

S-100 Testbed Project of KHOA



22 Feb. 2023

KRISO Sewoong OH

On behalf of KHOA(Izzy Kim)



00 Contents

- **Introduction**
 - Objectives/Scope
- **Status**
- **Stakeholders**
- **Challenges**
- **Project management**
- **Lessons learnt**
- **Recommendations**



01 Introduction

- **Objectives**
 - Support the S-100 development of IHO for the S-100 infra system and S-100 testing system
 - Promote sharing platform of S-100 knowledge and resources
 - Provide the S-100 data for domestic e-Navigation project
 - Prepare the S-100 implementation plan of IHO
 - Establish and operate the national S-100 committee



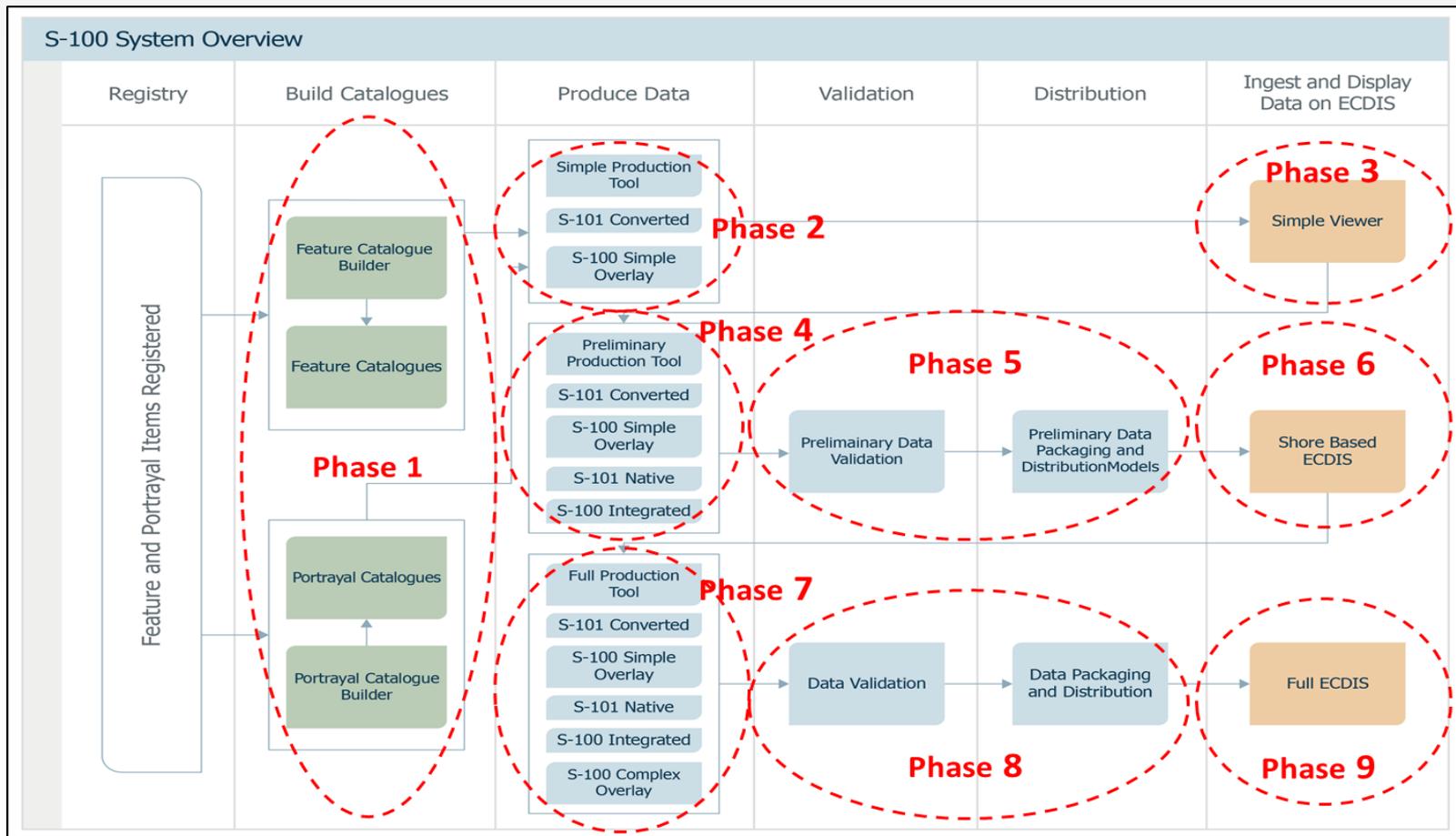
01 Introduction

- **Scope of KHOA S-100 testbed project**
 - Technical support to the IHO S-100 development
 - S-100 GI Registry and S-100 Tools
 - S-100 testing system (S-100 Viewer and S-100 ECDIS)
 - Measuring the efficiency of S-100 data service
 - Sharing platform of S-100 knowledge and resources
 - Open S-100(Open source code), S-100 Open Online Platform
 - S-100 data for domestic e-Navigation project
 - S-101, S-102, S-104, S-111, S-122, S-123, S-127
 - Establish and operate the national S-100 committee
 - 4 meetings were held



02 Status

- Technical support to the IHO S-100 development
 - Phase 1 (Registry, Tools and Catalogues)
 - Phase 3 (Simple Viewer), Phase 6/ Phase 9 (Shore based/Full ECDIS)



02 Status

- Technical support to IHO S-100 development
 - IHO GI Registry

International Hydrographic Organization

• S-100 Registry Development History



02 Status

- Technical support to IHO S-100 development
 - S-100 Tools

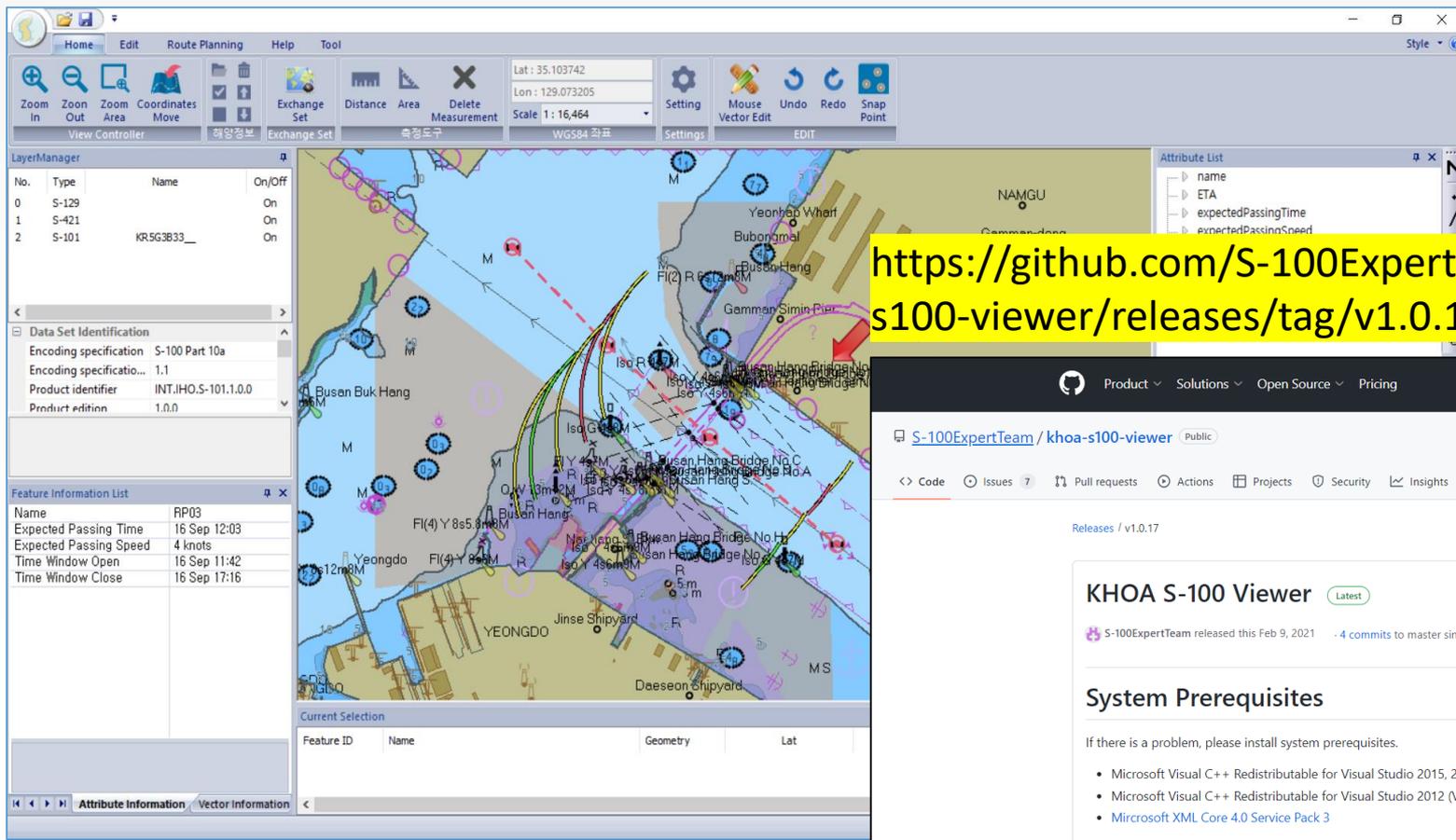
IHO S-100 Infra (Development, support and maintenance by KHOA)

S-100 GI Registry

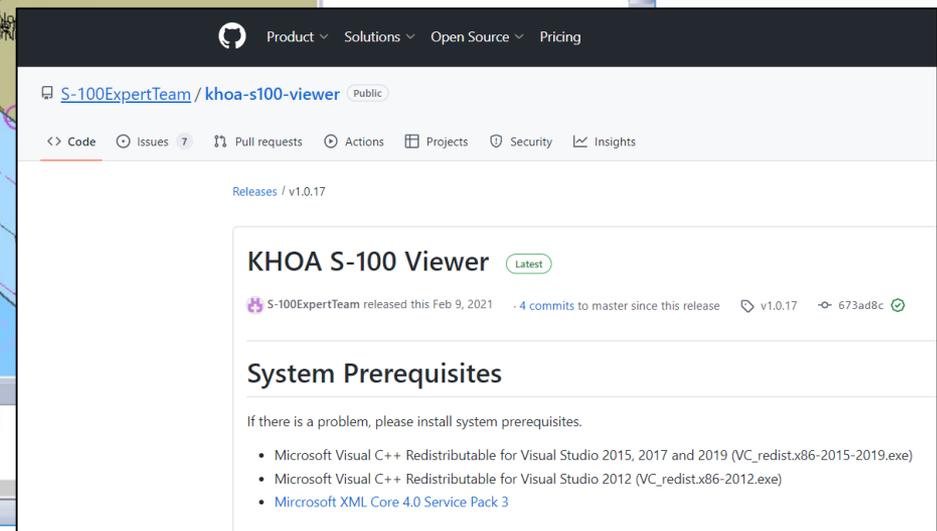


02 Status

- Technical support to IHO S-100 development
 - KHOA S-100 Viewer
 - Developed to test the S-1XX TDS and Catalogues (FC/PC)
 - Support S-101, S-102, S-111, S-122, S-124, S-123, S-127, S-129

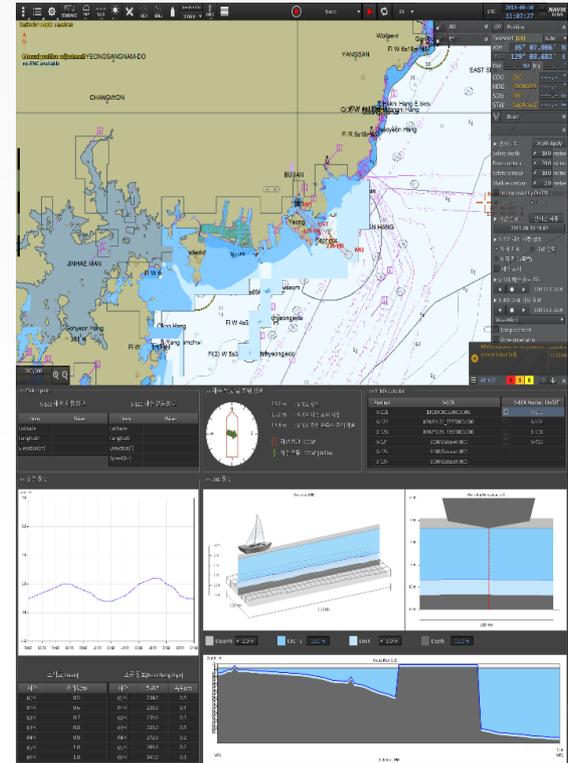
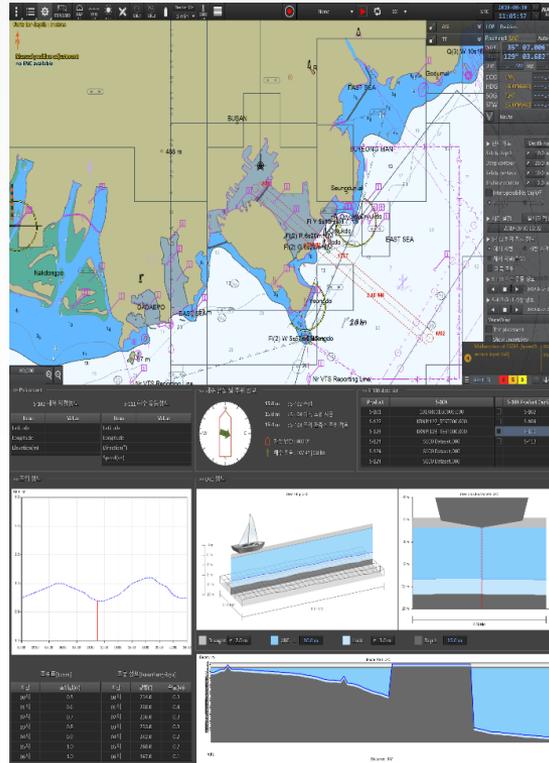


<https://github.com/S-100ExpertTeam/khoa-s100-viewer/releases/tag/v1.0.17>



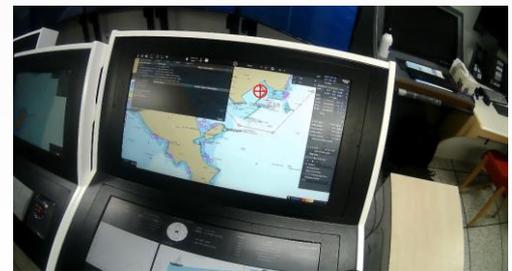
02 Status

- Technical support to IHO S-100 development
 - Shore based ECDIS / Full ECDIS
 - KHOA has been developed to support the S-100 test framework
 - The shore based ECDIS was used to test various TDS in sea trial
 - Support S-101, S-102, S-104, S-111, S-122, S-123, S-124, S-127, S-129
 - DF-mode, WLA(Water Level Adjustment) tested



02 Status

- **Technical support to IHO S-100 development**
 - S-100 Testing Center
 - The S-100 testing center was built with the FMB(Full Mission Bridge) Ship handling simulator
 - The TDS and PS(Product specification) were tested in simulated environment

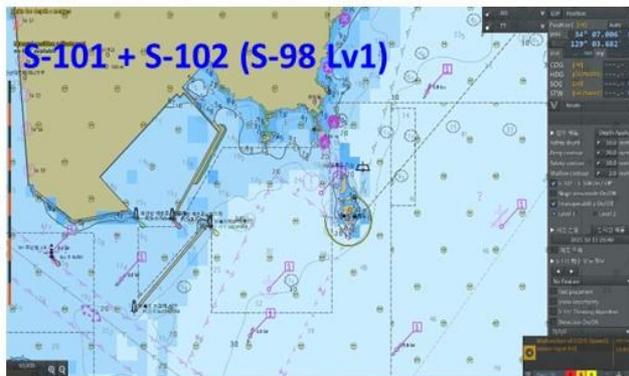


02 Status

- **Decision C5/60**
 - The Council noted the approach proposed by the KHOA-NOAA S-100 Testbed project to measure the efficiency quantitatively for the use of S-100 data service and
 - invited Member States to join the project and suggest other quantitative measures (safety of navigation, efficiency) as appropriate
- **S-100 testbed project in 2022**
 - Technical issues of S-100
 - S-98 Interoperability
 - DF-mode in S-100 testbed system
 - Up-to-dateness of S-100 data using the S-128 dataset
 - Usability of S-100 service
 - Economic efficiency test of S-100 service

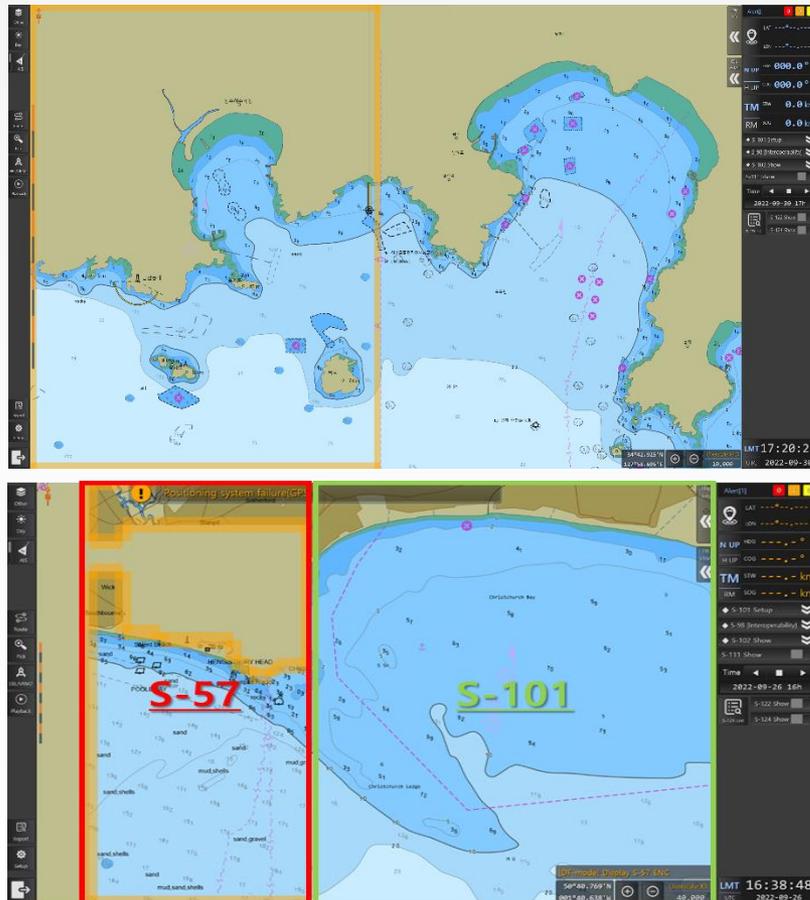
02 Status

- Technical support to IHO S-100 development
 - (Technical issues) S-98 Interoperability
 - ROK-US joint project is improving the S-98 IC (Interoperability Catalogue)



02 Status

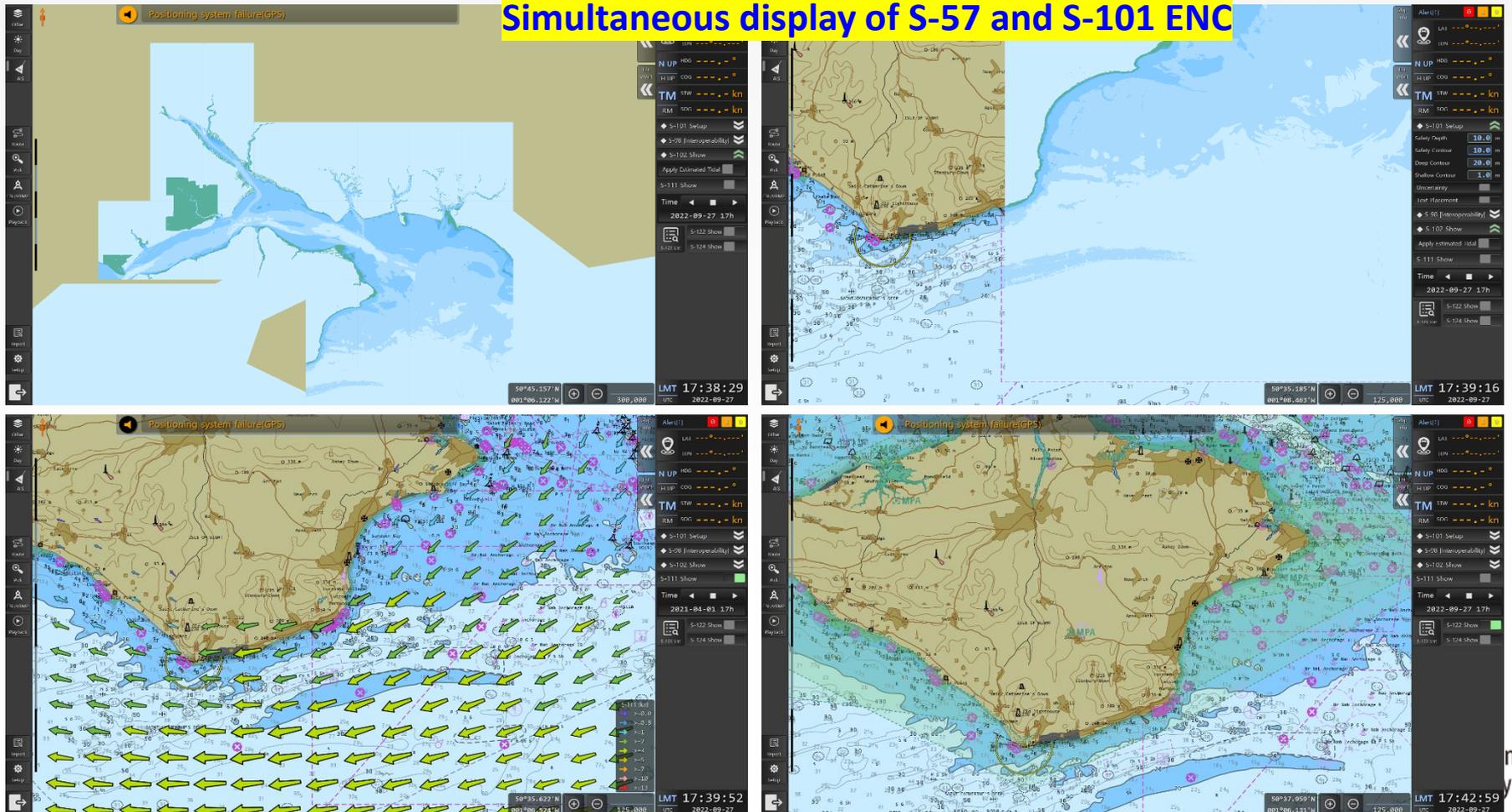
- Technical support to IHO S-100 development
 - (Technical issues) DF-mode in S-100 testbed system



02 Status

- Technical support to IHO S-100 development
 - (Technical issues) DF-mode test using the UKHO dataset

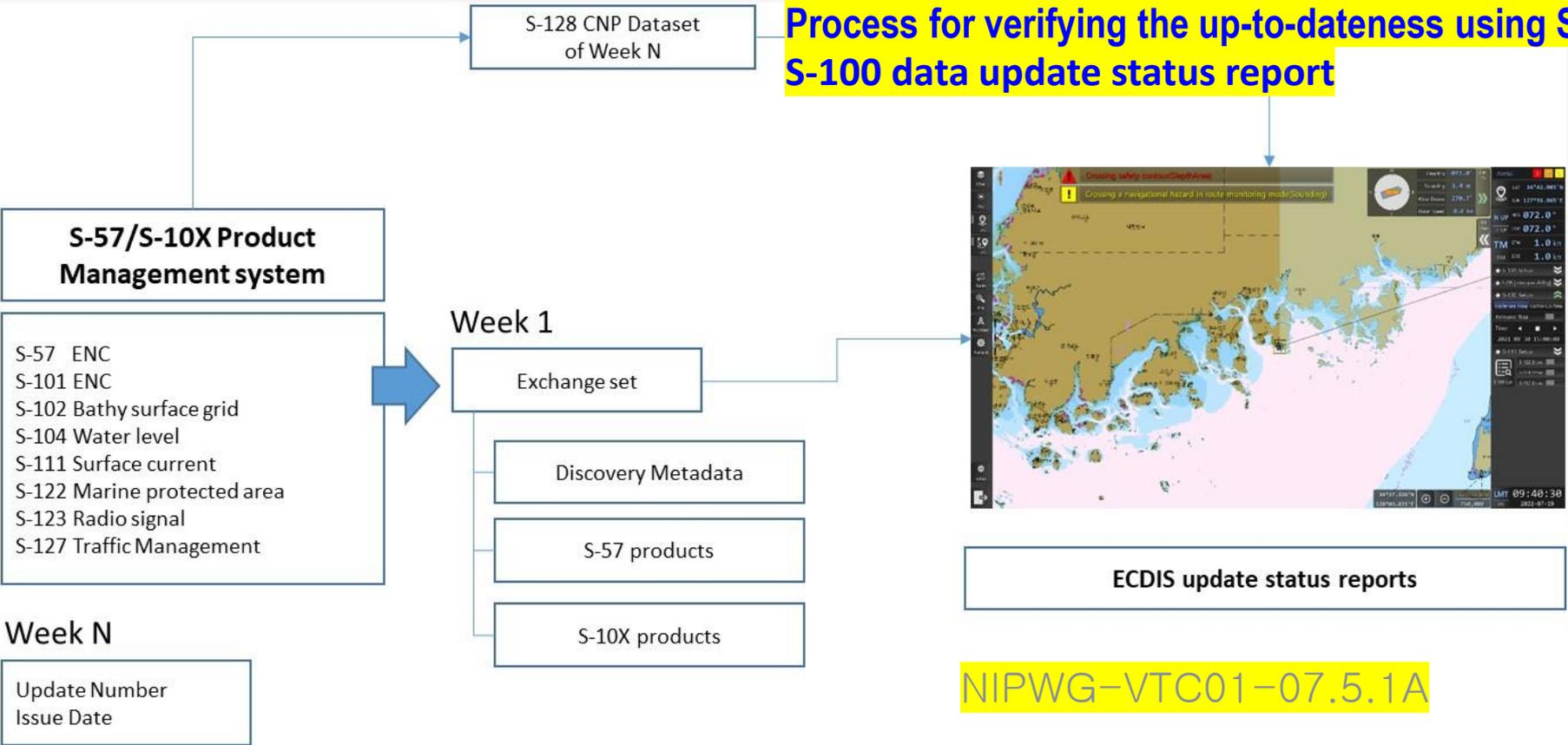
UKHO contributed their S-100 based data sets for DF-mode test
Simultaneous display of S-57 and S-101 ENC



02 Status

- Technical support to IHO S-100 development
 - (Technical issues) S-100 data update report using S-128 dataset

Process for verifying the up-to-dateness using S-128 S-100 data update status report



02 Status

- Technical support to IHO S-100 development
 - (Technical issues) S-100 data update report using S-128 dataset

[Revised Form]

Report Name: **Electronic Navigational Charts (ENC) Update Status Report**

Vessel Name:

Identifier:

Update Reference Date: (from S-128)

Date of Report:

Content: **Filtered for Route Plan "Goteborg – Kiel"**

Start WP:

End WP:

Dataset Status Summary

Data Server: XXXX

Product	Dataset Name	Edition	Update	Issue Date	Status
S-101	101US23495820	10	4	2020-01-02	Up to Date
S-102	102US29348021				

Report(S-128)

Report Name : Electronic Navigational Charts(ENC) Update Status Report

Vessel Name :

Identifier :

Update Reference Date : (from S-128)

Date of Report : 2022-09-13

Content :

Chart Status	Count
Total	462
Up to Date	446/462
Not Up to Date	16/462
Withdrawn	0/462
Unknown	0/462

Dataset Status Summary

Products	Num	Dataset Name	Edition	Update	Issue Date	Status
ALL	1	[S-57] KR1F0000	18	20	20220107	Up to Date
S-57	2	[S-57] KR2F4000	17	6	20220107	Up to Date
S-101	3	[S-57] KR3F4D00	9	0	20220107	Up to Date
S-102	4	[S-57] KR3F4H00	25	2	20220107	Up to Date
S-104	5	[S-57] KR4F4H10	20	5	20220107	Up to Date
S-111	6	[S-57] KR4F4H20	36	2	20220107	Up to Date
S-122	7	[S-57] KR4F4H30	22	21	20220107	Up to Date
S-123	8	[S-57] KR4F4H40	22	13	20220107	Up to Date
S-124	9	[S-57] KR5F4H21	24	2	20220107	Up to Date
S-127	10	[S-57] KR5F4H22	29	4	20220107	Up to Date
	11	[S-57] KR5F4H23	24	4	20220107	Up to Date
	12	[S-57] KR5F4H24	21	2	20220107	Up to Date

Report(S-128) ! Positioning system failure(GPS)

Report Name : Electronic Navigational Charts(ENC) Update Status Report

Vessel Name :

Identifier :

Update Reference Date : (from S-128)

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S-101	3	KR3F4D00	9	0	20220107	Up to Date
S-102	4	KR3F4H00	25	2	20220107	Up to Date
S-104	5	KR4F4H10	20	5	20220107	Up to Date
S-111	6	KR4F4H20	36	2	20220107	Up to Date
S-122	7	KR4F4H30	22	21	20220107	Up to Date
S-123	8	KR4F4H40	22	13	20220107	Up to Date
S-124	9	KR5F4H21	24	2	20220107	Up to Date
S-127	10	KR5F4H22	29	4	20220107	Up to Date
	11	KR5F4H23	24	4	20220107	Up to Date
	12	KR5F4H24	21	2	20220107	Up to Date

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Withdrawn	0/462
Unknown	0/462

Dataset Status Summary

Products	Num	Dataset Name	Edition	Update	Issue Date	Status
ALL	1	101KR00648A24_1	1	1	20220408	Not Up to Date
S-57	2	101KR00648A26_1	1	0	20210129	Up to Date
S-101	3	101KR00648A28_1	1	0	20210129	Up to Date
S-102	4	101KR00648A29_1	1	1	20210629	Up to Date
S-104	5	101KR00648A30_1	1	4	20220408	Up to Date
S-111	6	101KR00648A32_1	1	2	20220408	Up to Date
S-122	7	101KR00648A34_1	1	0	20210129	Not Up to Date
S-123	8	101KR00648A35_1	1	4	20220408	Not Up to Date
S-124	9	101KR00648A36_1	1	0	20210129	Up to Date
S-127	10	101KR00648A38_1	2	3	20220111	Not Up to Date
	11	101KR00648A25_1	1	0	20210129	Up to Date
	12	101KR00648A39_1	2	3	20220408	Not Up to Date

02 Status

- **Technical support to IHO S-100 development**
 - Measuring the efficiency of S-100 data services
 - Traditional products(S-57 ENC and NPUB) vs S-100 data service
 - Quantitatively, measure usability levels for two types products

Test condition

- Conducted for 10 mariners with more than 3 years of navigation experience
- Testing procedure: Assignment of voyage planning missions with different levels of difficulty between “Busan↔Jeju” and “Incheon↔Pyeongtaek” routes. (4 courses in total)



1) Education of testing purpose and scenarios



2) Familiarization with navigation system



3) Wear eye tracker equipment and focus adjustment



4) Task using traditional products



5) Task using S-100 data service



6) Conduct questionnaire evaluation and interview after route planning

Test equipment



S-57 ECDIS



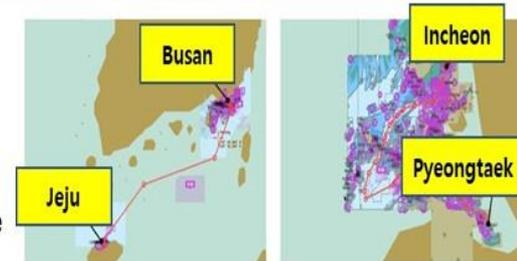
S-100 testbed system



Eye tracker

Test scenario

- Task 1. Update of nautical products
- Task 2. Navigational warning
- Task 3. Route planning
- Task 4. Check the surface current
- Task 5. Confirmation of route and save



02 Status

- **Usability evaluation**
 - Qualitative indicators (for questionnaire survey)
 - Quantitative indicators (for measuring eye movements)

Evaluation indicators

- Qualitative evaluation indicators:
Questionnaire for subjective discomfort (visual, control, total), 7 point scale for visual and control discomfort (from 1 for very comfortable to 7 for very uncomfortable)
100 score scale for total discomfort
- Quantitative evaluation indicators:
Utilization of eye tracking data to track eye movements during conducting each task by participants.



02 Status

- **Summary of evaluation result**
 - The subjective discomfort level of the S-100 test bed system was small compared to the use of the traditional products.
 - The quantitative evaluation results (Duration Time, Number of Fixation, Number of Saccades) of the S-100 test bed system were excellent compared to the use of traditional products.
 - The usability of the S-100 test bed system provides a higher usability compared to the traditional products in updating nautical products, navigational warning, and checking surface current in arrival port.



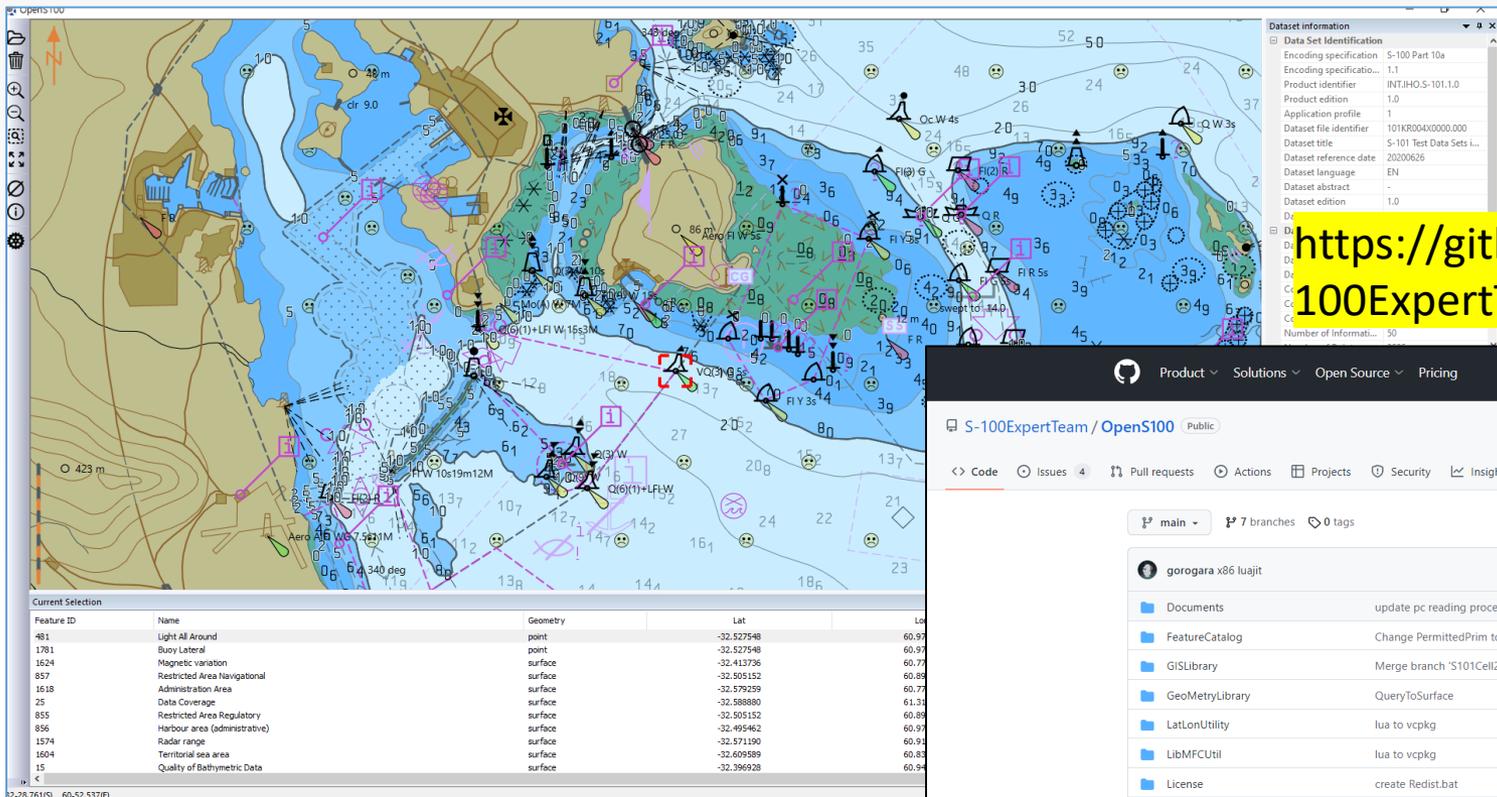
S-57 + Nautical publications



S-100 Testbed System

02 Status

- Sharing platform of S-100 knowledge and resources
 - Open source of KHOA S-100 Viewer
 - Developed to support SW developers
 - Aiming to improve it for S-100 Ed 5.0 and S-101 2.0



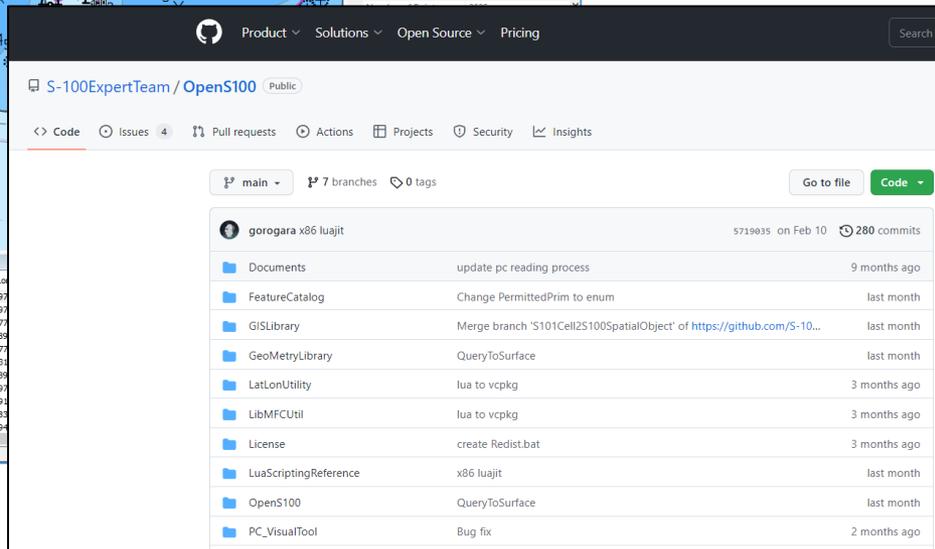
The screenshot displays the OpenS100 application interface. The main window shows a nautical chart with various features and symbols. A 'Dataset information' panel is open on the right, displaying the following details:

Property	Value
Data Set Identification	S-100 Part 10a
Encoding specification	1.1
Product identifier	INTJHO.S-101.1.0
Product edition	1.0
Application profile	1
Dataset file identifier	101KR004X0000.000
Dataset title	S-101 Test Data Sets ...
Dataset reference date	20200626
Dataset language	EN
Dataset abstract	-
Dataset edition	1.0

Below the chart, a 'Current Selection' table is visible:

Feature ID	Name	Geometry	Lat	Lon
481	Light All Around	point	-32.527548	60.97
1781	Buoy Lateral	point	-32.527548	60.97
1624	Magnetic variation	surface	-32.413736	60.77
857	Restricted Area Navigational	surface	-32.505152	60.89
1618	Administration Area	surface	-32.579259	60.77
25	Data Coverage	surface	-32.588880	61.31
855	Restricted Area Regulatory	surface	-32.505152	60.89
856	Harbour area (administrative)	surface	-32.495462	60.97
1574	Radar range	surface	-32.571190	60.97
1504	Territorial sea area	surface	-32.609589	60.88
15	Quality of Bathymetric Data	surface	-32.396928	60.94

A yellow box highlights the GitHub repository URL: <https://github.com/S-100ExpertTeam/OpenS100>



The screenshot shows the GitHub repository page for S-100ExpertTeam/OpenS100. The repository is public and has 7 branches and 0 tags. The commit history is as follows:

Author	Commit Message	Date	Commits
gorogara x86 luajt	update pc reading process	Feb 10	280
	Change PermittedPrim to enum		
	Merge branch 'S101Cell2S100SpatialObject' of https://github.com/S-10...		
	QueryToSurface		
	lua to vcpgk		
	lua to vcpgk		
	create RedisT.lat		
	x86 luajt		
	QueryToSurface		
	Bug fix		

02 Status

- **Sharing platform of S-100 knowledge and resources**
 - S-100 Open Online Platform
 - Web Community to Support S100P Project
 - Share S-100 related data, tools, technology, etc. released in Building Blocks (10 Blocks including Validation, Protection, Data Viewing etc)
 - Wiki for discussion support for various topics of S100P activity

International Hydrographic Organization

S-100P Building blocks Value Added Services (VAS) Disclaimer

S-100 GI Registry

This registry is owned by the International Hydrographic Organization (IHO) is managed by the Secretariat of the IHO

[GET STARTED](#) [Reference Site](#)

- GI Registry
- S-100 Web Viewer
- SOOP Wiki
- Test Datasets(S-44)
- Production Tools
- Validation Tools
- Storage Tools
- Protection Tools
- Dissemination Tools

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<http://119.195.114.103:8080/xwiki/bin/view/Main/>

International Hydrographic Organization

Navigation

About S-100P

Last modified by admin on 2022/01/06 13:48

S-100 Open Online Platform

- What is S-100P?
 - S-100P is an S-100 community platform to accelerate wider adoption of the S-100 hydrographic framework by joint development.
 - The platform shares required building blocks to the public to overcome any technical difficulties for S-100 implementation.
- Visions
 - Support the introduction of the IHO S-100 Roadmap for the Implementation Decade.
 - Establish an online platform for testing S-100 based data and sharing information for the hydrographic community as well as other potential ones.
 - Develop a gateway to the S-100 World for different potential users and developers.

Last Members

Photo	Name
	Friedhelm Mogger-Kägeler
	hyebin oh
	Raphael Malayanar
	tomdepuyt
	Jari Gaute Vartdal

[View All](#)

Tag Cloud

Quick Links

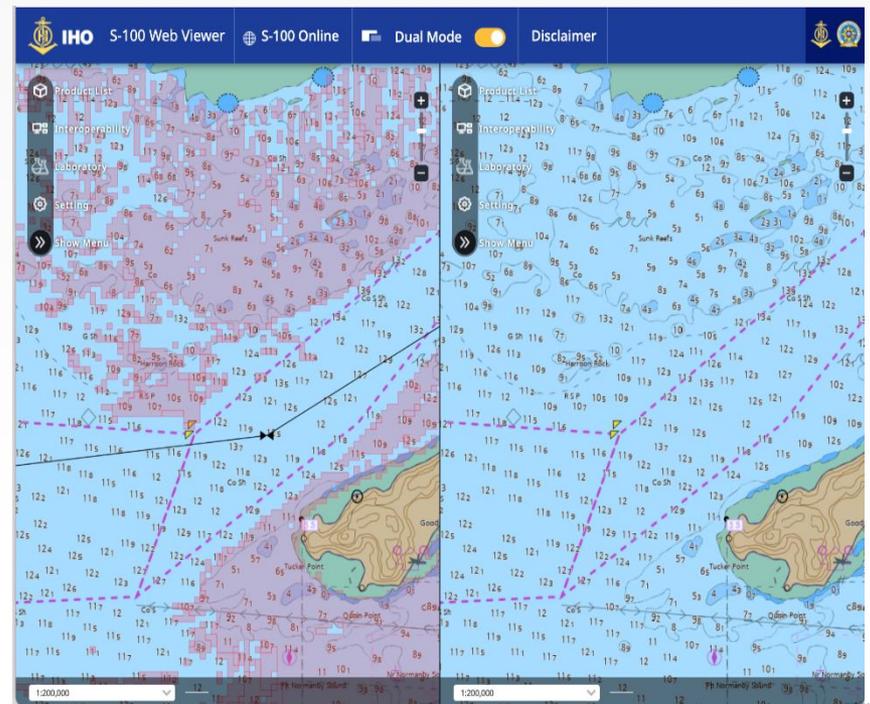
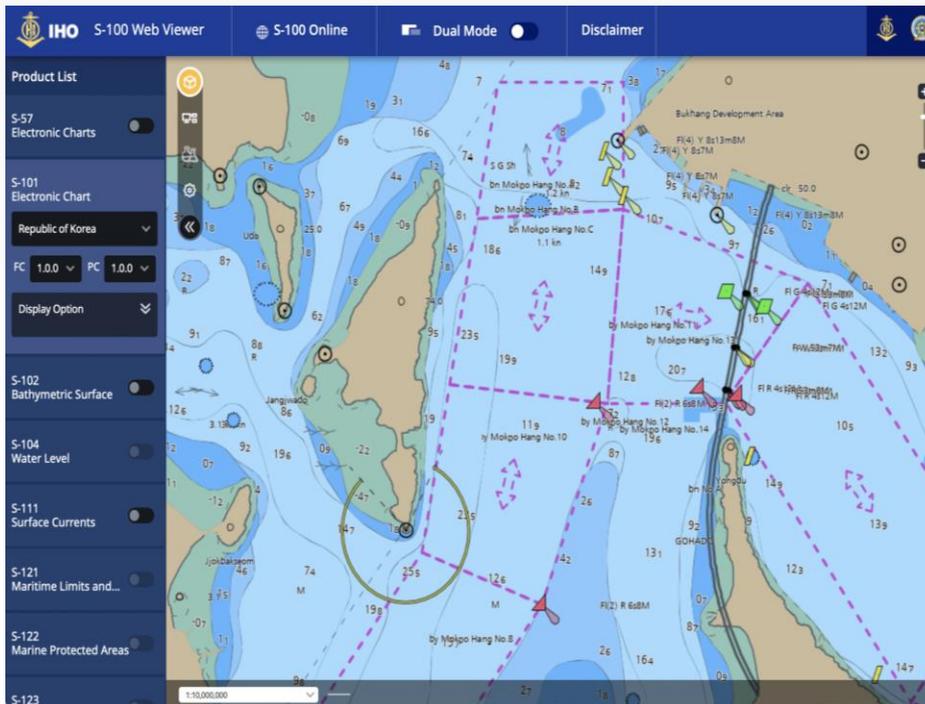
© Show you

02 Status

- Sharing platform of S-100 knowledge and resources

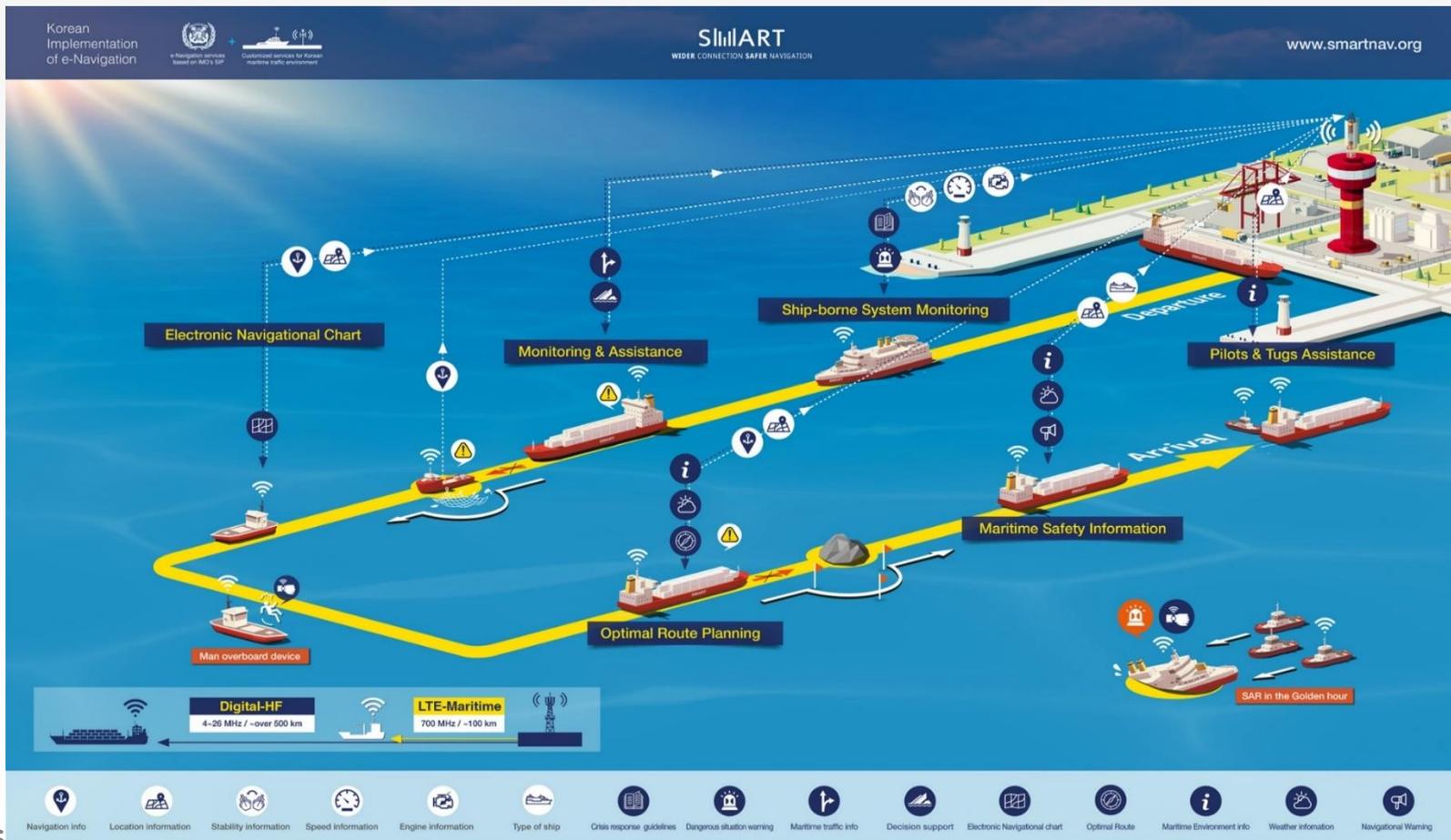
- S-100 Web Viewer

- Support to simultaneously test data from the S-100 products being developed
- Based on S-101 ENC, overlap or compare other S-100 products
- Plan to expand various S-100 products and S-98



02 Status

- S-100 data service for domestic e-Navigation project
 - S-101, S-102, S-104, S-111, S-122, S-123, S-127



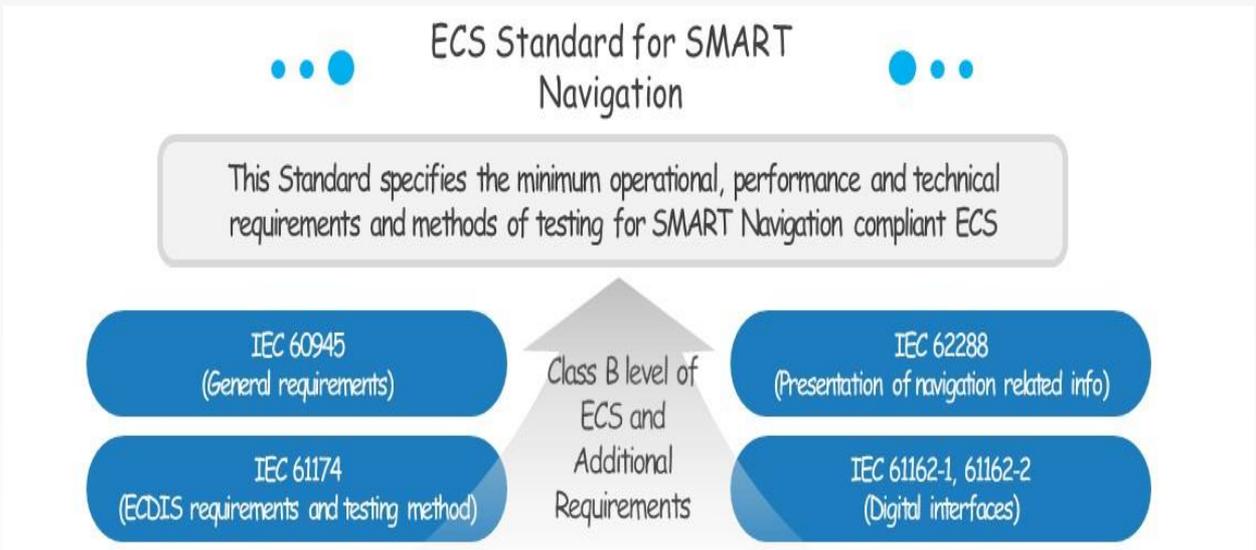
02 Status

- S-100 data service for domestic e-Navigation project
 - S-101, S-102, S-104, S-111, S-122, S-123, S-127

ID	Service	Target Vessels	Communication Method
WP1 (NAMAS)	SV1-Navigation Monitoring & Assistance Service	Vulnerable vessels	LTE-Maritime VDES/D-HF
WP2 (SBSMS)	SV2-Ship-borne System Monitoring Service	Korean passenger ship (Domestic/International) Upon request	LTE-Maritime VDES/SAT
WP3 (SORPS)	SV3-Safe & Optimal Route Planning Service	Korean passenger ship (Domestic/International) Upon request	LTE-Maritime VDES/SAT
WP4 (REDSS)	SV4 – ENC Distribution & Streaming Service for Non-SOLAS Vessel	Domestic Coastal vessel	LTE-Maritime
WP5 (PITAS)	SV5-Pilot & Tugs Assistance Service	Pilots and Tugs	LTE-Maritime
WP6 (MESIS)	SV5-2-Maritime Environment and Safety Information Service	Upon request	LTE-Maritime VDES/D-HF/SAT

02 Status

- S-100 data service for domestic e-Navigation project
 - ECS performance standard



ECS



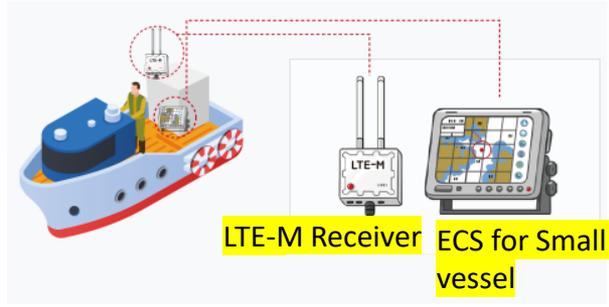
DATA

S-101 ENC
S-10X data
E-Navigation service data

Standard

Environmental tests
Interface tests
Performance tests

S-101 and S-10X datasets	SMART Navigation Service Based on S-100	Interoperability Requirement	LTE-M Router Interface
<ul style="list-style-type: none"> ▶ S-101 ENC ▶ S-104 Water level for Navigation ▶ S-111 Surface Current ▶ S-124 Navigational Warnings ▶ S-12X Nautical Publications 	<ul style="list-style-type: none"> ▶ Message service for collision and grounding accident ▶ Optimal route planning service ▶ ENC service ▶ Marine information service 	<ul style="list-style-type: none"> ▶ Interoperability catalogue ▶ Files describing how an ECS must combine data products conforming to different product specifications for display purposes 	<ul style="list-style-type: none"> ▶ Define the digital interfaces to link to the LTE-M Router



02 | Status

- **Composition of national S-100 committee**
 - Various national stakeholders
 - maritime administrations, research institutes and industry in the fields of nautical publications, aids to navigation, e Navigation and marine weather
 - Regular meetings, ad hoc meetings and seminars

- **Activities**
 - share the status of the development of S-100 standards,
 - actions nationally executed by domestic organizations,
 - product distribution connections between organizations
 - other S 100 related topics from international meetings

02 Status

- **Composition of national S-100 committee**
 - Understand the progress on the development of different standards and create an opportunity to encourage discussion and cooperation.
 - A plan for cooperation among different fields
 - If there are other IHO MSs who run similar committees,
 - it would be useful to share such activities so that many MSs can make preparations for the implementation of S-100.



03 Stakeholders

- **S-100 GI Registry and tools**
 - IHO secretariat, WG and PT, PS developers
- **S-100 Testing System (Viewer and ECDIS)**
 - S-100 dataset producers
 - S-100 SW developers
 - S-10X product specification developers
- **Sharing platform of S-100 resources**
 - Anyone who wants to know and use S-100
 - S-100 SW developers for open source code
- **Domestic e-Navigation Project**
 - Small vessel, Fishery vessel, On-shore service provider
- **National S-100 committee**
 - Aton domain, Hydro domain, VTS domain, MASS domain, Shipping and harbor logistics domain, e-Navigation domain, etc



04 Challenges

- **S-100 GI Registry and tools**
 - GI Registry has been stable, but S-100 tools need to be updated based on S-100 5.0
 - Difficult to support every requirements for S-100 tools like commercial software
 - S-100 Tools need to be harmonized and focused for maintenance
- **Production of S-100 data for e-Navigation service needs**
 - The version of S-10X FC is various
 - The workflow of S-10X data production was not harmonized
 - Validation rule and process is not ready
 - Existing production system does not support S-100 5.0
- **S-100 Test System (Viewer and ECDIS)**
 - The standards development like S-10X 2.0 and S-164 is still ongoing
 - Stakeholders don't know the KHOA Viewer well
 - Difficult to meet whole improvements of S-100/S-98 discussed by S-100WG, TSM and WGs

04 Challenges

- **Sharing platform of S-100 resources**
 - S100P project was not active, Open S-100 is not well known
 - WIKI pages need to be updated and require more active involvement
 - Online viewer aims to share S-100 testing data, but Copyright issues were discussed, and data sharing was not actively pursued
- **Domestic e-Navigation project**
 - The S-100 data have been produced according to the specific version of S-10X PS (Edition 1.x.x) which is not the operational version
 - Machine readability and Plug and Play concept was not fully introduced
 - Interoperability and S-98 was not introduced strictly
 - When the operational versions are ready, the e-Nav service needs to be updated
- **National S-100 committee**
 - Non-hydro domains understood the benefits of S-100, but no action
 - Need to explore what specific co-operations are needed
 - More demo and training on S-100 is required to the Non-hydro domain



05 Project management

- **Management of KHOA project**
 - Managed on an annual basis
 - Most activities are related to IHO's S-100 development and the results of each activity are reported as an agenda at IHO meetings
- **GI Registry and S-100 Tools**
 - Works with IHO Secretariat closely
 - Updates of S-100 tools reports S-100WG and TSM
- **S-100 Testing System (KHOA Viewer and ECDIS)**
 - Update major improvements like S-98/S-128/DF-mode
 - Research on measuring the efficiency of S-100 data service
 - Report to HSSC and Council meetings
- **Cooperation platform**
 - VTC, Ad-hoc meeting for each topics
 - Report to S-100WG, HSSC, WGs



06 Lessons learnt

- **S-100 implementation plan**
 - S-100 ECDIS is legal from 2026 and mandatory for new system from 2029
 - Production of S-100 data service should be adjusted based on the operational versions of S-1XX PS
 - Workflow should be harmonized to produce S-10X products
 - Considering the S-100 implementation plan, most mariners don't know the S-100 well
 - Activities should be done to ensure that stakeholder groups have a better understanding of improvements and benefits of S-100
- **Sharing information and resources**
 - S-100 testbed participants and IHO meetings attendees are limited
 - Lack of sharing and dissemination of S-100 knowledge and resources
 - Efforts to understand the benefits of S-100 and share related information are important

07 Recommendations

- **Use of KHOA S-100 testbed**
 - Invited to use KHOA S-100 Viewer and Open S-100 (Open source)
 - Provide any comments on the KHOA S-100 testbed project
 - Use the user feedback repository like Github for S-100 tools
 - Conduct the S-100 test project jointly
- **Sharing platform of S-100 resources**
 - Invited to join the S-100 Open Online Platform project
 - Share S-100 information and knowledge
- **National S-100 Committee**
 - Report to IHO meetings on the progress of national meetings
 - Share which cooperation can be conducted between different domains
 - S-100 implementation plan and e-Navigation strategy



THANK YOU



Korea Hydrographic and
Oceanographic Agency