Paper for Consideration by WENDWG14

IC-ENC ENC Conversion Analysis Summary

Submitted by:	IC-ENC
Executive Summary:	This paper provides a high-level summary of the actions taken and conclusions reached in response to IC-ENC Steering Committee Action SC22/10: *IC-ENC to analyse ENC Conversion options (technical, operational, governance) and report back to SC.* This paper is submitted to WENDWG to complement paper WENDWG14-05.2B2 PRIMAR Converstion Task Force Report.
Related Documents:	n/a
Related Projects:	n/a

Introduction/Background

Member States of the IHO have committed themselves to the implementation of S-100. Significant coverage of S-101 ENCs is required by 1st January 2026 to support the IHO S-100 Roadmap for the "dual fuel" model and synchronisation with IMO.

In support of discussion at IC-ENC Steering Committee 22 (SC22) in September 2021, the following Steering Committee action was set:.

Action SC22/10	IC-ENC to analyse ENC Conversion options (technical, operational, governance) and report back to SC

Analyses/Discussion

In response to Action SC22/10, IC-ENC conducted the following analysis work:

- Initial analysis work to identify the different ENC conversion options, presented at SC23 (July 2022), concluded that:
    - ENC production tools are developing sufficient functionality as the S-101 standard evolves towards an operational level**,** so that S-57/S-101 production and/or conversion is able to be done at source (i.e. by HO), and in a fully automated manner. It is recognised that there are still challenges to be resolved for ENC Conversion to become fully automatable;
    - An IC-ENC third party conversion service is technically feasible, but not recommended because of the significant complexity in the operation and governance (e.g. liability) with setting up and managing such a remote service, which would provide comparatively little additional benefit to an HO
    - Member engagement: There is very little declared interest amongst IC-ENC Members for a conversion service (although the survey response rates have been low, and some Members are not yet decided).

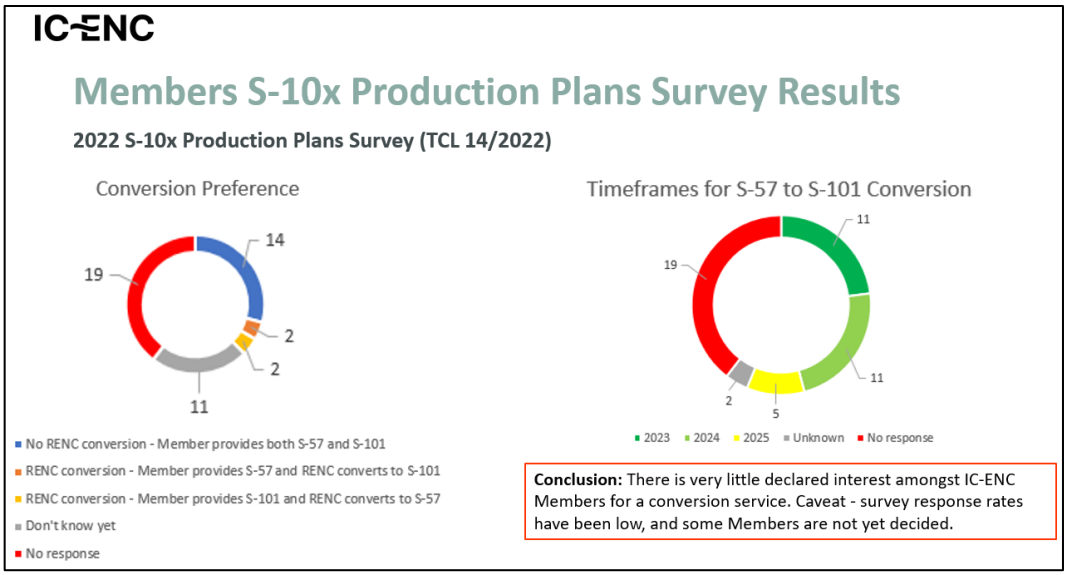

Figure 1 - Members Conversion preference survey results (2022)

- Extensive conversion analysis research, the following outcomes of which were presented at TC22_5 (December 2022)

    - A third-party conversion service would produce S-57 ENCs and only basic S-101 converted ENCs, with no enrichment that S-101 is designed to achieve

    - ENC Updates are not a simple conversion of the S-57 to S-101 update or S-101 to S-57 update. They are an identification of the change between the S-57 and S-101 base cells and updates to create a new S-101 or S-57 update using the differencing information. This is a complex process and the resultant update may not be optimised, e.g., a simple update to move a feature, may become a delete and insert feature. The features would need to be tracked to ensure that the content is the same or as expected for S-57 and S-101 updates. IC-ENC's conclusion is that S-57/S-101 production is optimised at source (i.e. by HO) through ENC production tools, in a fully automated manner, thereby negating the need for a conversion service and the additional complexity that would bring

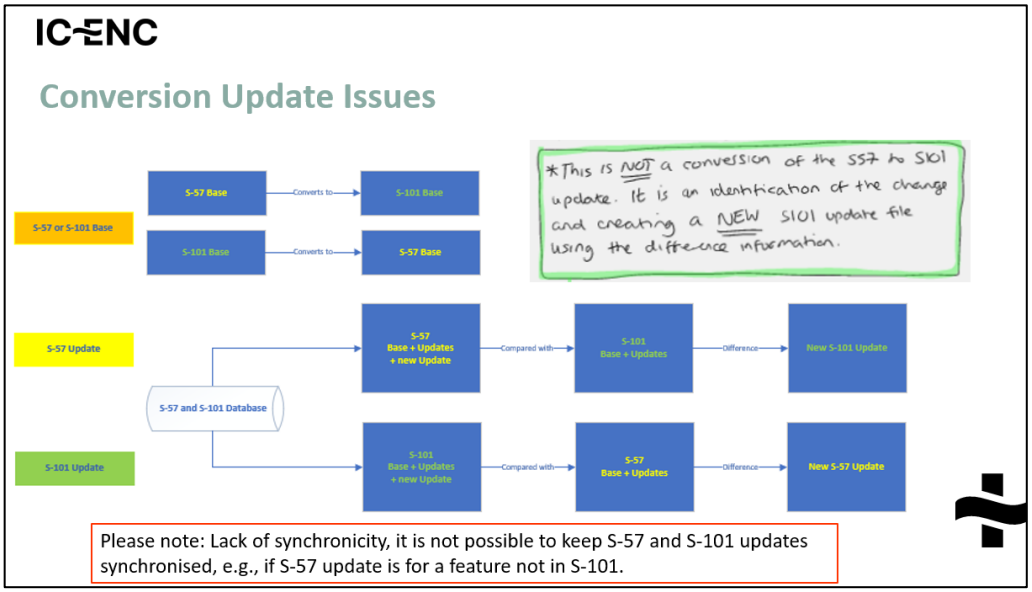

Figure 2 - Conversion Update Issues diagram

- IC-ENC Technical Conference TC22_4 (October 2022) focused on Conversion, and Industry shared their Roadmaps for S-100 Production tools. It was concluded that, ENC production tools are developing sufficient functionality so that S-57/S-101 production and/or conversion is able to be done at source (i.e. by HO), and in a fully automated manner
- Related to conversion, progress has been made on IC-ENC's Conversion Readiness Service and the S-101 Validation Service, and this will provide the necessary support to Members in their transition to dual fuel production

- IC-ENC held a 2-day workshop in October with UKHO and their production tool provider:
  - The aim was to investigate the technical feasibility of building a standalone third-party ENC conversion service offering that would enable the automated conversion of S-57 to S-101 and S-101 to S-57
  - The workshop identified two high level options to deliver a third-party conversion service, standalone and integrated. These two third-party conversion service options were explored, for a service that ingests both S-57 and S-101 ENCs as input and converts them to S-101 or S-57 ENCs as output, whilst ensuring the content is the same.
    a) **Standalone third-party conversion service -** this would require significant development and duplicate technology in other areas (workflow processes, database, signing capability)
    b) **Integrated third party conversion service -** this would extend existing IC-ENC workflow/infrastructure and integrate with new conversion service functionality. This avoids unnecessary duplication of development however would still require DMD enhancement work for the additional rules required
  - The workshop produced an example workflow process flow diagram (see figure 3 below) to better understand the requirements for a third-party conversion service integrated into the IC-ENC DMD system. The diagram shows the complexity involved, as additional rules are required to handle converted ENCs through the workflow process and to flag ENCs ready for conversion for Members who have opted in. Logic would need to be applied, and this logic would differ dependent on whether an update or base cell is required
  - It was concluded that both solutions are life limited, as at some point S-57 will be retired by the IHO, and given the limited uptake the argument for making such an investment seems hard to make

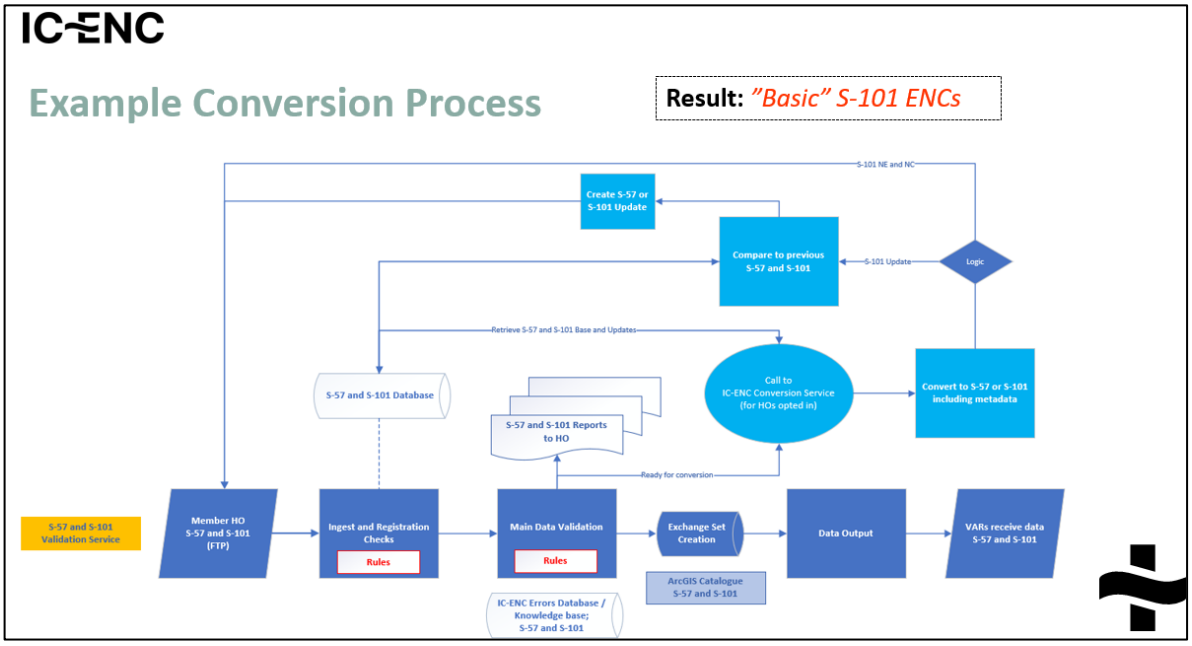

Figure 3 - Example conversion process flow diagram

Based on the research conducted, an IC-ENC third party conversion service is feasible, but not desirable because:

a. There is significant complexity, cost and governance implications with setting up and managing such a service, which would provide little additional benefit
b. There is very light demand from amongst the Membership, losing any benefits of economy of scale

From the research conducted, the most efficient model for Members to move to dual fuel production is a combination of:

- HOs adopt the production tools with the dual fuel capability (for flat file and/or database driven production) and,
- Support from IC-ENC with the **Conversion Readiness Service** to ensure that S-57 ENCs are optimised for conversion to S-101 as flat files and/or migration to S-101 database.

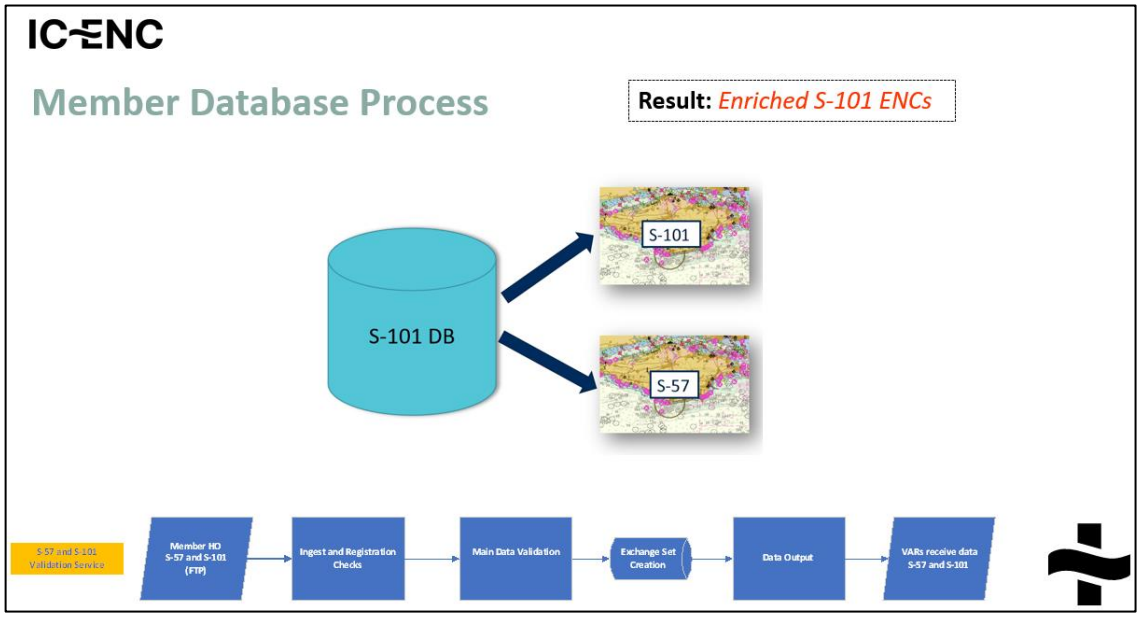

Figure 4 - Example Dual Fuel Capability – Member Database Process

The analysis work and conclusions were subsequently presented to TC and SC, and endorsed by both.

Therefore, IC-ENC will provide support to Members with the Conversion Readiness Service to ensure that S-57 ENCs are optimised for conversion to S-101 as flat files and/or migration to an S-101 database. The Conversion Readiness Services includes the following components:

In place/operational:

- A set of conversion readiness checks, performed on each base cell validation, which provide recommended action steps for Members to take in their S-57 ENCs in preparation for conversion to S-101
- Offering to provide a sample assessment of Members' datasets (up to 10 ENCs)
    - S-57 to S-101 conversion assessment (support from S-101 to S-57 to follow, aligned with the development of the IHO S-65 Annex C S-101 to S-57 Conversion Guidance)
    - S-101 trial data assessment
- Testing of production/validation tools to compare functionality and provide the results to Members to help them make informed decisions on the optimal tools to support their conversion routines
- S-57 Knowledgebase updated to include the conversion readiness checks, accessible by Members
- ENC Conversion Knowledgebase developed to include conversion software tool error messages, accessible by Members

- Online training seminars specifically on S-57 to S-101 conversion (delivered Q4 2023), available via LMS

In development:

- An ENC Global Query capability tool to identify trends in Members' ENCs with an overall goal of improving ENC quality, to be demonstrated at the next TC in March 2024
- IC-ENC hosted seminars from the production tool companies on their software tools and specifically conversion functionality/process, amongst other varied topics
- Regional ENC Conversion Workshops to take place during 2024

Joint RENC Support

Through RENC-to-RENC cooperation, the aim is to draw consistent RENC conclusions for Conversion. Both IC-ENC and PRIMAR jointly supported the changes from SHOM to the Synoptic Diagram amended at IHO Council 7.

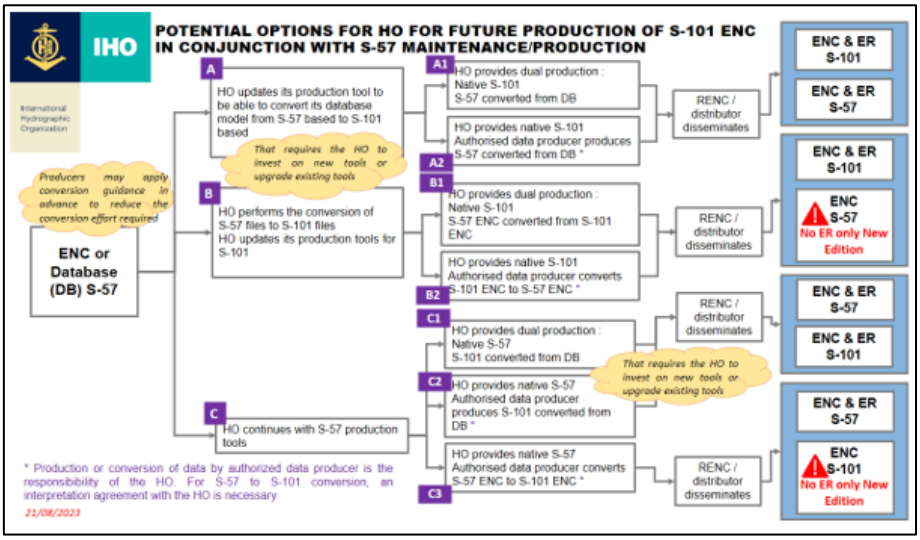

Figure 5 - Synoptic Diagram on Options for HOs for Parallel Production of S-101 and S-57 ENCs

Conclusion

IC-ENC's conclusion is that the most efficient model for dual fuel production for HOs is a combination of:

- HOs adopting the production tools with dual fuel capability (for flat file and/or database driven production)
- Support from IC-ENC with the Conversion Readiness service to ensure that S-57 ENCs are optimised for conversion to S-101 as flat files and/or migration to S-101 database.
- IC-ENC Technical Conferences have concluded that all relevant commercial off the shelf (COTS) tool providers have a roadmap to provide dual fuel functionality (flat file and/or database driven production tools) for HOs.

These conclusions have been endorsed by Members via both Technical Conference and Steering Committee.

IC-ENC will not develop a third-party ENC Conversion service for Members. IC-ENC will continue to monitor this closely as the Product Specifications and production/conversion software tool offerings continue to develop and mature.

Instead, IC-ENC will support Members' transition to S-101 with the IC-ENC Conversion Readiness Service.

Action required of WENDWG14:

The WENDWG14 is invited to:

a. Note this report.