REPORT ON

Project to Demonstrate Availability of Electronic Navigational Charts (S-57 and S-101) in S-100 Electronic Chart Display and Information System along major shipping routes

Contents

Background

The International Hydrographic Organization (IHO) is transitioning from the existing S-57 Electronic Navigational Chart (ENC) standard to the new S-101 ENC standard, part of the broader S-100 framework. Both standards need to be supported simultaneously, also known as "dual fuel" capability.

The International Maritime Organization (IMO) has set a timeline for a phased transition for use on ships. As described in Resolution MSC.530(106), the Electronic Chart Display and Information System (ECDIS) performance standards have been updated. From 1 January 2026 to 1 January 2029, S-100 ECDIS will be optionally available for use. After 1 January 2029, S-100 ECDIS will be mandatory for all new ships. Until all ships are operating and using S-100 ECDIS, both S-57 and S-101 ENCs must be made available.

Project's Main Objective

The IHO-Singapore Innovation and Technology Laboratory (IHO-Singapore Lab) initiated the project to produce and demonstrate dual fuel concept (S-57 and S-101) using a prototype S-100 ECDIS in real-world conditions. The main objective is to demonstrate the availability and smooth operation of ENCs (S-57 and S-101) installed on a S-100 ECDIS along major shipping routes ahead of the 1 January 2026. This aligns with the IHO's commitment to the IMO to support the transition to S-100 standards.

This project was approved by the IHO-Singapore Lab Governing Board in January 2024.

Project Outline

The project comprised two phases:

- Phase 1 involved producing S-57 and S-101 ENCs covering Malacca and Singapore Straits (MSS) and conducting sea-demonstrations.
- Phase 2 involved conducting sea-demonstrations of a wider geographical coverage of shipping routes with S-57 and S-101 ENCs on the Italian Training Ship *AMERIGO VESPUCCI*.

Tasks and Timeline

1. Planning and Preparation	Q1 2024	- Coordinating with participating Hydrographic Offices (HOs), software providers and ENC distributors
2. Data preparation	Q2 2024	- Preparing and converting S-57 to S-101 - Conducting workshops in Singapore and Tokyo for MSS-ENCs - Identifying any data loss or inconsistencies during conversion against the relevant IHO S-101 standards
3. Sea-demonstrations	Q3 2024	- Testing interoperability of S-57 and S-101 ENCs on a prototype S-100 ECDIS while at sea - Using wireless network to update the ENCs - Documenting performance and user experience
4. Reporting	Q4 2024	- Reporting findings to inform on the practical applications of current IHO standards

Test scenarios for sea-demonstrations in Phase 1 and Phase 2

A list of S-101 ENCs used in Phase 1 and Phase 2 is provided in Annex 2. The detailed test scenarios for both Phase 1 and Phase 2 were designed to verify the display of ENCs on the prototype S-100 ECDIS, by

- assessing the simultaneous presentation of both S-57 and S-101 data,

- confirming the presence and accurate portrayal of essential navigational features, and
- verifying the S-57 and S-101 updates can be performed while enroute.

The test scenarios also encompassed a variety of object types (point, curve, and surface) and geographical considerations (areas at cell borders and different cell bands). These scenarios, for S-101 ENCs used in Phase 1 and Phase 2, are provided in Annex 3.

Throughout both phases, the findings focused on application of relevant IHO S-101 standards, as observed during production of S-101 in Phase 1, and through the display of ENCs in the prototype S-100 ECDIS during the sea-demonstrations in Phase 1 and Phase 2.

Production of ENCs, Challenges and Significant Findings under Phase 1 and 2

Production of ENCs

Cartographic work was supported by various software providers i.e. 7Cs, Caris and Esri to convert, produce, and validate the S-101 ENCs based on S-101 Edition 1.2.0, with efforts focused on resolving issues critical to navigation in the converted S-101 dataset, prior to the sea-demonstrations. Only encrypted S-57 ENCs in accordance with S-63 and unencrypted S-101 ENCs with Exchange Set version 5.1 were used on the prototype S-100 ECDIS. Wireless updates of charts at sea were also tested.

Challenges

Phase 1

The Hydrographic Offices of Indonesia, Malaysia, and Singapore, and the Japan Hydrographic Association (JHA) jointly produced six S-57 and three S-101 ENC cells covering the traffic separation scheme along the Malacca and Singapore Straits (MSS). The three S-101 ENC cells were converted from two existing S-57 Band 4 ENC cells, and one overlapping S-57 Band 3 ENC cells. The process involved conducting two in-person harmonisation workshops using various software tools to convert, produce, and validate the datasets (Annex 1).

Both the existing S-57 and converted S-101 MSS-ENCs were then tested on the prototype S-100 ECDIS provided by Republic of Korea in selected areas of the MSS during two sea-demonstrations (Annex 1b).

The conversion from S-57 to S-101, and subsequent refinement of S-101 datasets, required iterative adjustments to produce as accurate S-101 ENCs as possible. These presented challenges for the project partners, particularly as production tools were continually adapting to keep pace with the evolving S-101 specifications from the relevant S-101 working groups. The short 1-year timeline and dynamic environment created a complex situation for ENC production and validation in two aspects:

Evolving S-101 Standards and Production Software Versions

The S-101 Product Specifications Edition 1.2.0 was released in March 2024, and the project commenced during the same period. Thereafter, software tools for Edition 1.2.0 were then able to be developed and used during the project. Thus, managing the time gap between standards revisions and corresponding production software and ECDIS version releases was an ongoing effort, involving:

a. Identifying discrepancies in feature object portrayal and its attributions in S-101 ENCs, as well as among different S-101 software tools.
b. Maintaining regular feedback between data producers and software providers to clarify or to resolve issues via hot fixes or version updates.

c. Understanding how different software tools might interpret the relevant IHO S-101 standards and thus translate S-57 attributes into the S-101 format differently.
d. Deciding whether to accept the conversion results of an S-101 ENC as-is, revert to existing S-57 practices (potentially limiting full S-101 capabilities), or make further adjustments in the post-converted S-101 ENC to align closely with S-101 requirements.
e. Partly due to lack of sufficient validation tools for cross validation, many decisions had to be made on the fly to resolve warnings and errors. This was necessary in order to ensure data integrity and S-101 standards compliance, particularly for navigational-critical elements.

Learning curve on technical changes

The transition from S-57 to S-101 involved data preparation and conversion processes, where data producers needed to:

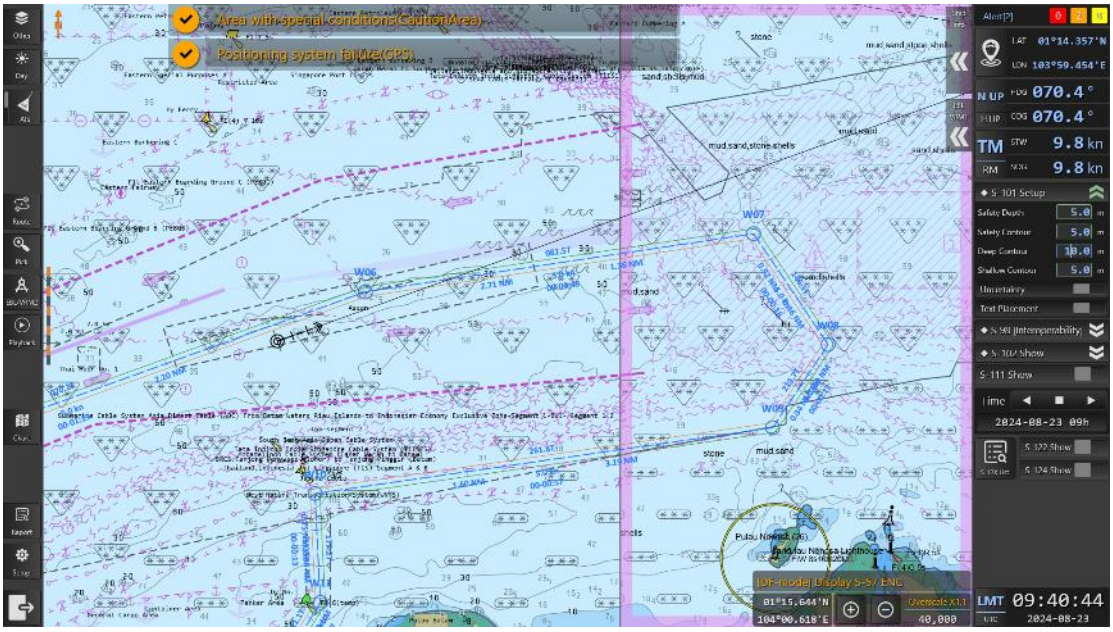
f. Be conversant with S-101 data encoding practices and its nuances.
g. Familiarise with the available array of software tools for converting S-57 to S-101, creating S-101 exchange sets, creating S-101 incremental update files, validating the S-101 datasets, and portrayal of dual fuel ENCs.
h. Evaluate the trade-offs between pre-conversion preparation work of S-57 datasets, and post-conversion compilation or editing required for S-101 datasets.
i. Investigate whether issues encountered were due to compilation process, software gaps, or IHO guidance documents.
j. Identify where information were dropped during conversion, and determine if, and how to retain these information.

Significant Findings during Production of S-101 ENCs and MSS-ENC Harmonisation Workshops

a. A conversion error was identified from S-57 to S-101 where VALNMR was incorrectly handled. The attribute for 'major lights' should be <True> when VALNMR is more than or equal to 10 NM. This was subsequently reported to the software provider and immediately resolved with a software hotfix.
b. Validation revealed issues on DuplicateFeatureAssociation for SpecialPurposeGeneralBeacon and RelatedObjRecNotDefined for LightAllAround. These were investigated by the data producers and software providers, and subsequently resolved with a software hotfix.
c. AtoN structures were not displaying correctly in S-101 ENC on the production and validation software tools. This was subsequently resolved in software providers' respective later released versions.
d. The software tools used during the project were not able to create only the S-101 ENC update file. Creating exchange sets for S-101 ENC updates were only possible with the base cell, including any prior update files, and the new update file.
e. When an S-101 update file contained an AMEND instruction for a feature object (e.g. amending light characteristics of a buoy), the amended feature object attributes were incorrect (i.e. the Topmark sub-attribute Topmark/Daymark Shape did not appear), and portrayal was missing in the prototype S-100 ECDIS software. This issue was not observed in production software tools. Hence, data producers had to use INSERT/DELETE instructions instead of AMEND instructions to reflect the update correctly in the prototype S-100 ECDIS.

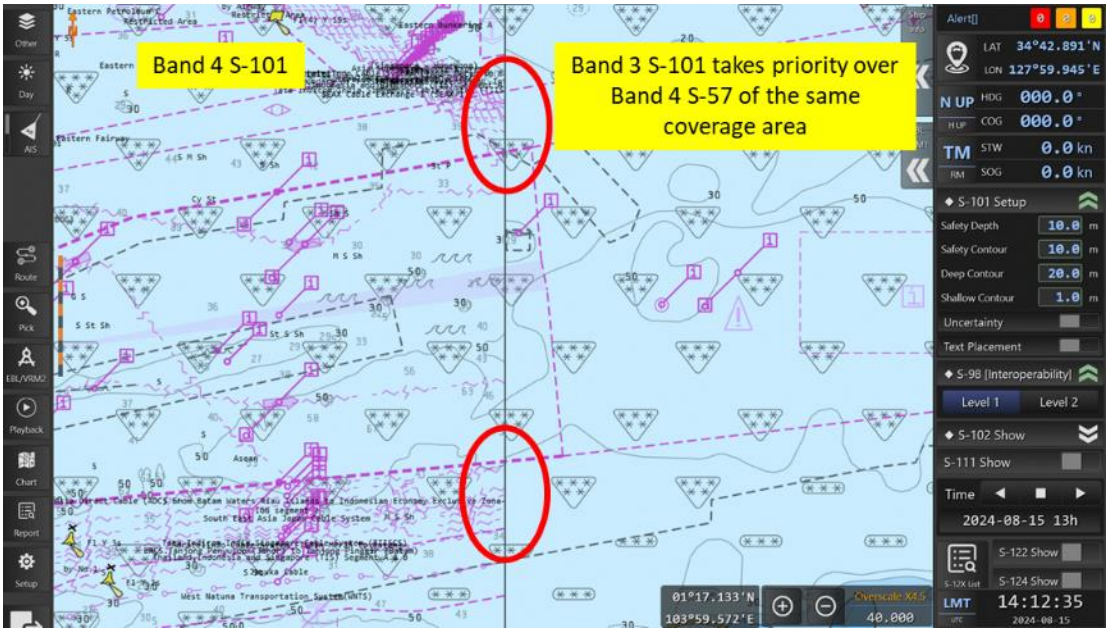
Significant Findings during MSS Sea-demonstrations

f. The transition between the S-57 chart and the S-101 chart of the same band (e.g. between two S-57 Band 3 ENCs or two S-57 Band 4 ENCs) appeared seamless and continuous in the prototype S-100 ECDIS. This allowed for **navigation without visual disruptions** when transitioning between areas covered by different chart formats.



Screenshot of a Band 4 S-101 ENC and a Band 4 S-57 ENC. The area where the S-57 ENC is displayed is demarcated with a magenta border, and a text "[DF-mode] Display of S-57 ENC" indicates that the S-57 ENC is currently displayed.

g. However, it was also **observed that S-101 ENCs took priority, regardless of scale, over S-57 ENCs** in the prototype S-100 ECDIS. As a result, when there was a larger-band S-57 ENC available within the same coverage area of a smaller-band S-101 ENC, the feature objects that are only available in the larger-band S-57 ENC would be hidden. This could potentially lead to visual discontinuities and information gaps when transitioning between areas covered by different chart formats of different bands.



A Band 4 S-57 ENC (right side) was observed to be hidden by a Band 3 S-101 ENC covering the same area.

h. Overscale indication was observed (depicted above as "Overscale X4.5") in the prototype S-100 ECDIS, but the **overscale portrayal pattern was not triggered**. In current S-57 ECDIS, it is

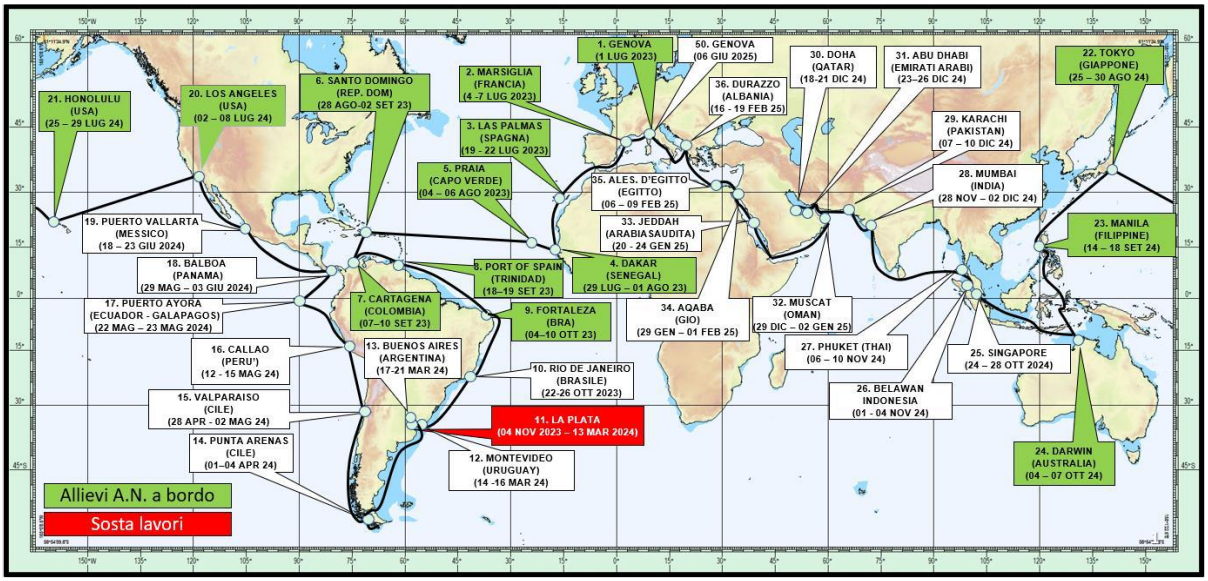
possible to toggle the overscale portrayal on/off, depending on the mariners' preferences and the benefits the overscale portrayal offers during route planning or route monitoring.

i. In S-101 ENC, when a feature object's (e.g. wreck) Value of Sounding is <empty>, the portrayal of the feature object on the prototype S-100 ECDIS software is *QUESMRK1* "". However, on production tools as well as in S-57 ENC, the portrayal is a *ISODGR01* "". This would need to be informed to relevant working groups for clarification on the intended S-101 portrayal of feature objects in these scenarios.

j. Both S-57 and S-101 ENCs incremental update files were **downloaded while enroute and successfully applied** in the prototype S-100 ECDIS, which is crucial for maintaining up-to-date navigational information during voyages. Though some basic operational steps were required to load the update files, the process did not significantly interrupt navigation.

Phase 2

The IHO-Singapore Lab capitalised on the opportunity of Italian Training Ship *AMERIGO VESPUCCI's* 20-month world tour from 2023-2025 to conduct trials across a wider geographical coverage along major shipping routes. During a segment of its world tour, the Italian Training Ship *AMERIGO VESPUCCI* tested both the S-57 and S-101 ENCs, including those from Phase 1, on the prototype S-100 ECDIS installed onboard, from the west coast of the United States of America to MSS (Annex 1c).

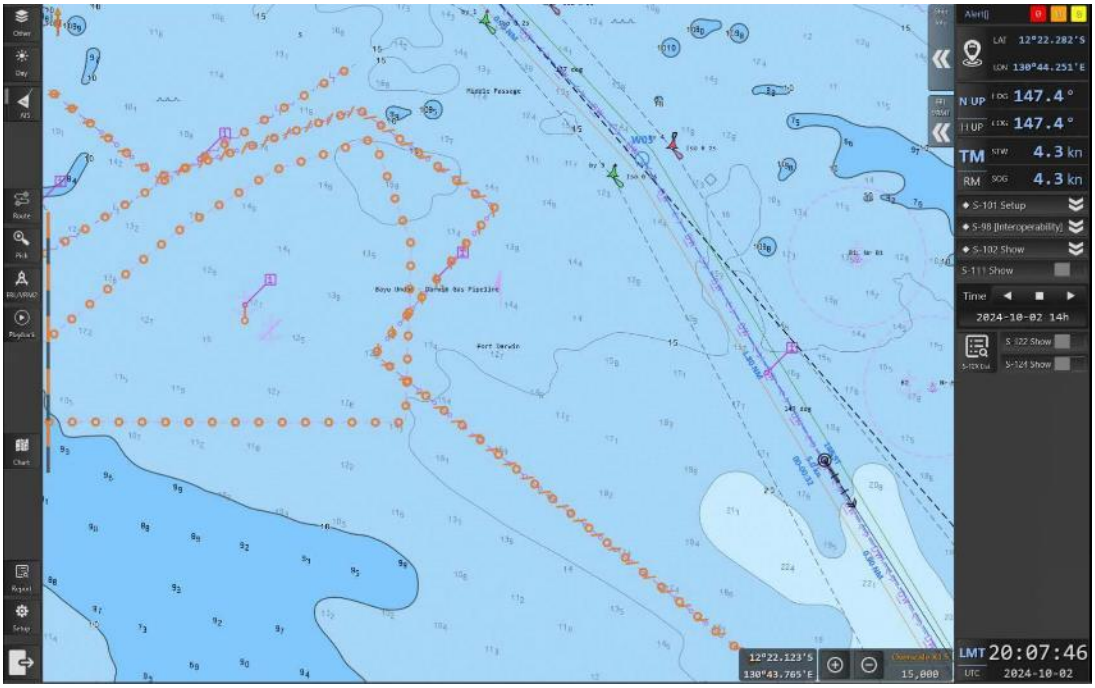


AMERIGO VESPUCCI world tour planned route

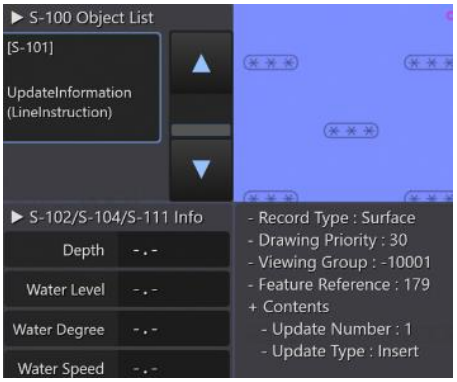
The Hydrographic Offices of Japan (JHOD), the United Kingdom (UKHO), and the United States of America (NOAA) contributed data for various segments of the route. Additionally, despite the very short notice given, the Australian Hydrographic Office (AHO) provided 14 S-101 ENCs for the Darwin area.

Significant Findings during AMERIGO VESPUCCI Sea-demonstrations

a. Indication of a **successfully applied S-101 incremental update was observed** as shown in orange in the prototype S-100 ECDIS. This view can be toggled on/off, depending on the needs of the mariner. However, **data producers would need to encode this information in the S-101 dataset**.



Applied S-101 ENC incremental updates shown in orange



Encoding of UpdateInformation in S-101 dataset

Funding Support

The project had very good response and support for HOs and industry partners. Majority of the funding support was provided through in-kind contributions from the project partners from initial planning to execution. The figures represent an approximated value of contributions across both project phases. Due to the nature of in-kind contributions, actual costs may vary. The total contributions from partners, excluding software and equipment related costs, are estimated to be €95,000. These figures should be interpreted as indicative of the project's scale rather than as project expenditures.

Phase 1:

Funding Support (in-kind)		**Approximated Cost of Item**
Category	**Items**	**€K**
Manpower	Hydrographic Offices of Indonesia, Malaysia and Singapore and Japan Hydrographic Association (JHA): - provision of MSS S-57 and S-101 test datasets - conduct of the two MSS-ENC Harmonisation Workshops - coordinate and conduct two MSS sea-demonstrations	€30k
Equipment	7Cs, Caris, and Esri:	€25k

	- software tools & licenses - technical support KHOA: - Prototype S-100 ECDIS for Phase 1 project partners	 €10k
Others	Administrative, Logistics and IT	€5k
	Total	**€70k**

Phase 2:

Funding Support (in-kind)		**Approximated Cost of Item €K**
Category	**Items**	
Manpower	Hydrographic Offices of Australia (AHO), Japan (JHOD), United Kingdom (UKHO), United States of America (NOAA) and Regional ENC Coordinating Centre (IC-ENC): - provision of the S-57 and S-101 test datasets for *AMERGIO VESPUCCI* planned route Italian Navy, Italian Hydrographic Institute (IIM) and project team onboard *AMERGIO VESPUCCI*: - coordinate and conduct of sea-demonstrations from west coast of the U.S. to MSS	€30k €25k
Equipment	KHOA: - Prototype S-100 ECDIS for Phase 2 project partners	€10k
Others	Administrative, Logistics and IT	€5k
	Total	**€70k**

Recommendations

The following recommendations based upon the challenges faced and provide assistance to HOs and industry partners in facilitating a smooth implementation of S-101 ENCs, in the lead up to 1 January 2026.

<u>Production and Validation Software</u>

a. Encourage software providers to make various tools available for data producers to trial conversion of S-57 ENCs and production of S-101 ENCs.
b. Encourage regular feedback between data producers and software providers to promptly identify and resolve issues, e.g. discrepancies in feature object portrayal and attributions, which may arise from the product specification revisions and subsequent software versions.

<u>S-100 ECDIS</u>

c. Encourage ECDIS manufacturers to make S-100 ECDIS available for data producers and mariners to trial the simultaneous handling of S-57 and S-101 ENCs in dual fuel mode, including respective update files.

<u>Relevant S-100/S-101 Product Specifications</u>

d. Clarify protocols for handling the display priority of S-101 ENCs over S-57 ENCs, especially when dealing with different formats at different scale bands.

e. Clarify handling of feature object portrayal of both S-57 and S-101 ENCs among production software, validation software and S-100 ECDIS for objects with <empty> or undefined values, e.g. how wrecks with an <empty> 'Value of Sounding' attribute should be depicted (as "?" or "⊗").
f. Clarify handling of S-101 ENC update functionality among production software, validation software and ECDIS for objects with AMEND instruction, e.g. amending light characteristics.
g. Clarify the intended trigger and toggle options for overscale portrayal functionality of both S-57 and S-101 ENC in S-100 ECDIS.

Sea trials and user guidance

h. Encourage participation from hydrographic offices worldwide in providing S-101 ENCs for more testing in sea trials across various geographical areas and covering more navigational scenarios to identify any potential gaps.
i. Promote the exchange of knowledge and provide guidance to mariners on interpreting S-101 ENC and operating S-100 ECDIS in dual-fuel mode.

Conclusion

The project successfully demonstrated the production, validation and use of both S-57 and S-101 ENCs on a prototype S-100 ECDIS in real-world conditions.

During the data preparation stage, data producers worked with new production tools and processes, in the midst of ongoing revisions to S-101 product specification and corresponding software versions. The conduct of harmonisation workshops were most valuable, especially with the full support from software providers. It facilitated exchange of ideas on S-101 ENC conversion and production, thus supporting compilation efforts and quality assurance.

During the subsequent sea-demonstrations, when vessel moved through ENC cells, the display transition between S-57 and S-101 ENC of the same band was observed to be largely seamless, allowing for navigation without visual disruptions to mariners. However, when a larger-scale band S-57 ENC was available within the same coverage area of a smaller-band S-101 ENC, S-101 ENC would take priority. This raises concerns about potential inability to use a more appropriate chart scale when transitioning between areas covered by S-57 and S-101 ENCs of different bands.

Aside from the issues resolved immediately by software providers' hot fixes, other issues identified throughout Phase 1 and Phase 2 will require further investigation and guidance from relevant S-100 working groups. For example, the correct portrayal of S-57 and S-101 ENCs to achieve consistency across production software, validation software, and S-100 ECDIS such as the:

- handling of different ENC formats of different bands;
- criteria for triggering overscale portrayal pattern and options for user control of its display;
- handling of AMEND instructions in S-101 updates, where the alternative was to use INSERT/DELETE instructions; and
- different symbology "⊗" and "?" used in S-57 and S-101 ENCs respectively for feature objects (e.g. wrecks) with <empty> Value of Sounding.

Additionally, an issue pertaining to production software was identified:

- The limitation in generating stand-alone update files in S-101 ENC exchange set.

Addressing all these issues are essential to ensure that the S-101 ENC production and validation software functionalities align with cartographic practices and that S-100 ECDIS systems meet safety of navigation requirements and mariners' needs.

The project highlighted the need for continuous collaboration and testing are essential for a smooth and effective implementation of S-101 ENC, benefiting both data producers and mariners. The findings and recommendations will contribute to refining S-100 products and processes, while helping to ready the maritime community for S-100 implementation and meeting the IMO's timeline.

Acknowledgements

The success of this project was made possible through the support of numerous organisations. These partners have generously provided resources, facilities, assets, expertise, and technology crucial for the production and sea-demonstrations of S-101 ENCs on S-100 ECDIS.

- The Hydrographic Offices of Indonesia, Malaysia, and Singapore, and Japan Hydrographic Association (JHA), for their joint efforts in producing and testing the Malacca and Singapore Straits Electronic Navigational Charts (MSS-ENCs).
- The Italian Navy, the Italian Hydrographic Institute and the project team onboard *AMERIGO VESPUCCI* for their participation in the global sea trials, during the ship's world tour.
- Republic of Korea (KHOA) for provision of the prototype S-100 Electronic Chart Display and Information System (ECDIS).
- Australia (AHO) for their support in providing 14 S-101 ENCs for Darwin area.
- Japan (JHOD), United Kingdom (UKHO), United States of America (NOAA), Regional ENC Coordinating Centre (IC-ENC), for their support in providing ENCs for coverage of *AMERIGO VESPUCCI's* planned route.
- Software providers 7Cs, Caris, Esri, for their technical support in S-101 ENC production and validation.

Annex 1a: Report – Conversion and Production of S-101 MSS-ENCs (Phase 1)

The Malacca and Singapore Straits Electronic Navigational Charts (MSS-ENCs) consists of six ENC cells covering from One Fathom Bank in the Malacca Strait to Eastern Bank in the South China Sea, and is jointly produced by hydrographic offices of the three littoral states of the Malacca and Singapore Straits – Indonesia, Malaysia and Singapore, and supported by the Japan Hydrographic Association. The first edition of the MSS-ENC was published in 2005.

For this project, in addition to the existing six S-57 ENCs, three S-57 MSS-ENCs were also converted to S-101 using software tools supporting S-101 Edition 1.2.0.

1st Harmonisation Workshop on MSS-ENCs

a. Converted and Produced S-101 using Esri ArcGIS Pro.
b. Compared findings on 7Cs Analyzer with IHO Standards documents.

2nd Harmonisation Workshop on MSS-ENCs

a. Resolved follow-up tasks from the First Workshop, including discussing and prioritising of newly discovered errors or warnings.
b. Discussed how to create S-101 exchange set and how to create incremental updates files for the S-101 product using Caris tools.
c. Finalised the test scenarios at sea.

(left) The 1st Harmonization Workshop – Singapore, 11 - 13 June 2024
(right) The 2nd Harmonization Workshop – Japan, 30 July – 1 August 2024

Software tools used

CONVERTER		
SOFTWARE	**VERSION**	**Feature Catalogue 1.2 Compatible**
ArcGIS Pro	3.3	Yes
Caris S-57 Composer	5.0.3	Yes

VALIDATION		
SOFTWARE	**VERSION**	**Feature Catalogue 1.2 Compatible**
*7Cs Analyzer	5.2.9	Yes

VIEWER

SOFTWARE	VERSION	Portrayal Catalogue 1.2 Compatible
NIWC	1.9.6	Yes
*7Cs Analyzer	5.2.9	Yes
Caris S-57 Composer	5.0	Yes

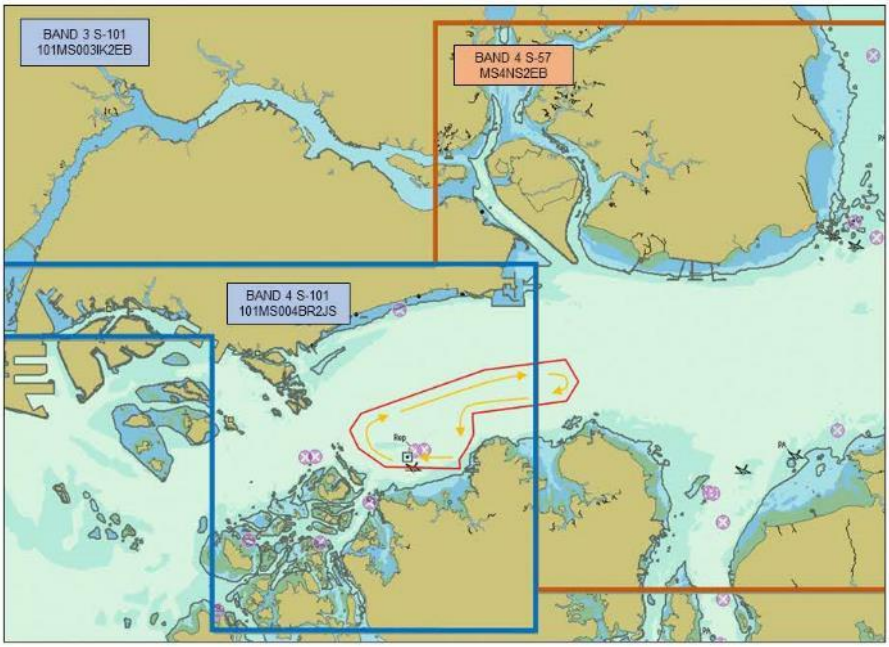
**7Cs Analyzer version 5.2.9 was used for 1st and 2nd Harmonisation Workshop. Version 5.3.0 was used thereafter.*

Annex 1b: Report – MSS Sea-demonstration (Phase 1)

1st Malacca and Singapore Straits (MSS) Sea-demonstration

The first MSS sea demonstration was conducted on the Indonesian Navy vessel KRI SPICA-934, in the eastern part of the straits. Test scenarios relevant to this area were conducted on the prototype S-100 ECDIS.

1st Malacca and Singapore Straits (MSS) Sea-demonstration, Batam, Indonesia, 22 - 23 August 2024



Start & End Point:
Batu Ampar Harbour

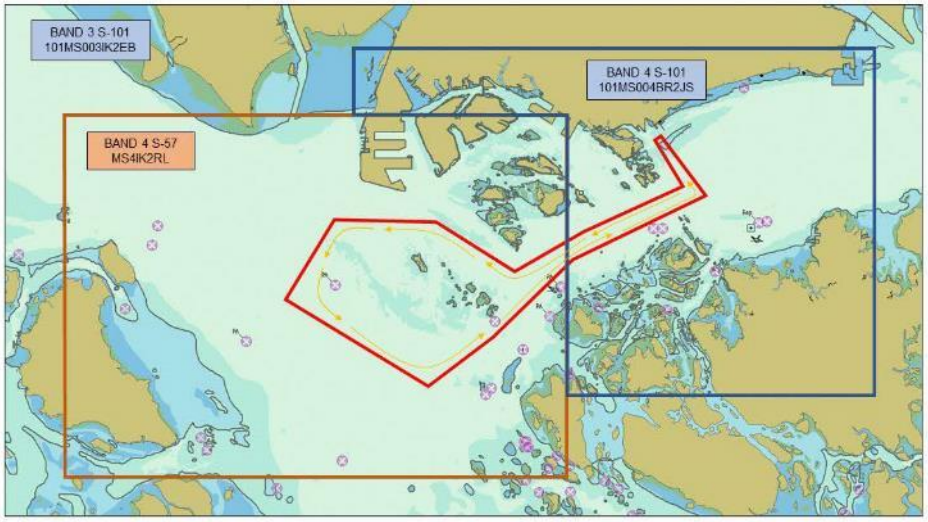
Distance : +/- 29 nm
Duration : 3 Hour

3 ENCs used:
2 Band 4 and 1 overlapping Band 3 (in S-57 and S-101 format)

2nd Malacca and Singapore Straits (MSS) Sea-demonstration

The 2nd MSS sea-demonstration was conducted on Singapore Maritime and Port Authority (MPA) *MATA IKAN*, in the western part of the straits. Test scenarios relevant to this area were conducted on the prototype S-100 ECDIS.

2nd Malacca and Singapore Straits (MSS) Sea-demonstration, Singapore, 25 - 26 September 2024



Start & End Point: Marina South Pier

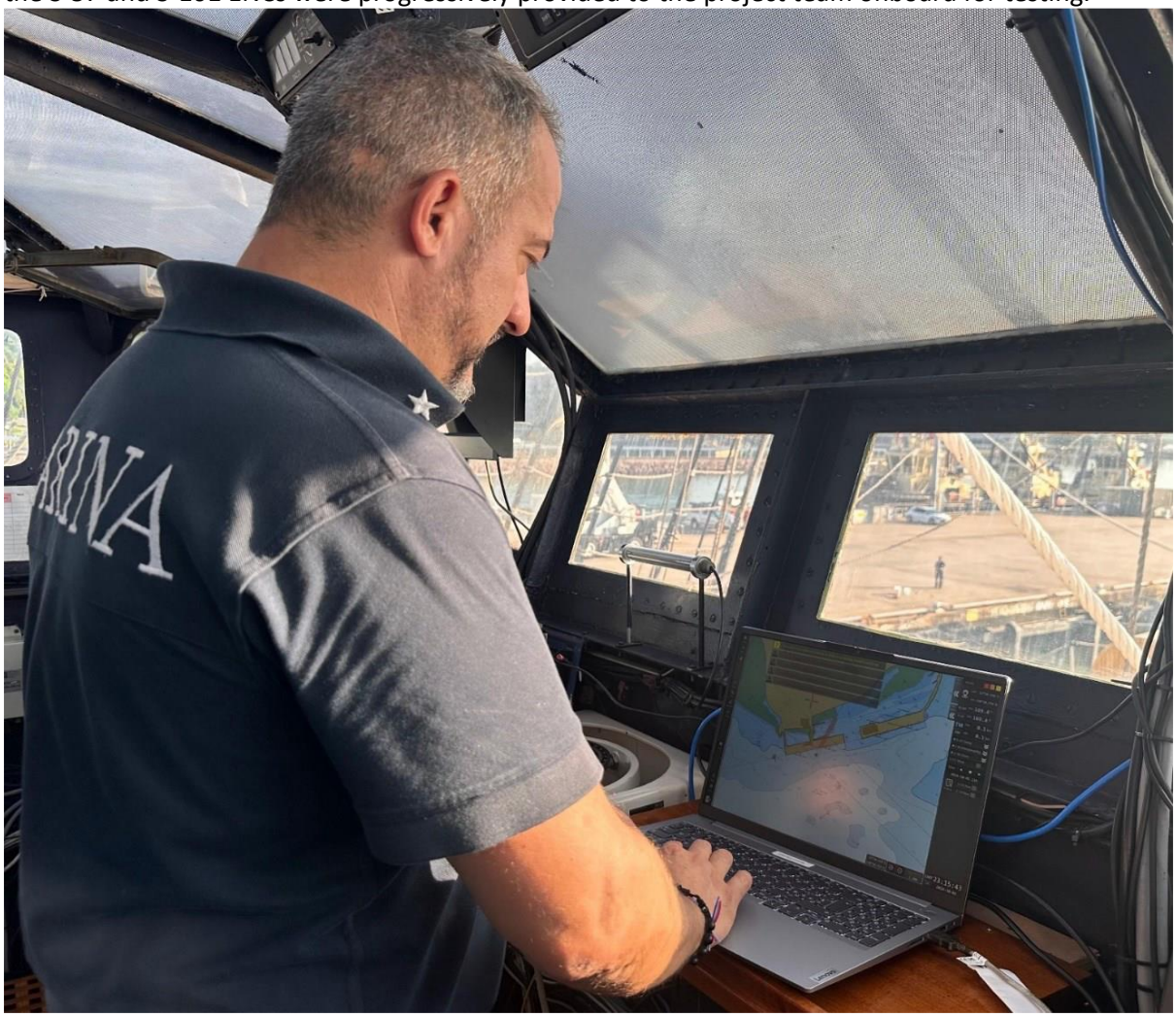
Distance: +/- 60 nm

Duration: 5 Hour

Three ENCs used: Two Band 4 and one overlapping Band 3 (in S-57 and S-101 format)

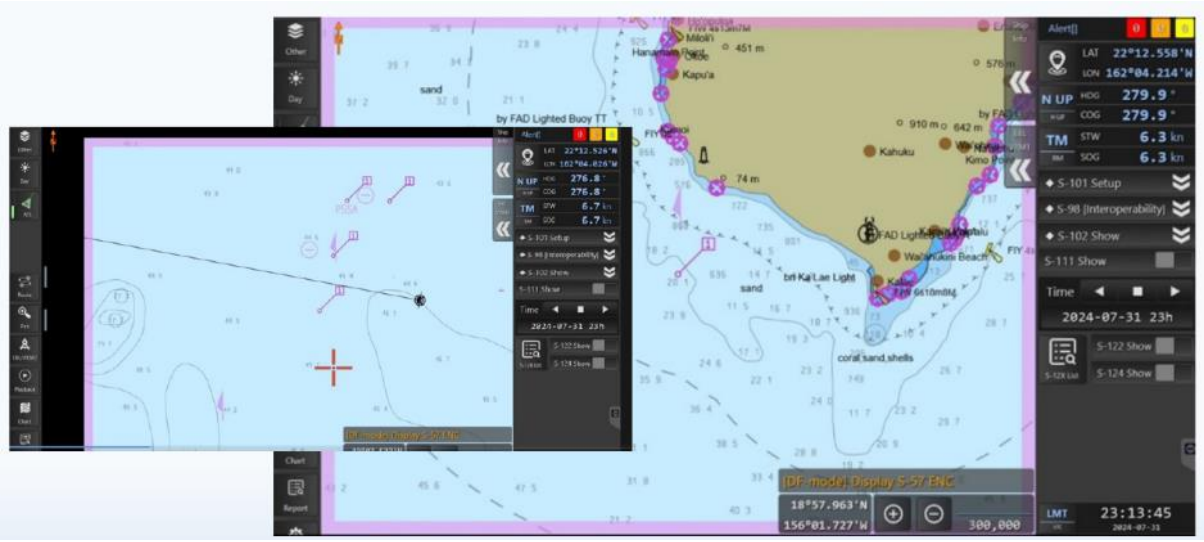
Annex 1c: Report – *AMERIGO VESPUCCI* Sea-demonstration (Phase 2)

The prototype S-100 ECDIS software was installed on *AMERIGO VESPUCCI* in April 2024. Subsequently, the S-57 and S-101 ENCs were progressively provided to the project team onboard for testing.

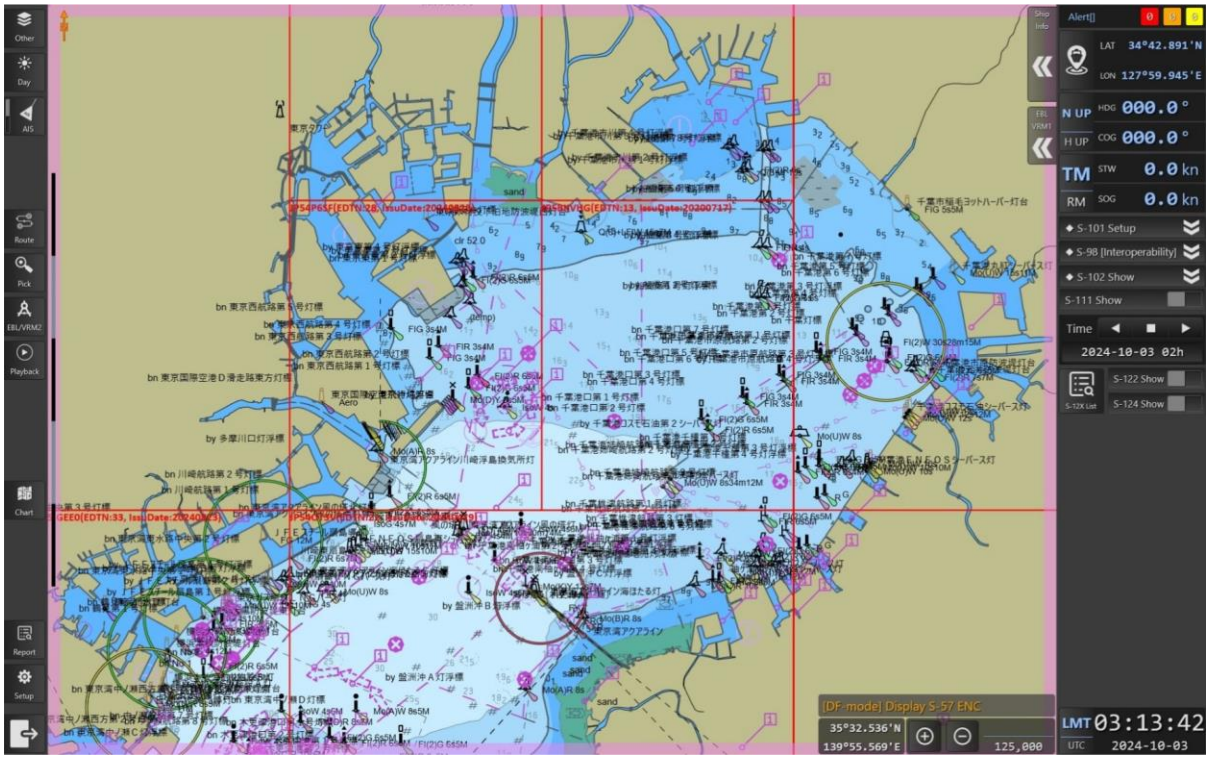


AMERIGO VESPUCCI ECDIS Operator

S-57 ENCs were tested covering the ship's planned route, from the west coast of the United States of America to the Malacca and Singapore Straits (MSS).



Honolulu



Tokyo

The entry into and departure from Port of Darwin were tested, involving 14 S-101 ENCs provided by the Australian Hydrographic Office (AHO).

AMERGIO VESPUCCI visit to Darwin

The entire Malacca and Singapore Straits was tested, including test scenarios in areas not covered in Phase 1, as well as confirmation that the results from Phase 1 were consistent.

AMERGIO VESPUCCI visit to Singapore

Annex 2: List of S-101 ENCs Used in Phase 1 and Phase 2

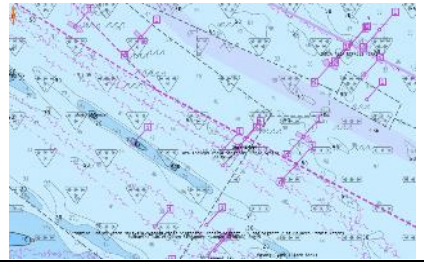
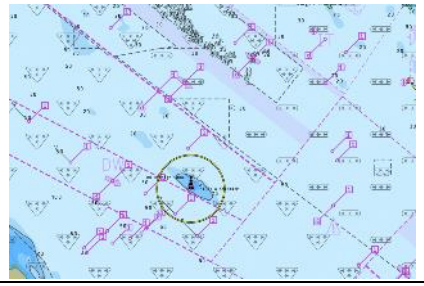
Malacca and Singapore Straits (Phase 1 and Phase 2):
101MS004BR2JS
101MS003IK2EB
101MS003RS2FC

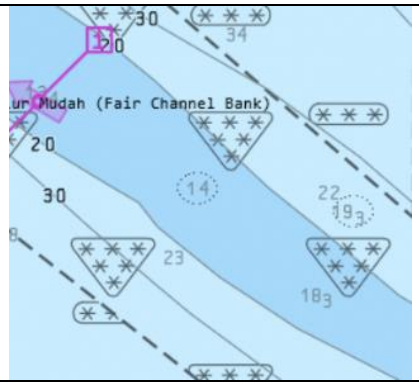
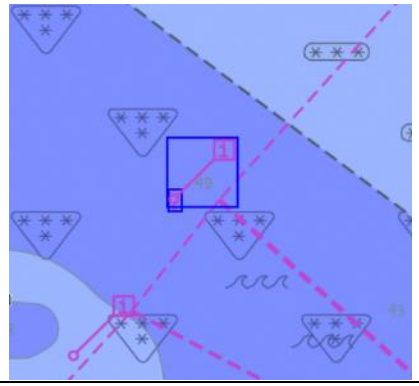
Darwin, Australia (Phase 2):
101AU005DRW01
101AU00210120
101AU00220110
101AU00220120
101AU00309128
101AU00310128
101AU00311128
101AU00312125
101AU00312126
101AU00312127
101AU00312128
101AU00412129
101AU00413129
101AU00413130

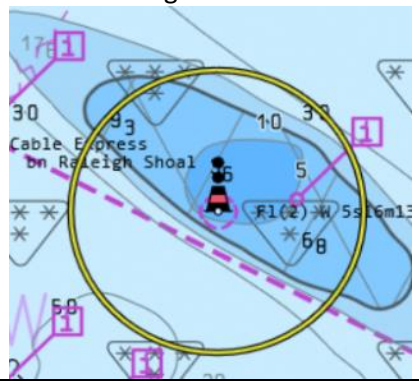
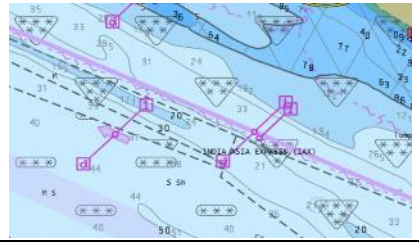
Annex 3: List of Test Scenarios for S-101 ENCs in Malacca and Singapore Straits and in Darwin

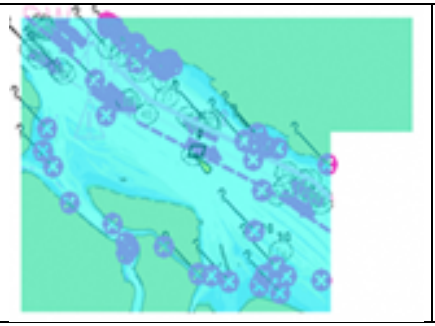
Test Scenarios for S-101 ENCs (Malacca and Singapore Straits)

Cell Name: 101MS003RS2FC

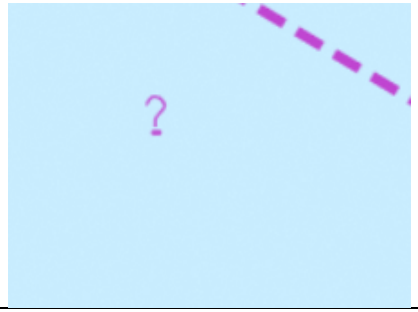
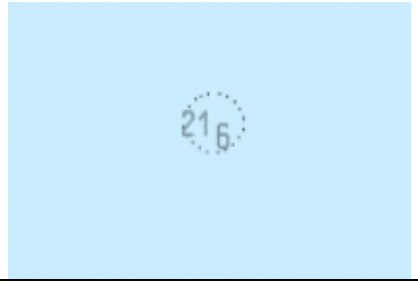
Edition	Feature Object	Position Lat Long (degree minute)	Check
.000	Pipelines 	2-13.244N 102-07.710E	Text description and portrayal
.000	Cable 	01-49.114N 102-43.471E	Text description and portrayal
.000	TSS 	-nil-	- Information - Portrayal / display
.000	OBSTRN 14m	01-34.440N 103-00.709E	Portrayal / display

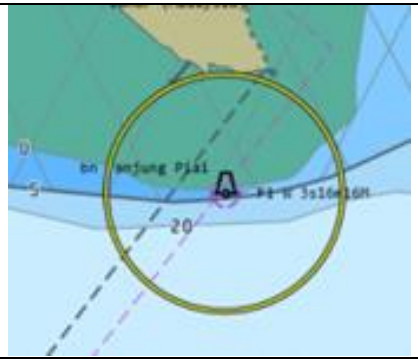
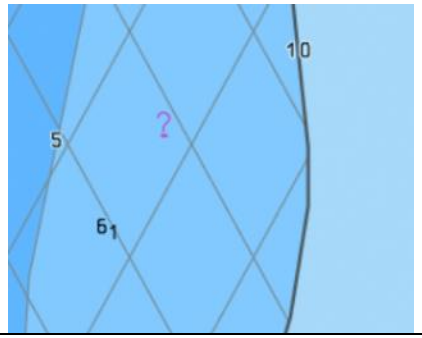
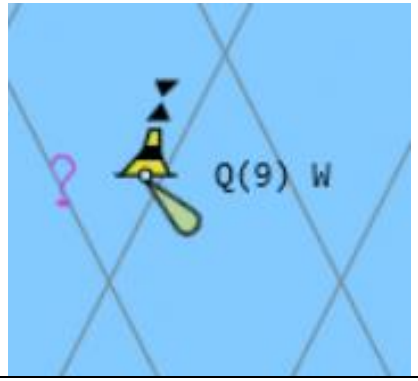
			
.000	Wreck 	02-02.790N 102-01.750E	Portrayal / display
.000	BCNSPP	01-37.210N 102-57.130E	Portrayal / display

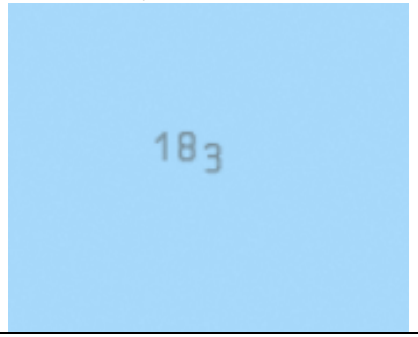
			
.000	BCNISD Raleigh Shoal 	02-06.779N 101-53.063E	Portrayal / display
.001	Submarine cable 	01-49.38N 102-35.15E	Update, [INSERT submarine cable]
.000	Cell border	1-05-59.97156N 101-42-00E 2-18-00N 103-27-00E	Is there a line to demarcate S-57 and S-101? Adjacent cells are MS3OF2TT (S-57), MS3IK2EB (S-101)

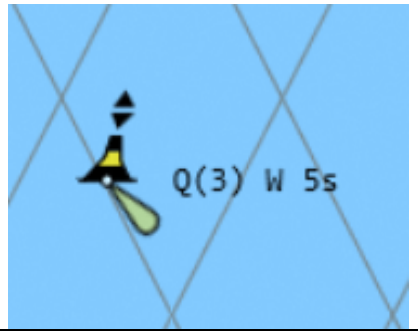
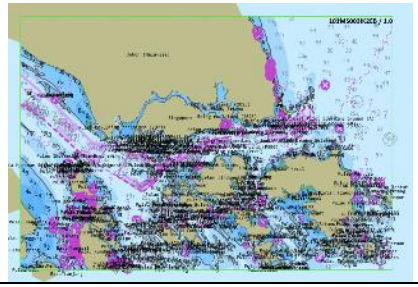
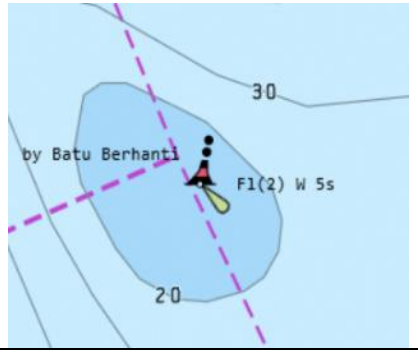
			

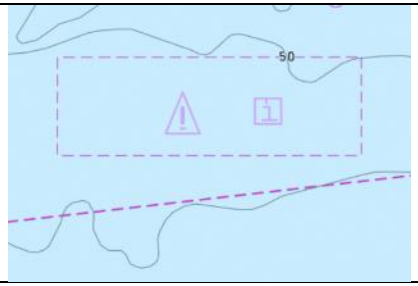
Cell Name: 101MS003IK2EB

Edition	Feature Object	Position Lat Long (degree minute)	Check
.000	Wreck 	01-09.780N,103-25.500E	Portrayal
.000	Wreck 	01-11.510N,103-32.460E	Portrayal
.000	BEACON SPP, Tanjung Piai	01-15.520N,103-30-570E	LightsAllAround portrayal

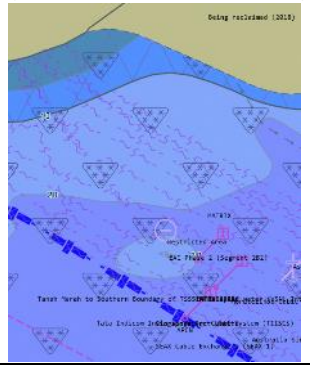
			
.001	Wreck 	01-25-240N,104-18.080E	Update, [INSERT wreck]
.002	Cardinal Mark 	01-25.240N,104-18.110E	Update, [INSERT west cardinal mark]

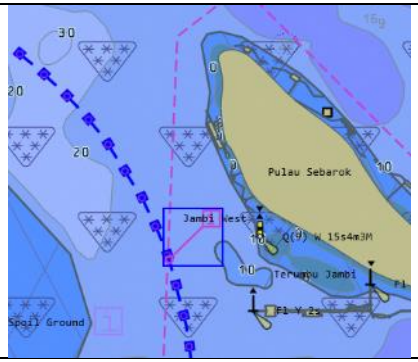
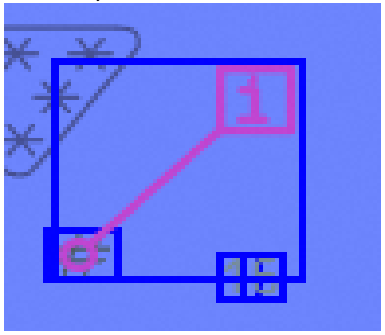
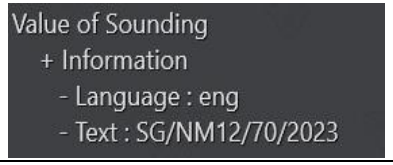
.003	Cardinal Mark 	01-25.240N,104-18.110E	Update, [AMEND west cardinal mark to east cardinal mark]
.003	SOUNDING, 18.3M 	01-27.920N,104-21.500E	Update, [DELETE sounding]
.004	Cardinal Mark 	01-25.250N,104-18.210E	Update, [MOVE cardinal mark from 01-25.24N,104-18.11E to 01-25.25N,104-18.21E]

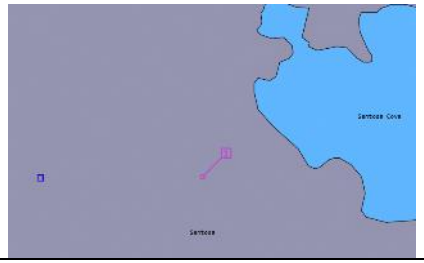
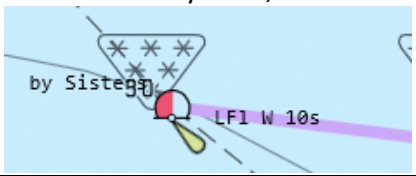
.005	Cardinal Mark 	01-25.250N,104-18.210E	Update, [REPLACE cardinal mark]
.000	Cell border 	0-40.000N, 103-05.000E/ 1-50.000N, 104-50.000E	Is there a line to demarcate S-57 and S-101? Adjacent cells are MS4IK2RL (S-57), MS4NS2EB (S-57), MS4BR2JS (S-101)
.000	BOYISD Batu Berhanti 	01-11.752N 103-52.504E	Portrayal (different scale compared to MS4BR2JS)
.000	Precaution Area	1-14.882N 104-05.533E	Portrayal

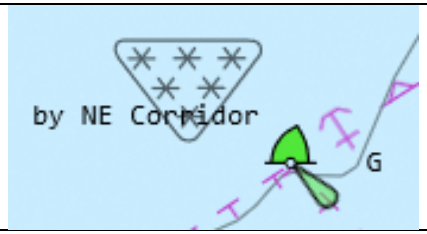
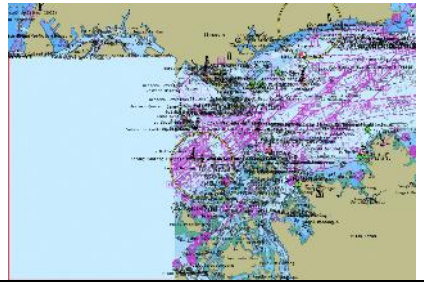
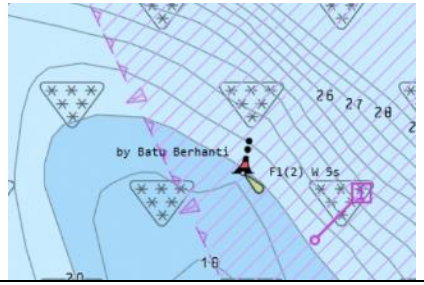
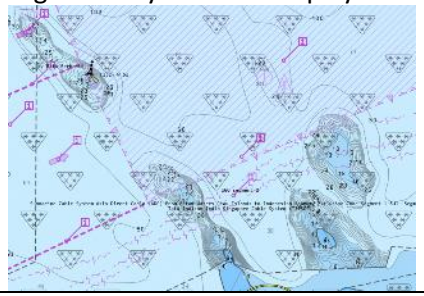
			

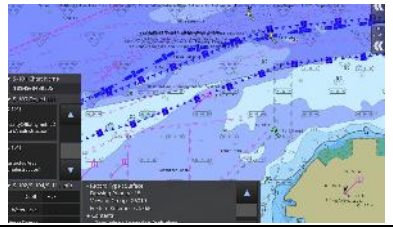
Cell Name: 101MS004BR2JS

Edition	Feature Object	Position Lat Long (degree minute)	Check
.000	Cable, Pipelines (Name of CBLSUB: APCN) 	1-17.506N 104-01.516E	Text Description Name of TXTDSC: 101MS00CB_PLS (Simulation purposes only)
.000	Cable, Pipelines (Name of PIPSOL: No name)	1-11.740N 103-47.447E	Text Description Name of TXTDSC: 101MS00CB_PLS

			
.000	TSS	-nil-	Information (e.g direction, Nautical Information)
.000	Obstruction (CATOBS Foul Ground)  	01-11.120N 103-47.620E	Check Encoding of Obstruction (This is no longer OBSTRN in S-101. This is now a FoulGround.)
.000	Sebarok Beacon	01-11.872N 103-48.433E	Portrayal and LightAllAround

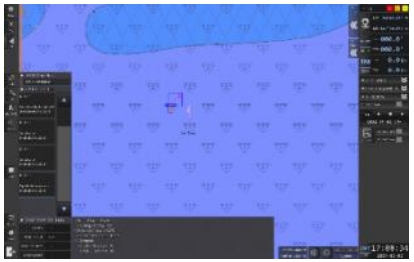
			
.000	Landmark 	01-15.044N 103-50.033E	- Prescence of Landmark - Visually Prominance Attribute is unknown (The landmark, which is a CTRPNT, existed both in S-101 & S-57 datasets.) (Visual Prominence Attribute has been input as "Not Visually Conspicuous”) in S-101
.001	Safe water buoy mark, Sister 	01-12.419N 103-48.773E	Update, [DELETE safe water buoy mark, Sister]
.002	Selegi Beacon 	01-13.582N 103-49.593E	Update, [DELETE Selegi Beacon]
.003	NE Corridor lateral mark buoy (starboard)	01-15.432N 103-53.812E	Update, [AMEND From Flashing (1) 5 seconds to Fixed. (Simulation purposes only)

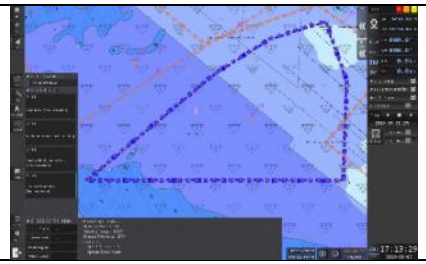
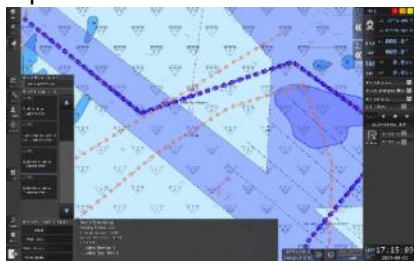
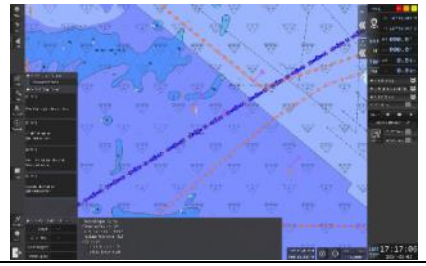
			
.000	Cell border 	Long: 103-47.000E, 103-36.000E, 104-03.000E Lat: 01-16.500N	Is there a line to demarcate S-57 and S-101? Adjacent cells are MS4IK2RL (S-57), MS4NS2EB (S-57), MS3IK2EB (S-101)
.000	BOYISD Batu Berhanti 	01-11.752N 103-52.504E	Portrayal (different scale compared to MS3IK2EB)
.000	High Density Contour Display 	01-11.476N 103-53.176E	Portrayal (different scale compared to MS3IK2EB)

.000	Restricted Area 	1-10.528N 103-54.902E	Portrayal

Test Scenarios for S-101 ENCs (Darwin, Australia)

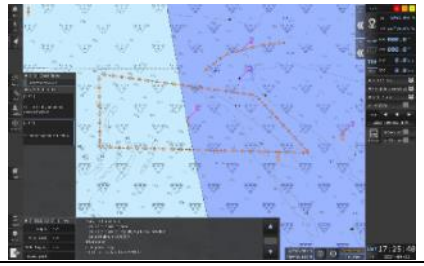
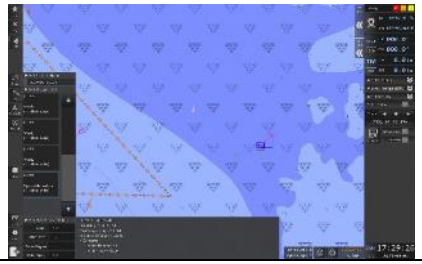
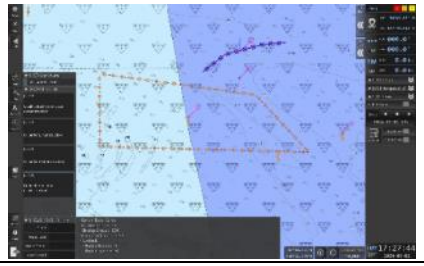
Cell Name: 101AU005DRW01

Edition	Feature Object	Position Lat Long (degree minute)	Check
.000	-nil-	-nil-	Display (of the ECDIS) along the transit from 12-33.009S (approximately at Channel Rock)
.001	-nil-	-nil-	Update process
.001	Sandwave 	12-21.307s 130-41.128e	Update, [ADD] UpdateInformation of the object
.001	Anchorage Area	12-21.707s 130-41.951e	Update, [ADD] UpdateInformation of the object

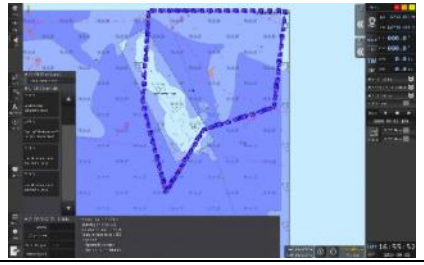
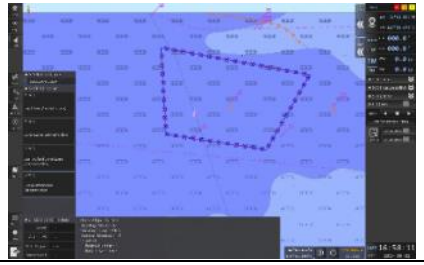
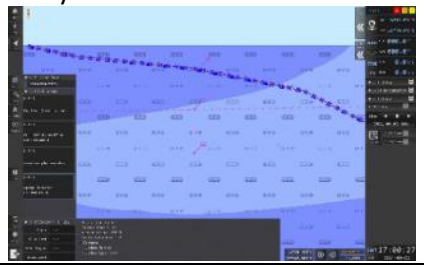
			
.001	PipelineSubmarineOnLand 	12-21.107s 130-42.657e	Update, Modify and Move UpdateInformation of the object
.001	CableSubmarine 	12-21.466s 130-41.206e	Update, [ADD] UpdateInformation of the object

Cell Name: 101AU00413130

Edition	Feature Object	Position Lat Long (degree minute)	Check
.000	-nil-	-nil-	Display of the boundary of S-101 101AU00413130 and S-57 AU413131
.001	-nil-	-nil-	Update process

.001	Seabead Area 	12.365s 130.478e	Update, [DELETE] UpdateInformation of the object
.001	Wreck 	12-21.357s 130-30.532e	Update, Modify and Move UpdateInformation of the object
.001	OilBarrier 	12-19.062s 130-27.591e	Update, [ADD] UpdateInformation of the object
.001	AdministrationArea 	12-20.942s 130-26.223e	Update, [ADD] UpdateInformation of the object

Cell Name: 101AU00413129

Edition	Feature Object	Position Lat Long (degree minute)	Check
.000	-nil-	-nil-	Display of the boundary of S-101 101AU00413129 and S-57 AU413128
.001	-nil-	-nil-	Update process
.001	Caution Area 	12-03.317s 129-55.630e	Update, Modify and Move UpdateInformation of the object
.001	Custom Zone 	12-03.629s 129-43.206e	Update, [ADD] UpdateInformation of the object
.001	FerryRoute 	12-00.341s 129-44.820e	Update, [ADD] UpdateInformation of the object