

PRO 2.1**S-100 IMPLEMENTATION STRATEGY**

Submitted by: **Council (Council Chair)**

Reference: A. 3rd Meeting of the Council – Summary Report.

Annex: A. S-100 Roadmap for the S-100 Implementation Decade
(C3-03.6A Rev1)

PROPOSAL

The Council having considered the progress of the technical standardization of the S-100 Framework, the interrelation to IMO's e-navigation programme and the needs to assist Member States for readiness and capacity to commence the production and the integrated provision services of S-101 ENC and other S-100 based products, the Assembly is invited:

- to approve the "S-100 roadmap for the S-100 Implementation Decade" endorsed by the Council as presented in Annex A.
- to task the Council to maintain the S-100 roadmap and resulting activities in liaison with external bodies on an annual basis as a key priority of the Council activities.

EXPLANATORY NOTE

1. At the 3rd meeting of the Council meeting (C-3) in October 2019, the Secretary-General introduced the discussion of the S-100 Implementation Strategy, indicating the topic was amongst the most important to be discussed by the Council and carried a mix of responses by Member States due to the improved technology versus the anxiety of implementation timelines.

2. The presented document (Annex A) sets out the strategic fields of engagement to develop an accepted roadmap for the S-100 Implementation Decade. The main drivers to develop S-100 are increasing digitalization in the shipping industry - for classic and autonomous navigation – and the benefits of "smart hydrography".

3. The implementation of S-100 based data services will not only improve safety of navigation and shipping in ports, but provide a cyber-secure, easily maintained software foundation that will support creative industry policy. S-100 based services should be considered an important driver for autonomous shipping capability.

4. S-101 ENC will become the premium product of hydrographic offices. The future provision of such S-101 datasets is regarded as vital for the future success of the IHO.

5. It is understood that S-101 ENC provision and other S-100 based data services require production and dissemination harmonization over time. Likewise, S-101 and S-10x capacity building, fostered through RHCs, is critical to implementation success.

6. The Council agreed that substantial data coverage is necessary for successful adoption by customers, especially within the shipping industry. It was also noted that there should be a technical and standardized compatibility between S-101 and S-57 during the transition phase for the implementation period to allow for S-57-only ECDIS to meet carriage requirements and remain operational. To start with substantial coverage, S-101 ENC could be produced by converting S-57 datasets before native production of ENCs in the cartographically enriched S-101 format.

7. The IHO will coordinate with IMO and industry stakeholders concerning the transition to the S-101 ENC production, coverage and use in end user applications. Since the so called "S-mode" for ECDIS is scheduled to be implemented by IMO on new ECDIS from January

2024 onwards this would create a window of opportunity for the S-101 ENC processing capability. The “dual fuel” model of parallel provision of S-57 ENCs and S-101 ENCs after this date for a significant duration would be instrumental for the transition period.

8. The Council endorsed the draft roadmap for the provision of S-100 based services (Decision and Action C3/13), as a first step, noted the important IMO target of January 2024 for the implementation of the S-mode and tasked the Secretary-General to start engaging with IMO.

9. The inclusion of a detailed plan of action and milestones, along with a strategic narrative, appears indispensable for road map communication. The Council / HSSC / IRCC Chairs / Secretary-General supported by subject matter experts as appropriate are tasked to maintain this roadmap as an incremental document (including narrative and timelines) on an annual basis taking into account comments already made at C-3 (engagement plan, production plan, capacity building) and to be made at A-2.

10. The Council tasked the chairs of HSSC/IRCC and the Secretary-General to align the IHO Work Programmes 1, 2 and 3 for 2021 with this roadmap (Reference A, Action C3/14).

11. The Council also tasked the Council Chair to report at A-2 on the IHO progress towards the provision of S-100 based services and to propose to the Assembly to task the Council to maintain the S-100 roadmap on an annual basis as a key priority of the Council activities. (Reference A, Action C3/16).

Annex A to PRO 2.1

Roadmap for the S-100 Implementation Decade (2020 – 2030)

Version 1.0 Rev 1

Introduction

The 2nd Meeting of the IHO Council tasked the chairs of the Council, HSSC, IRCC Chairs and the Secretary-General to draft an implementation strategy/roadmap for a transition plan aiming to the regular and harmonized production and dissemination of S-100 based products for further discussion at A-2 and for the preparation of the 2021-2023 IHO Work Programme (Ref. A: Action C2/31).

In addition the Secretary-General was tasked to start engaging with the IMO to update on the current status of the S-100 framework and potential future impact on IMO instruments (Ref. A: Action C2/32).

As a result of their deliberations the noted group of offices bearers identified the following strategic fields of engagements to develop an accepted roadmap for the now called *S-100 Implementation Decade*:

1. Operational infrastructure
2. Technical standardization
3. Coordinated implementation of services
4. Synchronization with IMO
5. Collaboration with industry
6. Capacity Building of Hydrographic Offices
7. Development of Global Distribution Capability

These seven topics have to be considered in detail to enable Member States of IHO, IMO and all other affected stakeholders including industry partners, to adjust their legal and technical arrangements to contribute to the establishment of S-100 based products services. This submission proposes a basic timeline and actions to be taken in concert with IHO liaison partners affected.

Analysis and Discussion

1. Operational infrastructure

Operational infrastructure such as registry and tools to compose product specifications will be ready for the ongoing maintenance of S-1xx product specifications **by 2020 (IHO SEC – HSSC)**.

2. Technical standardization

Two main fields in S-100 based products specifications:

S-101 ENC:

- According to the HSSC road map, the S-101 PS will be **technically ready for regular production of S-101 ENCs by end of 2022.** (HSSC)
- It can be expected that S-101 ENCs and S-57 ENCs can be produced through export from commercially-developed upgraded database-driven ENC production systems at that date. (Industry in collaboration with HSSC)

- Note that since S-101 contains features and attributes not available in S-57, fully-featured S-101 ENCs cannot be created through a simple conversion process of S-57 ENCs. However, S-101 ENCs created by conversion will meet all conditions to maintain full safety of navigation on the same level as S-57 ENCs do.

Additional S-1xx Product Specifications:

- Standardization within the S-100 hydrographic domain should put special focus on the following products.

S-101	Electronic Navigational Chart (ENC)
S-102	Bathymetric Surface
S-104	Water Level Information for Surface Navigation
S-111	Surface Currents
S-122	Marine Protected Areas
S-123	Radio Services
S-124	Navigational warnings
S-129	Under Keel Clearance Management

- Additional standardization projects beyond those already registered under the hydrographic domain are not currently planned, but should be expected during the upcoming decade if a compelling need will be demonstrated by stakeholders. (HSSC and IRCC)

3. Coordinated implementation of services

S-101 ENC:

- S-101 ENC coverage will grow faster than S-57 ENC in its early days since the relevant concept model (objects featured with geometry and attributes are linked to specific presentation rules given by S-52, encoding remains ISO-IEC8211) is identical and distribution concepts for ENCs via RENCs and national services are in place.
- For the ignition phase conversion of S-57 ENCs to S-101 ENCs can help to reach significant coverage, knowing that there will be limitations of those converted cells in some cartographic details in comparison to the full range of S-101 ENCs native features.
- In order to maintain ECDIS devices already installed on SOLAS vessels which are technically not ready nor required to be upgraded to S-101 ENC process capability and to be in line with the applicable IMO regulations pertaining to existing navigation equipment, identical coverage has to be provided for S-57 ENCs and S-101 ENCs for a transition period until the end of the decade. The IHO will assess the progress of the transition 18 months before the conclusion in collaboration with IMO and industry stakeholders. If the results indicate that there will be widespread and substantial residual dependence on S-57 ENCs, limited provisions will be made to extend the period to ensure an orderly transition.
- As a consequence, new ECDIS systems to be brought into the market at the time when S-101 ENC coverage starts (2024) have to be capable to process both formats: S-57 ENCs and S-101 ENCs in parallel.
- This “dual fuel” model is instrumental for the transition period. From the user’s perspective, presentation of cartographic features to meet the IMO mandated content (ENC = official nautical chart) should be seamless and presented under the identical

presentation regime. The latter is facilitated through compliance of S-101 ENC presentation with S-52 portrayal standards.

- In order to accomplish this phase of transition on the data production and data distribution side:
 - o It is proposed to seek commitment from as many as possible IHO MS to start **regular native production of S-101 ENCs in 2023 and regular availability gradually growing in the course of 2024** in parallel to regular S-57 production.
 - o RENCs and VARs must be capable to feed the market with the S-101 ENCs – including encryption aspects and be ready for a mixed distribution arrangement to support the “dual fuel” model.

Additional S-1xx Product Specifications:

- It is anticipated that these additional services will be offered at a variety of timeframes globally, so that coverage will be discontinuous. It is not anticipated that these services will be mandated by IMO, but will be available at the option of users through compatible systems.
- However, these datasets are anticipated by shipping industry for specific applications in national waters and specific regions.
- The navigation equipment industry stands ready to make use of these products as soon as regular provision of such datasets is provided for areas of substantial size and importance.
- There is no need for industry to wait for the final implementation of a S-101 ENC enabled ECDIS. Additional S-1xx products can be used in existing systems with upgrades to software for those clients who wish to use them.
- IHO via IRCC will create and maintain a global catalogue of services and planned services on a regular basis and encourage them to start service provision via RENCs or individual arrangements. (IHO SEC)
- Some services may only be of attraction for customers where regional cover has been established. Coordination of regional approaches via the respective RHC is desired. (IRCC)

4. Synchronization with IMO

S-101 ENC:

- Having defined a target date for regular provision of S-101 ENC with significant coverage by 2024, IHO can now approach IMO instruments: (IHO SEC)
 - o Amend IMO’s ECDIS Performance Standards with a reference that S-101 ENCs are equivalent to the composition of S-57 ENCs and S-52 Presentation rules (minor amendment).
 - o Suggest to IMO to synchronize this amendment with IMO’s amended Performance Standards for the presentation of navigation-related information on ship borne navigational displays coming into force on **1 January 2024 for new equipment.**
 - o Assure IMO that the concurrent provision of S-57 ENCs and S-101 ENCS will remain through the transition period.

- Advise IMO that S-57 ENCs and S-101 ENCs both fulfil the requirements for ENC as defined in IMO ECDIS mandation and are both suitable for use during the transition period.
- Advise IMO that S-101 ENCs (in contrast to S-57 ENCs) are cyber secure, improve the clarity of portrayal, and open the door for the implementation of the e-navigation service concept (S-100 is the adopted data model for e-navigation).

Additional S-1xx Product Specifications:

- So far there is no need for synchronisation with IMO since the content of these datasets are not mandated requirements and can be used by mandated navigation devices as long as they do not disturb their regulated core functionality.

5. Collaboration with industry (IHO SEC)

S-101 ENC:

- Nautical cartography software industry has to confirm that S-101 ENC production systems and validation tools will be ready **by end of 2022** and training can be provided.
- ECDIS industry has to be made aware of the start date of S-101 ENC provision service **in 2024** to be prepared to read S-101 ENC (including encryption) and maintain consistent performance (Display, Alarms, update etc.) in new ECDIS equipment from 1 January 2024.
- Industry should understand that the timeline is deliberately arranged to coincide with the application of the amended IMO PS on navigational displays.
- IEC has to be contacted to adapt IEC61174 for S-101 ENC based tests.
- Type approval houses have to be informed accordingly to adapt their test arrangements and to meet the target date of end of 2023 for re-approval – noting that they will be subject to such activity due to the amended IMO PS on navigational displays anyway.

Additional S-1xx Product Specifications:

- ECDIS and other GIS industry has to be made aware that provision of such datasets starts according to individual commitment of MS or regions. IHO will play a coordinating role, through the RHCs by encouraging MS to set up such services on one hand and informing ECDIS and other GIS industry about the progression. (IRCC)
- These provisions will be patchy and remain so but are not bound to the final advent of S-100 compliant ECDIS or other equipment under carriage requirement regulations such as Radar or INS.

6. Capacity Building for Hydrographic Offices

- The CBSC of the IRCC should develop and execute a line of effort to assess the needs and assist hydrographic offices with the transition of ENC production to S-101. CBSC should also consider activities to raise awareness on the benefits for producer nations.

- The IBSC should consider the advent of these new services in the review cycle of S-5A/B and S-8A/B Standards.
- As new services are matured for S-1xx services (besides S-101), and relevant production and quality systems are developed, those producer nations with technology and expertise are encouraged to share these within the framework of IHO Capacity Building strategy, the respective RHC or bilaterally to support the growth of these services.

7. Development of Global Distribution Capability

- The WEND working group of the IRCC has begun development of principles that will guide the coordinated provision of S-1xx services globally. These principles should be adopted by A2.
- The application of these principles envisions a new generation of global service delivery networks, analogous to the current RENC arrangements, which will enable convenient global availability of authoritative services. These networks will need to consider:
 - o The wider variability of perishability of these services, and the necessity for very low latency for dynamic services.
 - o The need to manage the availability of S-101 and S-57 ENCs simultaneously, in combination with other interoperable S-100 compliant data services belonging to the hydrographic or alternative domains.