be mandatory or optional and which organisations would determine the applicable requirements. It recognised that some training cannot be completed until the relevant S-100 and S-200 products, equipment and software systems have been fully implemented.

The Working Group recommended that initial activity focus on core S-100 and S-200 knowledge for all stakeholders, supported by harmonised materials and cooperation between IHO, IALA, industry and other training providers. It also recommended consideration of S-100 and S-200 within updates to STCW and continuation of the review of the IALA Level 1.1 AtoN Model Course, including its digital content. Senior management should be provided with the information needed to support the transition.

Greater participation from operational and technical specialists was considered necessary to inform future training development. The Working Group recommended that participants select their Working Group before future workshops and receive relevant material in advance. It also called for stronger representation in the Training Working Group from IHO, IALA, industry and the other bodies involved in implementation.

9. WORKSHOP CONCLUSIONS

- The implementation and operational phase of S-100 and S-200 is underway. As a result, there is a need for increased collaboration, potentially through an annual event involving IALA, IHO and their members to support this phase.
- Future IHO/IALA meetings should consider the provisions of SOLAS relating to carriage requirements for nautical publications, including the List of Lights.

Operations

- Validation procedures should be developed for all Product Specifications (PS). Service providers should consider using data confidence qualifications, such as CATZOC, to describe data quality. Methods for validating manually entered data should be included within these procedures.
- Product Specifications require routine maintenance to ensure continued interoperability. Member States should consult IHO C-615 and relevant IALA Guidelines for Product Specification maintenance advice and best practices.
- When referring to AtoN, the AtoN MRN should be used across domains to avoid confusion and potential negative impacts on S-124 and S-125.
- S-201 and S-125 remain misaligned with S-101 and require further alignment.
- The S-101 Product Specification has reached a mature state and should not be reopened to support the development of S-201 and S-125 Product Specifications. IALA should coordinate with IHO after 2030 regarding any new recommendations relating to AtoN within the S-101 Product Specification.
- Workflows between AtoN Authorities and Hydrographic Offices for the exchange of S-201 data should be agreed at the national level.
- The requirement for two types of AIS AtoN portrayal remains necessary.
- The future of the List of Lights remains unclear. Further consideration of the role of this nautical publication is required within the AtoN and hydrographic communities.
- It was noted that IHO NIPWG has drafted a description of the relationship between S-101, S-201, S-124 and S-125. The draft should be further developed at the next NIPWG meeting.

Technical

- The S-100 framework is now being applied beyond the traditional IHO ENC/ECDIS environment. The framework does not adequately support streaming, real-time and service-based data exchange, or message-based services such as S-210, S-212 and S-421. Further IHO-IALA discussion is recommended on how such services, and other non-ECDIS applications, fit within the S-100 framework and how interoperability should be addressed and reflected in S-97, S-98 and/or S-100. Working Group 2 requested that the IALA VTS Committee prepare an Information Paper on S-210 and S-212, detailing the issues for consideration at the IHO S-100 Test Strategy Meeting in March 2027, in order to initiate cross-organisational dialogue that can be taken forward within the S-100 Working Group.
- The relationship between IHO and IALA Maritime Connectivity Platform instances remains unresolved. It was noted that IALA is currently undertaking a feasibility study on operation of the MCP instance. Multiple interoperable trust domains could improve resilience, but certificate governance, mutual recognition, revocation, liability and organisational responsibilities require agreement. Certificate interoperability is primarily a governance challenge rather than a purely technical one.
- The Working Group identified a need for stronger schema quality assurance and business rule validation, noting that S-100 schemas can allow semantically invalid data to pass basic validation. The IHO Infrastructure Centre aims to provide support in this area.
- AtoN authorities, particularly smaller organisations, require clearer guidance and shared tools for producing, validating and distributing S-201 and S-125 data. RENCs, or similar intermediary organisations, may be able to provide validation, quality assurance and distribution support where individual authorities lack the necessary infrastructure or expertise.
- Working Group 2 discussed the development, ownership and approval of Technical Service Specifications. It was recommended that S-100 Part 14 be updated and aligned with IALA Guideline G1128 to provide practical guidance for modern service-based implementations. IHO requires a clear process for the approval, publication and maintenance of Technical Service Specifications, with appropriate references to IALA Guideline G1128 and related IALA documents. IHO will add a link to IALA Technical Services within the GI Registry.
- Validation (S-258) should combine standardised S-100 and product-specific checks with additional national or organisational rules where required.

Training

- Greater emphasis should be placed on training at future Joint Workshops. The Training Working Group requires representation from all stakeholder groups, including IHO, IALA and industry.
- There remains a lack of awareness of available S-100 and S-200 training and knowledge-sharing resources. Information explaining what training is available, why it is important and where it can be accessed is required for all users.
- Core courses should not be tailored to specific roles, as there are too many to address individually. Instead, different levels of training should be established: Base (fundamental), General (intermediate) and Super (advanced/technical).
- Existing courses and training materials, including those developed by UKHO, PRIMAR and others, should be reviewed. Consideration should be given to cooperation agreements that support information sharing. Consideration should also be given to the development of simulator tools for educational purposes and to promoting the benefits of S-100 to end users.
- There is a need to ensure that senior leadership across stakeholder organisations has access to the information required to support the transition to S-100 and S-200.

9.1 Review workshop report

The report was reviewed and agreed upon.

Report of the 3rd Joint IALA/IHO workshop on S-100/200

9.2 Closing of the workshop – Omar Eriksson – IALA Deputy Secretary-General, Yong Baek – IHO, Serhat Aytugel - Directorate General of Coastal Safety, Türkiye

Representatives of IALA, IHO and the Directorate General of Coastal Safety thanked the workshop organisers, hosts and participants for their commitment, contributions and active engagement throughout the workshop. They noted that the workshop had generated a number of important discussions and valuable outcomes that would help inform future work on the development and implementation of S-100 and S-200 standards.

On behalf of IALA, a gift was presented to the Directorate General of Coastal Safety in recognition of its support in hosting the workshop and its contribution to the success of the event.

The representatives reaffirmed the importance of continued cooperation between IALA, IHO, national administrations, industry and other stakeholders as implementation of S-100 and S-200 progresses. Participants were thanked for their contribution to the workshop and wished a safe journey home.

The Third Joint IHO/IALA Workshop on S-100/200 Development and Portrayal was then formally closed.

10. SOCIAL EVENTS AND TECHNICAL VISIT

10.1 Workshop icebreaker - Intercontinental Hotel Istanbul

A workshop icebreaker reception was held at the InterContinental Hotel on the evening of 1 September 2026. The event provided participants with an opportunity to meet informally, establish professional contacts and exchange views ahead of the technical programme. The gathering brought together representatives from IHO, IALA, national administrations, industry, academia and other stakeholders participating in the workshop.

10.2 Workshop dinner at Fener Balık Lokantası

A workshop dinner was hosted at Fener Lokantası, an old but characterful lighthouse, providing participants with an opportunity to continue discussions in an informal setting and strengthen professional relationships developed during the workshop. The event encouraged networking and exchange between representatives from the hydrographic, aids to navigation, vessel traffic services and maritime technology communities.

10.3 Technical visit - Bosphorus Tour

Participants took part in a technical visit and boat tour of the Bosphorus, travelling from central Istanbul through the Istanbul Strait towards the entrance to the Black Sea before returning to the city. The visit provided an opportunity to observe one of the world's busiest and most important waterways and to gain further appreciation of the operational environment that supports maritime navigation in the region.

The visit also enabled participants to view a number of historical and maritime sites along the Strait while continuing informal discussions on the implementation of S-100 and S-200 standards and services.

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ANNEX B TECHNICAL PROGRAMME

11. DAY 1 – Tuesday, 1st September 2026

Time	Topics	Chair or Speaker
08:30 – 09:30	Registration	
09:30 – 10:40	Session 1 – Opening and setting the scene	Chair: Guttorm Tomren, Chair of ARM Committee, NCA
10 mins	Welcome	Serhat Aytugel - Directorate General of Coastal Safety, Türkiye
10 mins	Welcome from IHO & IALA	Omar Eriksson - Deputy Secretary-General, IALA and Yong Baek - Assistant Director, IHO
5 mins	Administration and Safety Briefing	Selay Turan - Directorate General of Coastal Safety, Türkiye
5 mins	Technical programme for the week and expectations	Guttorm Tomren – IALA ARM Committee Chair, Norway
20 mins	Report IALA	Minsu Jeon - Technical Operations Director, IALA
20 mins	Report IHO	Nathalie Leidinger – IHO/HSSC Vice Chair, France
10 mins	Group photo	
10 mins	Break	
11:00 – 12:30	Session 2 – Alignment of international standards	Chair: Nathalie Leidinger – SHOM, France
15 mins	IHO - work on S-100 and product specifications	Stefan Engström – IHO NIPWG Chair, Finland
15 mins	IALA AtoN work (S-201)	Sewoong Oh – KRISO, Republic of Korea
15 mins	Development of S-212: When S-100 meets technical services and secure data exchange to support VTS operations	Wim Smets - Technical Manager, Flemish Agency for Maritime and Coastal Services (MDK), Belgium
15 mins	Updates from IMO regarding S-100 implementation and the S-100 capable ECDIS	Cafer Ozkan Istanbulu - Technical Officer, IMO
15 mins	IEC 61174 IEC 62288, ECDIS Standards	Antti Kukkonen – IEC, Furuno
15 mins	Q&A session	
1hr 15 mins	Lunch	
13:45 – 15:15	Session 3 – Operational data domain	Chair: Dave Lewald - USCG
20 mins	Data modelling, maintenance and production workflows: From IALA S-201 to IHO S-101	Stefan Engström - IHO
20 mins	S-125 Progress and Interoperability Update	Caroline Johansson – IHO S-125 Task Lead, Sweden
20 mins	Status of S-98 Ed.2.0.0 and its next phase	Ed Kuwalek – IIC
20 mins	Training to support operational implementation	Vincent Denamur, IALA WWA Dean
10 mins	Q&A session	
15 mins	Break	
15:30 – 17:00	Session 4 – Data Quality and Validation	Chair: Guttorm Tomren
20 mins	Quality assurance process of machine-readable IHO standard	Yong Baek - IHO
20 mins	PRIMAR Services and S-100 Validation	Svein Skjæveland – ECC/PRIMAR
20 mins	Development of the IALA S-201 Validation Rules	Sewoong Oh - KRISO
20 mins	Data Quality and Validation in the Transition to S-100	Su Marks – IC-ENC
10 mins	Q&A session	
17:00 – 19:00	Workshop Icebreaker – InterContinental Hotel Dress code: Business attire	

12. DAY 2 – Wednesday, 2nd September 2026

Time	Topics	Chair or Speaker
09:30 – 11:00	Session 5 – Secure exchange	Chair: Hamdi Erkan - ASELSAN, Türkiye
20 mins	Cybersecurity internal & Cyber Hygiene external	Alison Contreras – UKHO, UK
20 mins	IMO guideline on IP delivery (available methods)	Caroline Johansson – IHO S-125 Task Lead, Sweden
20 mins	S-100 Infrastructure Centre (MCP/SECOM)	Yong Baek - IHO
20 mins	Application Process for IHO Security Scheme and SECOM Service Test	Yong Baek - IHO
10 mins	Q&A	
15 mins	Break	
11:15 – 12:45	Session 6 – Experience and use cases	Chair: Okan Kanyilmaz - ASELSAN, Türkiye

Report of the 3rd Joint IALA/IHO workshop on S-100/200

20 mins	Implementation US S-101/201 S-124/125	Dave Lewald - USCG
20 mins	Implementation S-124	Ed Stacey - S-124 Project Chair, NGA, US
20 mins	First implementations of S-100-200 digital services in Finland	Juho Pitkänen - Head of Digital Services, Fintraffic, Finland
20 mins	Lessons learned from seven IHO S-100 Sea Trials Areas	Nathalie Leidinger – SHOM, France
10 mins	Q&A session	
1 hr 15 mins	Lunch	
14:00 – 15:30	Session 7 – Working groups	
15 mins	Establish Working Group goals	Guttorm Tomren
	Working groups: - WG 1 Operational considerations - WG 2 Technical considerations - WG 3 Training considerations	Co-Chairs – Dave Lewald and Selay Turan Co-Chairs – Alison Contreras and Sewoong Oh Co-Chairs – Heather Gilbert and Ulla Møller
15 mins	Break	
15:45 – 17:00	Session 8 – Working groups	
	Working groups continue	
Bus departs at 18:00	Workshop Dinner Bus transfer from the InterContinental Hotel (Transfer approx. 45mins) Dress code: Smart Casual	

13. DAY 3 – Thursday, 3rd September 2026

Time	Topics
09:30 – 11:00	Session 9 – Working groups
	Working groups continue
15 mins	Break
11:15 – 12:45	Session 10 – Working groups
	Working groups continue
1hr 15 mins	Lunch
Bus departs at 14:30	Technical visit Bus transfer from Intercontinental Hotel Boat Tour of Historical Sites, Istanbul Dress code: Casual (suitable footwear for a boat tour)

14. DAY 4 – Friday, 4th September 2026

Time	Topics	Chair or Speaker
0930 – 11:15	Session 11 – Workshop review and conclusions	Chair: Minsu Jeon - IALA
1 hour	Review of working group findings and Q and A	Working Group Co-Chairs
15 mins	Break	
15 mins	Workshop conclusions	Yong Baek – IHO and Guttorm Tomren – IALA / NCA
15 mins	Closing of the workshop	Omar Eriksson – IALA, Yong Baek – IHO, Serhat Aytugel - Directorate General of Coastal Safety, Türkiye
Departure or lunch provided for those who wish to remain at the Venue.		

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 Co-chairs of these WGs are:

Working Group	Focus	Co-Chairs
Working Group 1	Operational	Dave Lewald and Selay Turan
Working Group 2	Technical	Alison Contreras and Sewoong Oh
Working Group 3	Training	Heather Gilbert and Ulla Møller

WORKING GROUP OBJECTIVES

Suggested outcomes from these WGs have been identified as:

Working Group 1 – Operational

Review the actions identified during the previous workshops and implement necessary follow-up steps.

Identify remaining 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, as defined/permitted in S-98.

Liaison, discuss and provide guidance on S-12 (Light List)/S-125 development (carriage requirements fulfilment)

Consider the requirement for the List of Lights as a separate GIS Layer.

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 notes to the Workshop Report.

Working Group 2 – Technical

Consider lessons identified from IHO and IALA on S-124, S-125 and S-201 test beds (review test bed report).

Consider action item HSSC 18/054 on technical service specifications.

Consider how IHO and IALA should cooperate on SECOM and MCP to ensure interoperability and alignment between relevant IHO and IALA technical frameworks.

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 the need for S-258 (Validation) for IALA products.

Discuss S-210 IVEF as an example of how the S-100 framework can be applied beyond ECDIS, particularly for real-time operational maritime data exchange between shore-based systems.

Contribute to the proposals for the workshop conclusions.

Submission of WG report to the Workshop Report.

Working Group 3 – Training

Discuss IALA S-200 courses, review and document observations.

Report of the 3rd Joint IALA/IHO workshop on S-100/200

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. (Update on IMO Model Course 7.03)

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

Consider training needs based on recent changes/developments to AtoN, such as AIS AtoN.

Discuss and review external training on particular technical aspects.

Contribute to the proposals for the workshop conclusions

Submission of WG report to the Workshop Report

WORKING METHODS

In order to achieve their objectives the Working Groups may:

draw upon the presentations, discussions and experiences shared during the workshop;

focus on operational, technical and training challenges, implementation experience and practical outcomes, as appropriate to their remit;

identify gaps, challenges and opportunities relating to S-100 and S-200 implementation and development;

consider existing IHO and IALA standards, publications and related documentation;

consider relevant developments in technology, services, regulation and operational practice;

encourage contributions from all participants and seek to capture a range of perspectives;

liaise with other Working Groups where topics overlap to promote a coordinated approach;

seek to reach conclusions and recommendations by consensus wherever possible; and

identify proposals, recommendations or potential actions for consideration by IHO, IALA and other relevant bodies.

OUTPUTS

The Working Groups should capture their discussions using the template provided by the Workshop Secretary.

Outputs should focus on clarity and usefulness and should identify:

key findings and observations;

identified gaps, challenges or issues;

examples of effective practice, where relevant;

recommendations for consideration by IHO, IALA or other relevant bodies; and

proposed actions or tasks arising from the discussions.

The Working Group notes should be provided to the Secretary by the end of the workshop for inclusion as an annex to the Report.

REPORTING BACK

Each Working Group should provide a short summary of its findings during the final plenary session.

The summary should highlight:

key findings;

key recommendations; and

any proposed actions or tasks identified by the Working Group.

15. 1. KEY FINDINGS AND OBSERVATIONS

Capture the main points emerging from the discussion.

• Validation procedures for all Products Specifications (PS) should be created. Service providers should consider using data confidence qualifications such as CATZOC to describe the quality of data. Methods of data validation at manual entry points should be included in these procedures.
• Product specifications require routine maintenance to ensure continued interoperability. Member nations should consult IHO C615 and IALA Guidelines for PS maintenance advice and best practices.
• When refereeing to AtoN, the IALA Aton MRN should be used across domains to avoid confusion and potential negative impacts to S-124 and S-125.
• S-201 and S-125 remain misaligned with S-101 and need to be fixed.
The S-101PS is a mature status and should not be reopened to support S-201/125PS development. IALA should coordinate with IHO sometime after 2030 for new recommendations regarding AtoN in the S-101PS
• Workflow between Aton Authorities and Hydrographic Offices for S-201 data exchange must be negotiated at the national level.
• The requirement for two types of portrayal of AIS Aton remains necessary.
The future of List of Lights remains unclear. Reflection on the use of this nautical chart compendium is necessary within the AtoN and Hydrographic communities.
IHO-NIPWG has drafted a description of the relationship between S-101-201-124-125. Draft to be further advanced at the next NIPWG mtg.

3. RECOMMENDATIONS

Set out recommendations clearly and identify the intended recipient where possible.

Recommendation	Intended recipient
Guidelines should be developed where manual entry of data is used. Clear instructions for field units and remote data generations should be provided.	All
IALA should consider drafting a guideline similar to IHO C615 for member use.	IALA
Workgroup 1 recommends Hydrographic Organization to use IALA AtoN MRN within S-101 products.	HO
Specific discussion related to the future of the List of Lights should be an agenda item at the 4 th session.	SC

4. PROPOSED ACTIONS OR TASKS

Use this section for practical follow-up actions, tasks or proposals arising from the discussion.

Proposed action or task	Expected outcome	Suggested lead/contact
ARM should consider defining the levels of confidence and data integrity.	Definitions for level of confidence related to AtoN data	ARM

S-201 task group should continue to align with S-101 PS.	AN aligned S-201/125 PS	ARM
IALA and IHO continue discussion within committees/Workgroups to complete items identified in workshops 1-3	Tasks and recommendations are closed	All
S-100/S-200 Workshop Steering Committee should secure training workgroup commitments from participants in advance of the 4 th workshop session. SG should seek additional attendance of qualified personal to discuss emerging training requirements		SC
NIPWG should forward draft Guideline on the relationship between S-101-201-124-125 to ARM Committee for comment/review in Oct 2026		NIPWG

5. HEADLINE POINTS

Three to five short points to support plenary reporting and consolidation of workshop conclusions.

- These Workshop's need to continue.
- Training and overall awareness of S-100 remains woefully underserved. We all must become “S-100 Ambassadors” at home and abroad.
- S-201/125 must comply with the current S-101 edition.
- Portrayal and potential of cluttered display screens remains a concern but can be overcome through training and proper PS layer development.

1. KEY FINDINGS AND OBSERVATIONS

Capture the main points emerging from the discussion.

- The S-100 framework is now being applied beyond the traditional IHO ENC/ECDIS environment. The framework does not adequately support streaming, real-time and service-based data exchange and message-based services such as S-210, S-212, and S-421. Further IHO-IALA discussion is recommended, on how such services and other non-ECDIS applications fit within the S-100 framework and how interoperability should be ensured and reflected in S-97, S-98 and/or S-100. WG2 requested the IALA VTS Committee to prepare an Information Paper on S-210 and S-212 detailing the issues, for consideration at the IHO S-100 Test Strategy meeting in March 2027 to open cross organization dialog which can be taken forward at the S-100WG.
- The relationship between IHO and IALA Maritime Connectivity Platform instances remains unresolved. Multiple interoperable trust domains could improve resilience, but certificate governance, mutual recognition, revocation, liability, and organizational responsibilities require agreement. Certificate interoperability is mainly a governance challenge rather than a purely technical one.
- The group identified the need for stronger schema quality assurance and business-rule validation, noting S-100 schemas can permit semantically invalid data to pass basic validation. The IHO Infrastructure Centre aims to provide support in this area.
- AtoN authorities, especially smaller organizations, need clearer guidance and shared tools for producing, validating, and distributing S-201 and S-125 data. RENCs or similar intermediary organizations may be able to provide validation, quality assurance, and distribution support where individual authorities lack the required infrastructure or expertise.
- WG2 discussed Technical Service Specification development, ownership and approval mechanisms. It was recommended that S-100 Part 14 should be updated and aligned with IALA Guideline G1128 to provide practical guidance for modern service-based implementations. IHO needs a clear process to approve, publish, and maintain technical service specifications, with appropriate references to IALA Guideline G1128 and related IALA documents. The IHO will add an IALA Technical Services link to the GI Registry.
- Validation (S-258) should combine standardized S-100 and product-specific checks with additional national or organizational rules where required.

2. IDENTIFIED GAPS, CHALLENGES OR ISSUES

Identify gaps, challenges or issues that may require further consideration.

- Limited support for real-time services: S-100 is primarily designed for packaged datasets and exchange sets. It lacks sufficiently detailed rules for continuous streaming, short-lived messages, and bidirectional service interactions. S-210, S-212, and S-421 cannot practically follow every S-100 requirement. There is no agreed process for documenting or approving justified exceptions.
- GI Registry limitations: Some concepts are narrowly defined for individual product specifications, preventing reuse. Other definitions may be outdated or inconsistent. Altering a GI Registry concept can affect feature catalogues, application schemas, and existing product specifications.
- Unresolved trust governance: Responsibilities for issuing, recognizing, renewing, auditing, and revoking maritime digital identities have not been clearly assigned.

Single-point-of-failure risk: A centralized certificate authority could become a major operational and cybersecurity vulnerability. A distributed model improves resilience but introduces governance and interoperability challenges.
Schema-quality weaknesses: Existing schemas may allow semantically invalid documents to pass basic validation, requiring additional business rules and increasing implementation costs.
Insufficient validation tools: AtoN authorities need accessible tools for producing and validating S-201 and S-125 data.
Capability differences between authorities: Smaller VTS and AtoN authorities may lack the expertise, staffing, or infrastructure needed to operate S-100 services independently.
Slow coordination between organizations: Formal liaison procedures between IALA and IHO can take many months, which may not match the pace of technical development.
S-100 Part 14 lacks practical and current guidance for modern streaming and service-based implementations.
Roles and responsibilities for collecting, validating, distributing, and assuming responsibility for S-124 information require clarification.
Validation tools must support both standardized product checks and additional national or organizational requirements.
S-201 does not clearly communicate changes between dataset versions, creating extra analysis for hydrographic offices and other users.

3. RECOMMENDATIONS

Set out recommendations clearly and identify the intended recipient where possible.

Recommendation	Intended recipient
Establish faster and more direct technical coordination on shared S-100 issues.	IHO and IALA leadership and technical representatives
Review S-100 to better accommodate streaming, message-based, bidirectional, and short-lived data services. Develop guidance covering streaming encoding, delivery, endpoints, subscriptions, data-transfer methods, and metadata.	IHO S-100 Working Group/TSM in collaboration with IALA Committees
Create a formal mechanism for documenting and approving justified exceptions to S-100 requirements for S-200 products.	IHO S-100 Working Group, with input from IALA
Submit an information paper describing the S-210, S-212, and S-421 implementation problems and proposing solutions.	IALA VTS Committee and relevant task groups, for submission to the IHO S-100 TSM
Review GI Registry concepts that are identified as outdated, too narrow, or specific to one product specification.	IHO GI Registry management, through the IALA domain control body
Clarify the roles of IHO, IALA, national authorities, MCP operators, manufacturers, and service providers in maritime identity governance.	IHO, IALA, and relevant national authorities

Define an interoperable trust model that supports multiple MCP instances and certificate authorities.	IHO and IALA MCP, SECOM, and cybersecurity specialists
Establish common requirements for certificate issuance, recognition, renewal, auditing, termination, and revocation.	IHO, IALA, MCP operators, and certificate authorities
Use pilot projects and sea trials to test the proposed trust and certificate arrangements before wider adoption.	IHO, IALA, national administrations, and participating operators
Complete and share the IALA MCP feasibility study to support future governance decisions.	IALA/DTEC
Improve the technical quality of S-100 schemas so that invalid data is rejected during initial validation.	IHO S-100 Working Group and Infrastructure Centre
Develop consistent international guidance for producing, updating, validating, and exchanging S-201 data.	IALA, in coordination with IHO and national S-100 coordinators
Consider providing intermediary validation and distribution services to authorities with limited resources.	RENCs and other qualified service providers
Develop scalable infrastructure and support arrangements for smaller VTS centers implementing S-212.	IALA VTS Committee, S-212 task group, and potential service intermediaries
Update S-100 Part 14 and align it with IALA Guideline G1128 to support modern service-based implementations.	IHO S-100 Working Group and IALA
Establish a clear governance process for developing, approving, maintaining, and versioning technical service specifications.	IHO and IALA Secretariats and relevant committees
Develop interoperable but separate service specifications for S-124 and S-125 using common design principles.	IHO S-124/S-125 project teams and IALA technical experts
Clarify the roles of data producers, hydrographic offices, RENCs, and service providers in validating and distributing S-124 information.	IHO, national authorities, and RENCs
Develop validation tools that combine common S-100 and product-specific checks with optional national or organizational rules.	IHO S-100 Working Group, IALA, and national authorities

4. PROPOSED ACTIONS OR TASKS

Use this section for practical follow-up actions, tasks or proposals arising from the discussion.

Proposed action or task	Expected outcome	Suggested lead/contact
Submit an information paper on S-100 limitations for streaming and message-based services.	Agreed guidance for S-210, S-212, S-421, and future service-based products.	IALA VTS Committee and S-200 task groups, submitted to the IHO S-100 Working Group/TSM
Review outdated or overly product-specific GI Registry concepts and examine the use of namespaces.	More reusable definitions without unnecessary disruption to existing products.	IALA domain control body and IHO GI Registry team
Complete the IALA MCP feasibility study and develop an interoperable IHO–IALA trust model.	Clear governance for multiple MCP instances, certificate authorities, and organizational responsibilities.	IALA/DTEC and IHO security/MCP representatives
Define certificate lifecycle and identity requirements, including issuance, recognition, renewal, auditing, and revocation.	A scalable and enforceable certificate-management framework for organizations, ships, services, and equipment.	IHO–IALA MCP, SECOM, cybersecurity, and legal specialists

Improve S-100 schema quality and provide shared validation tools and guidance for S-201 and S-125.	Earlier detection of invalid data and more consistent production across authorities.	IHO Infrastructure Centre, IHO S-100 Working Group, and IALA
Prepare a proposal to align S-100 Part 14 with IALA Guideline G1128.	Updated guidance for modern service-based and streaming implementations.	IALA technical experts and IHO S-100 Working Group
Define governance and ownership arrangements for technical service specifications.	Clear responsibilities for approval, maintenance, publication, and version control.	IHO and IALA Secretariats and relevant committees
Develop implementation guidance for VTS authorities, including scalable service models and VHF fallback arrangements.	More consistent adoption by authorities with different capabilities and resources.	IALA VTS Committee, VTS suppliers, and national authorities
Develop a common validation framework supporting standardized and optional national checks.	Consistent validation with flexibility for national or organizational requirements.	IHO S-100 Working Group, IALA, and national authorities

5. HEADLINE POINTS

Three to five short points to support plenary reporting and consolidation of workshop conclusions.

- S-100 needs clearer provisions for streaming and message-based services, including encoding, delivery, metadata, and justified exceptions for S-200 products.
- An interoperable maritime trust and certificate-governance model is required to support multiple MCP instances while addressing resilience, recognition, renewal, revocation, and accountability.
- S-100 schema quality and validation require improvement, supported by shared tools and consistent guidance.
- IHO and IALA should establish clear governance for technical service specifications.
- Scalable implementation models are needed for authorities with differing resources, while VHF remains an operational fallback.
- A common validation framework should support both standardized and national requirements.

6. ADDITIONAL NOTES

Include any other relevant points that do not fit elsewhere.

- The workshop discussions were exploratory; many proposed actions, responsibilities, and timelines were not formally agreed.
- S-212 and S-421 face similar difficulties because their primary use cases involve short-lived messages rather than persistent files or exchange sets.
- The group distinguished service registries from identity registries. Services may be listed in multiple registries, while an identity normally belongs to a single certificate trust chain.
- Multiple MCP instances could improve resilience, but each instance would still require appropriate high-availability arrangements.

- IHO indicated that its identity registry is intended primarily for organizations, while end-user or ship identities may be managed by individual MCP operators or service providers.
- Different certificate-validity periods may be appropriate for long-term data protection and short-lived online communication services. National S-100 coordination mechanisms were encouraged, although participants also identified a need for international consistency between national approaches.
- Some AtoN authorities may prefer to send S-125 products directly for distribution, while others may rely on hydrographic offices or RENCs because they lack the necessary expertise or infrastructure.
- Digital services are intended for various vessels and shipboard systems, not exclusively SOLAS vessels or type-approved ECDIS.
- Linking relevant IALA technical-service documents through the IHO GI Registry was suggested to improve their visibility and accessibility.

1. KEY FINDINGS AND OBSERVATIONS

Capture the main points emerging from the discussion.

• More emphasis on WG3 - Training at future Joint Workshops and ensuring participation among the different working groups. The training working group NEEDS representation from all bodies (IHO, IALA, Industry, etc.)
• Lack of awareness on availability of base S-100/S-200 courses/knowledge sharing is need for ALL users stating what it is, why it is important, and where to easily find the courses
• Core courses should not be tailored to specific roles as there are too many. Different levels of training should be established - Base (fundamental)/General (intermediate) /Super (advanced/technical) (see notes for more detail on each level).
• Review existing courses/materials (e.g. UKHO, PRIMAR, etc) and cooperation agreements in information sharing.
• Harmonization, cooperation and data sharing among all stakeholders.
• Ensure senior leadership/top management has the information THEY need to support the transition to S-100/S-200

2. IDENTIFIED GAPS, CHALLENGES OR ISSUES

Identify gaps, challenges or issues that may require further consideration.

• Overall training challenges -- Access to training; cost of training; time needed away from job to take training
• Enforcement: Whether training is required, or is it optional? Who will determine the enforcement of training? IMO? Ship Owner? Insurance? Etc.?
• Development of needed training courses cannot be completed until S-100/S-200 is fully rolled out, including the physical product equipment/software systems.
• Consideration needs to be made for multiple languages and cultural training for both trainers and trainees.
• Lack of engagement/input from the technical and operational side as their input is critical for the decisions to made in training development.

3. RECOMMENDATIONS

Set out recommendations clearly and identify the intended recipient where possible.

Recommendation	Intended recipient
Engagement/input from the technical and operational working groups. Working groups needs better management, prior to arrival request with working group they will participate in and provide key materials ahead of workshop.	Joint Workshop Organizers
Simplification and standardization of training; not specific to roles but to need.	Training developers (IHO, IALA, Industry, etc)
STCW updates on S-100/S-200 training	IMO/IHO participants

Continuation of the review of IALA Level 1.1 ATON Model Course - the main driver is the digital edition including S100 (work in progress)	IALA WWA
Review and compile existing training resources into a single set of materials.	IALA WWA/IHO/RENC/etc

4. PROPOSED ACTIONS OR TASKS

Use this section for practical follow-up actions, tasks or proposals arising from the discussion.

Proposed action or task	Expected outcome	Suggested lead/contact
Engagement/input from the technical and operational working groups.	Improved input into the training work group.	Workshop Organizers
Simplification and standardization of training; not specific to roles but to need.	Better overall understanding and ease of use/access for all stakeholders.	Training developers (IHO, IALA, Industry, etc)
Whether training enforcement is required or optional, and to which level.	Clarification of expectations	IMO/IHO/IALA
Review of IALA Level 1.1 ATON Model Course.	Continued refinement of course to meet stakeholder needs.	IALA WWA
Review and compile existing training resources into a single set of materials.	Single place to find information/Ease of Use	IALA WWA/IHO/RENC/etc
Establish levels of training (Base/General/Super)	Defined appropriate level of training course(s) for stakeholders. Ex. Base (fundamental)/General (intermediate) /Super (advanced/technical)	IALA/IHO

5. HEADLINE POINTS

Three to five short points to support plenary reporting and consolidation of workshop conclusions.

- Establish three levels of training (Base/General/Super) to meet the needs of the stakeholders.
- Engagement/input from the technical and operational working groups at future Joint Workshops.
- Initially focus on core/base level knowledge of S-100/S-200 for stakeholders.
- Simplification and standardization/Ease of access to training materials to reduce burden on users (ex. Not needing to take time off of work for in-person training)

6. ADDITIONAL NOTES

Include any other relevant points that do not fit elsewhere.

- See Working Groups notes
- Sample three level training

Ex. S-100 Core Training

Base Level (Fundamental)

- Awareness of S-100
- Why S-100 was developed
- Relationship to S-57
- Overview of S-100 product specifications
- Benefits of data-centric navigation
- Future maritime navigation landscape

General User (Intermediate)

- Understanding S-100 services and products
- Operational impacts of S-100 implementation
- Using S-100 information in decision making
- Understanding limitations and risks
- Reporting issues and anomalies

Super User (Advanced)

- S-100 framework architecture
- Feature catalogues and registries
- Data exchange and interoperability
- Portrayal concepts
- Governance and implementation roadmaps
- Future S-100 developments



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