Joint IHO-IALA S-124/S-125 Sea-trial and Workshop
## - <u>Major findings and recommendations</u> -

12 July. 2023

KRISO (Korea Research Institute of Ships & Ocean Engineering)

Sewoong OH

01 | Overview

- **Discussion between IHO and IALA**
  - Joint IALA/IHO Workshop on S-100/S-200 development in 2022
  - Two organs discussed the Aton and Navigation warning service
  - Agreed with the need of demonstration project
  - MPA proposed KRISO to have the S-124/S-125 demonstration project

- **Demonstration project**
  - To demonstrate at sea the interoperability between S-124/S-125 and S-101 by assessing the S-124/S-125 status change symbology, pick reports and user interface
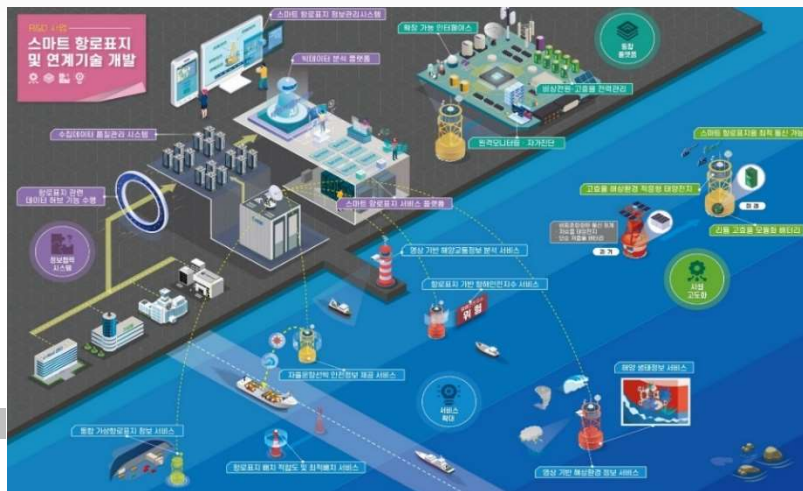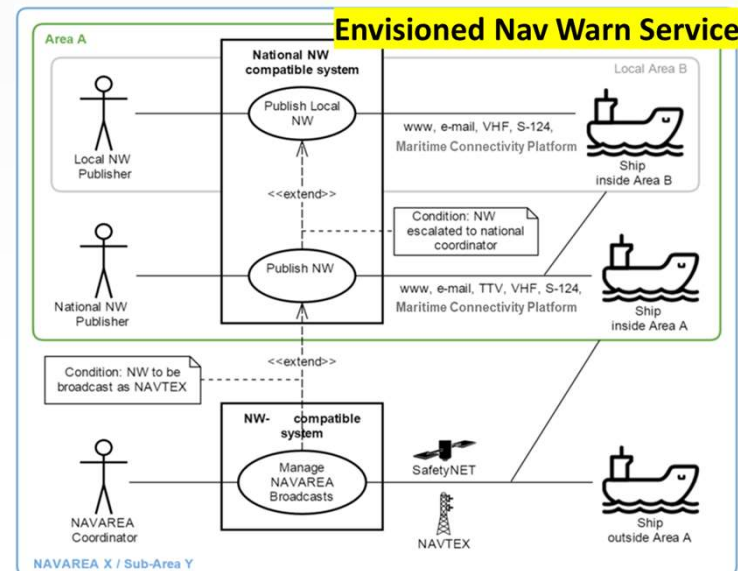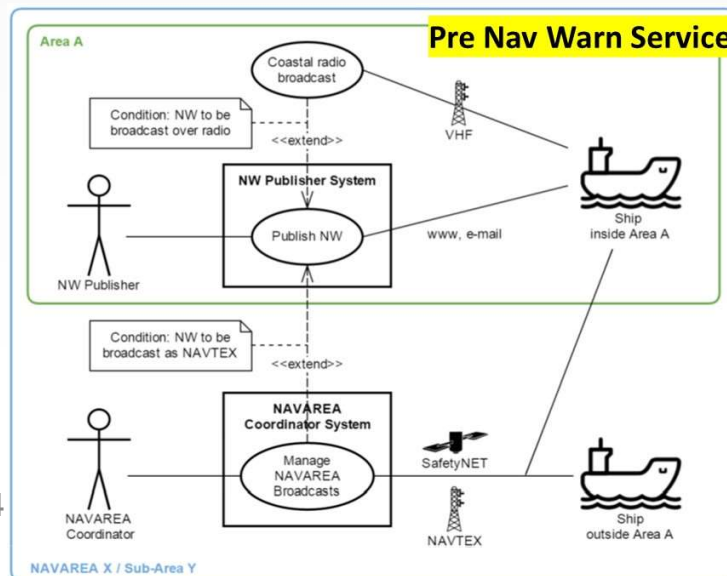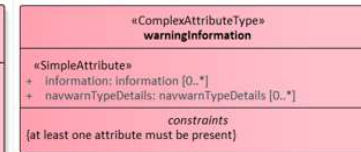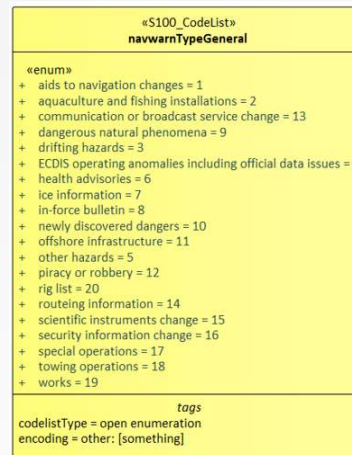
- **Demonstration project (Sea trial)**

  - Demonstration of interoperability of S-101, S-124 and S-125 At Sea Using Wireless Updating via 4G/5G Telecommunications Links

  - To support navigational safety to carry out supplementing of the S-101 ENCs using varying sizes of S-125 dataset, including overlays.

  - To operate an S-124 NW and S-125 Marine Aton in S-100 testbed system

  - To check the suitability of Aton status symbols in S-125 marine Aton product specification considering other symbols in ENC

  - To test the technical specification for the provision of Aton information service to end-users in terms of e-Nav maritime service
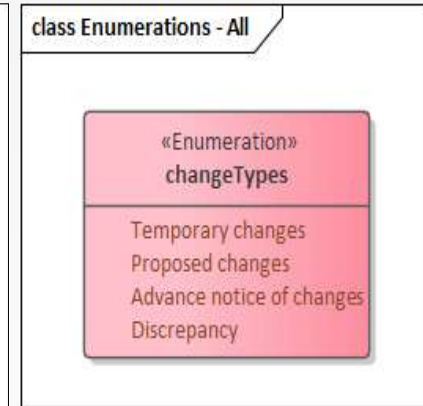
03 Data model and MRN

- S-124 data model and technical service specification

- S-125 Marine AtoN data model and technical service spec.
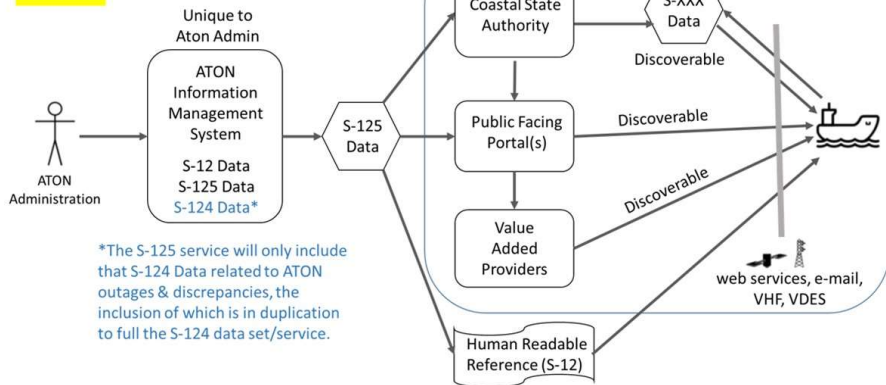
03 | Data model and MRN

- Data flow of S-201/S-125/S-124

Status changes
(Proposed changes,
Advance notice of changes)

Status changes
(Discrepancy,
Temporary changes)

AtoN Task

NAV Warning Task

S-124 data

S-124 data

S-201 data

S-124 Service

S-124 data

S-201 Service

S-201 data

Nautical Information Task

S-125 data

S-125 Service

S-125 data

S-201 data

ENC Task

S-57/S-101 Data

ENC Service

S-57/S-101 data

MRN concept

Equipment

Light

urn:mrn:iala:aton:kr:equipment:2022LTE001

Equipment

Charger

urn: mrn:iala:aton:kr:equipment:2022BCE001

Equipment

RTU(AIS)

urn:mrn:iala:aton:kr:equipment:2022:RTU:001

Equipment

Battery

urn:mrn:iala:aton:kr: equipment: 2022BTE001

Mark

urn:mrn:iala:aton:kr:mark:2022LB090

Structure

urn:mrn:iala:aton:kr:structure:2021BYS283

Repair management

urn:mrn:iala:aton:kr:repairorder:2022LTE001

Buoy tender schedule

urn:mrn:iala:aton:kr:shiporder:2022C01001

Aton Inspection

urn:mrn:iala:aton:kr:maintenanceorder:2022Y21001

03 Data model and MRN

MRN concept

IALA G1143	Type		Sub code
urn:mrn:iala:aton:kr	Mark		Mark code
	Structure		Structure code
	Equipment		Equipment code

urn:mrn:iala:aton:kr:mark:2021LH001

Mark

2	0	2	1	L	H	0	0	1
Year				Type		Serial number		

Aton	Mark Type	
Light Aids	Light House	LH
	Lighted Beacon	LC
	Leading Light	LL
	Projector Light	PL
	Sector Lights	SL
	Light Pile	LP
	Bridge Light	BL
	Vessel Traffic Light	TL
	Light Buoy	LB
	Spar Buoy	SB
	Large Automatic Navigation Buoy(LANBY)	LY
	Light Ship	LS
	Marine Structure Light	ST

Aton	Mark Type	
Shape Aids	Beacon	BC
	Leading Marks	LM
	Bridge Marks	BM
	Vessel Traffic Marks	TM
	Buoy	BY
Fog signal	Fog Signal	FS
Radio	Radar Beacon	RB
	Differential Global Positioning System(DGPS)	DG
	Loran	LR
Special Purpose	Marine Weather AtoN	WA
	Tidal Current Signal AtoN	TA
	AIS AtoN	AA
Other	Other	OT

03 | Data model and MRN

- AtoN Information Management System

04 S-124/S-125 Sea-trial

- Project team

KRISO	MPA	CCG
Overall management Leading project	**IHO-Singapore Lab Arrangement of all activities 4G/5G Network device Vessel, Focused Group workshop**	**Design of testing scenario Consultation of testbed projects**

Bluemap	Suresoft
Aton Info System Development of S-124/S-125 Service, User system	**S-124/S-125 service test document, Software quality assurance**
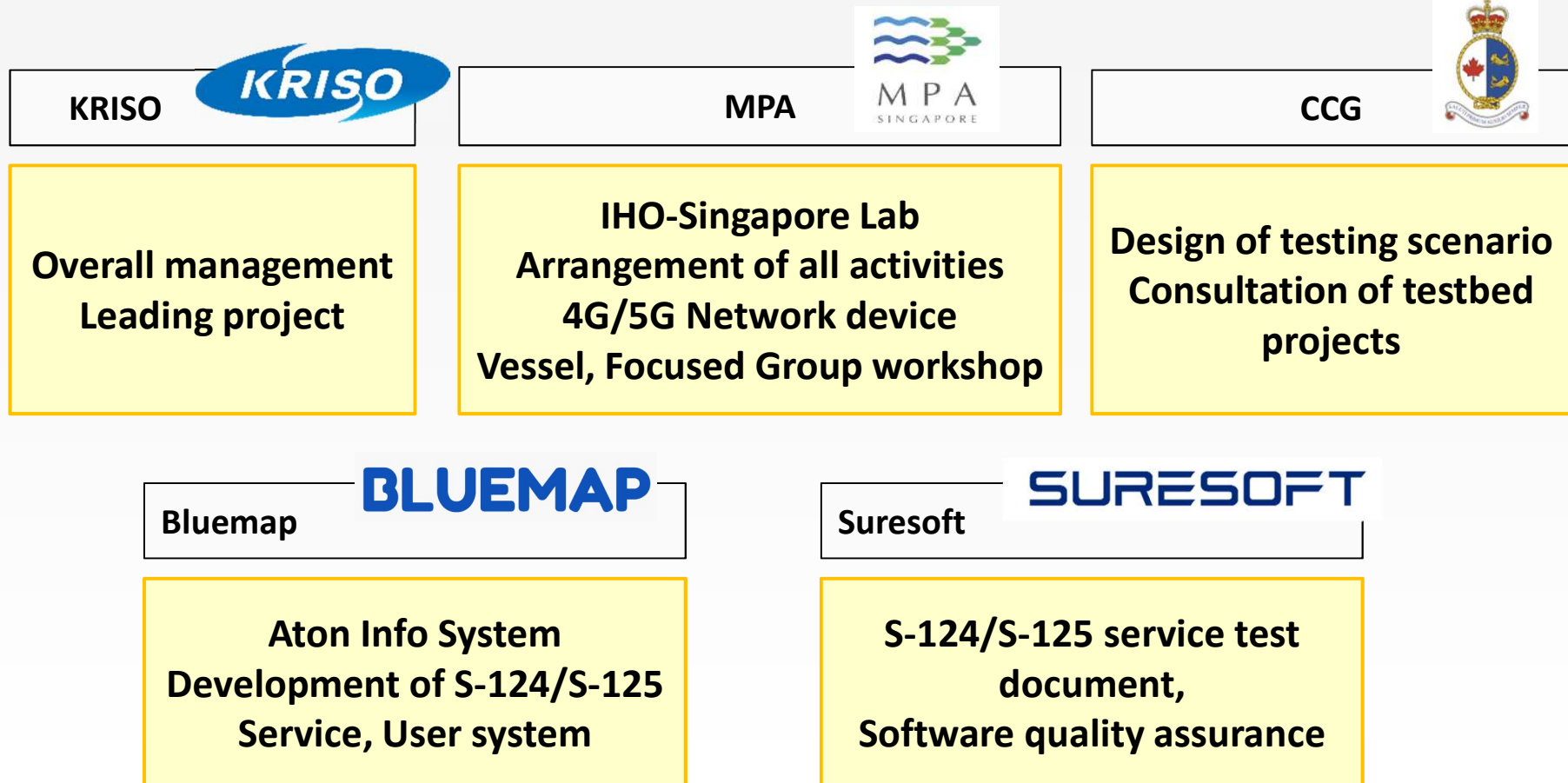
04 | S-124/S-125 Sea-trial

- **Online meeting of project team**
  - 28th Feb. 2023
    - Identification of the topics and scope for the testbed project
    - Review the test scenario
  - 4th Apr. 2023
    - S-101 ENC, Aton DB, Aton info system and User system(ECDIS)
    - Review the detailed scenario

- **Schedule in Singapore**

Date	Day	Time (Proposed)	Activity
19th April 2023	Wednesday	9am – 12pm	PSA Pass (To be confirmed) Set-up and Testing of Equipment on Vessel
20th April 2023	Thursday	9am – 6pm	Sea Trial
21st April 2023	Friday	9am – 12pm	Review findings and Mini Workshop
24th April – 28th April 2023	Monday – Friday		SMW Week
25th April 2023	Tuesday	4pm – 5pm (To be confirmed)	MPA-IALA E-Nav Workshop Joint Presentation on findings

- **S-124 NW / S-125 Aton Service**

Testing topics

AtoN Information Management System (Compatible with S-201)

S-124/S-125 (AtoN info only) Maritime Service (RESTful API)

S-124 NW dataset

S-125 AtoN dataset

4/5G Network

Testbed system

TC

NW

by PUB-PSME

Change Types
1. Temporary changes : TC
2. Proposed changes : PC
3. Advance notice of change : AC
4. Discrepancy : DC

TC PC

AC DC

(Interoperability)
S-124
S-125
S-101

Proposed route

Marina South Pier

Buran Channel

Jong Fairway

AtoN Database

101SG005C4035__.000 → 101SG005C4035__.gml
101SG005C4037__.000 → 101SG005C4037__.gml
101SG005C4041__.000 → 101SG005C4041__.gml

Mapping & Convertor

Mark Table | Structure Table | Equipment Table

Network diagram

Daejeon Korea

KT/S

Marina South Pier

Singapore Port

MPA

Wireless

WI-FI

MPA Survey Ship

LTE 4G/5G

Wired connection

S-124 NW Data S-125 AtoN Status

KRISO/Bluemap

S-124 NW Data S-125 AtoN Status

GPS Receiver

For S-100 ECDIS (Nav System)

Laptop1

S-101 ENC

AtoN Information System (Singapore AtoN Info for S-124/S-125 Service Demo)

S-124 NW Service

S-125 AtoN Service

For S-100 ECDIS SW Developer

Laptop2

S-101 ENC

User System

KHOA S-100 Testbed Technology

04 S-124/S-125 Sea-trial

- Planned sea route

Targeting Atons for S-124 service	
West Buran	POINT (103.83505 1.2341499)
Sirdhana	POINT (103.878 1.24465)
Mano 11A	POINT (103.9225 1.2486669)
Forward	POINT (103.9245332 1.2749333)
Bukom Berth 10	POINT (103.779 1.2266499)
SB 14	POINT (103.8233202 1.2438349)
Sisters	POINT (103.8128833 1.2069832)
E Cyrene	POINT (103.76475 1.2601833)
SC1	POINT (103.8315167 1.2376306)
PUB-PSME	POINT (103.8738 1.2760666)

Targeting Atons for S-125 service	
Buran	POINT (103.8486472 1.25235)
Bedok	POINT (103.9535639 1.3018831)
NE Corridor	POINT (103.8968667 1.2570972)
SB 5	POINT (103.8092389 1.2544583)
South Sebarok	POINT (103.8063806 1.1966472)
Marina Safe	POINT (103.8673831 1.2717306)
SIS-05	POINT (103.8335497 1.2173331)
SC1	POINT (103.8315167 1.2376306)

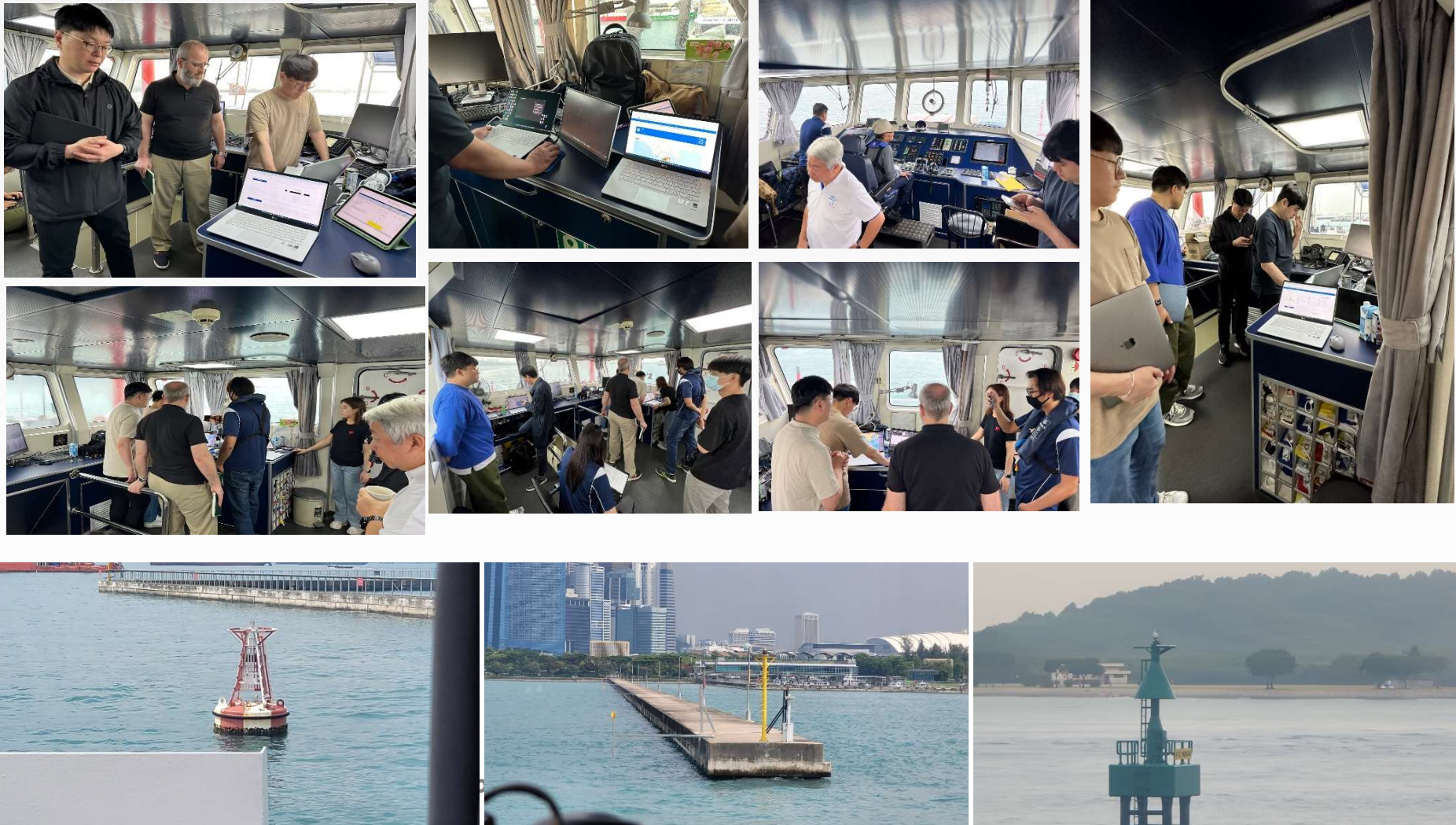**Confirmed sea route**

Targeting Atons
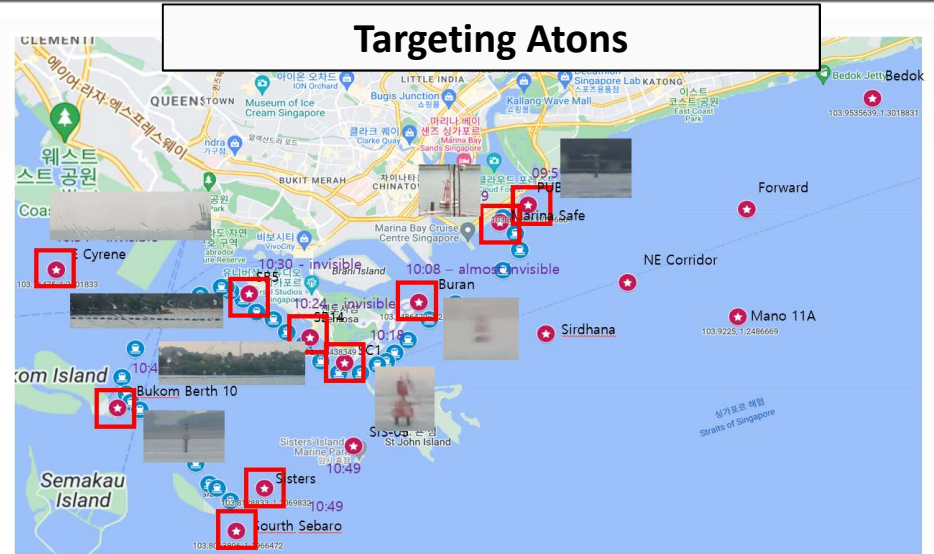
- **Set up the system and test the maritime comm network**
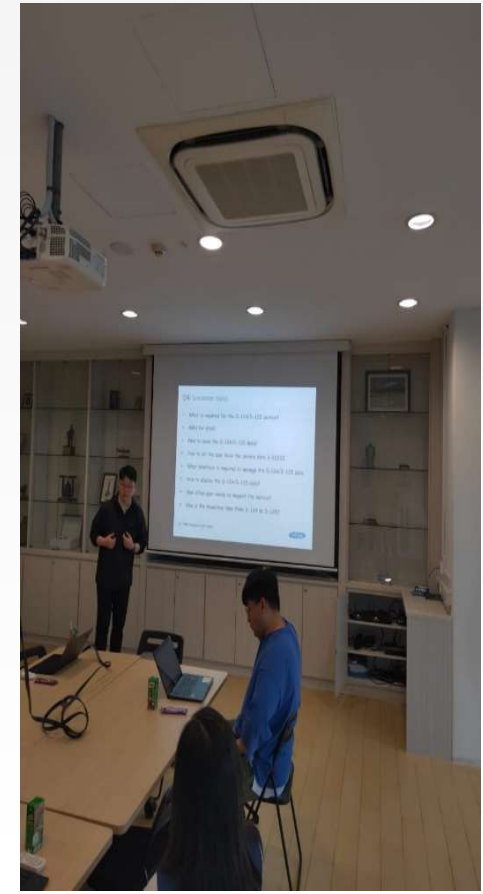
04 S-124/S-125 Sea-trial

- **Sea trial activities**
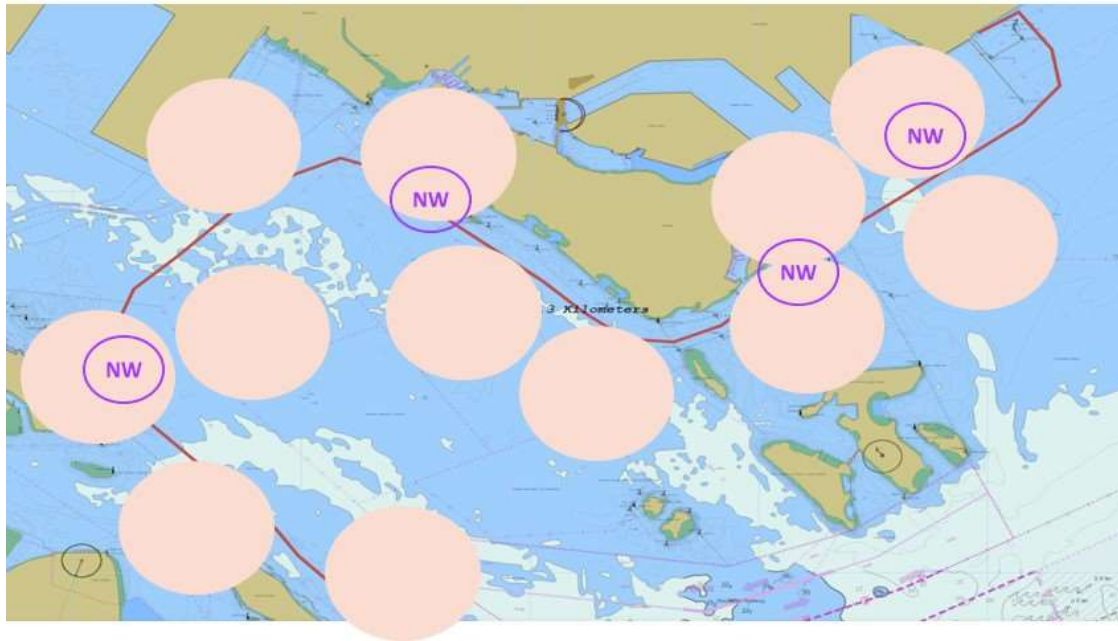
04 S-124/S-125 Sea-trial

- **Testing scenarios**

1. Request and receive S-124 before departure

    1-1. Receiving test of S-124 dataset in route + buffer

    1-2. Non-receiving test of S-124 dataset unrelated to route

    1-3. Receiving test of S-124 dataset where nominal range and route intersect

Before departure, request the S-124 NW service

Receive the S-124 NW data for the planned route

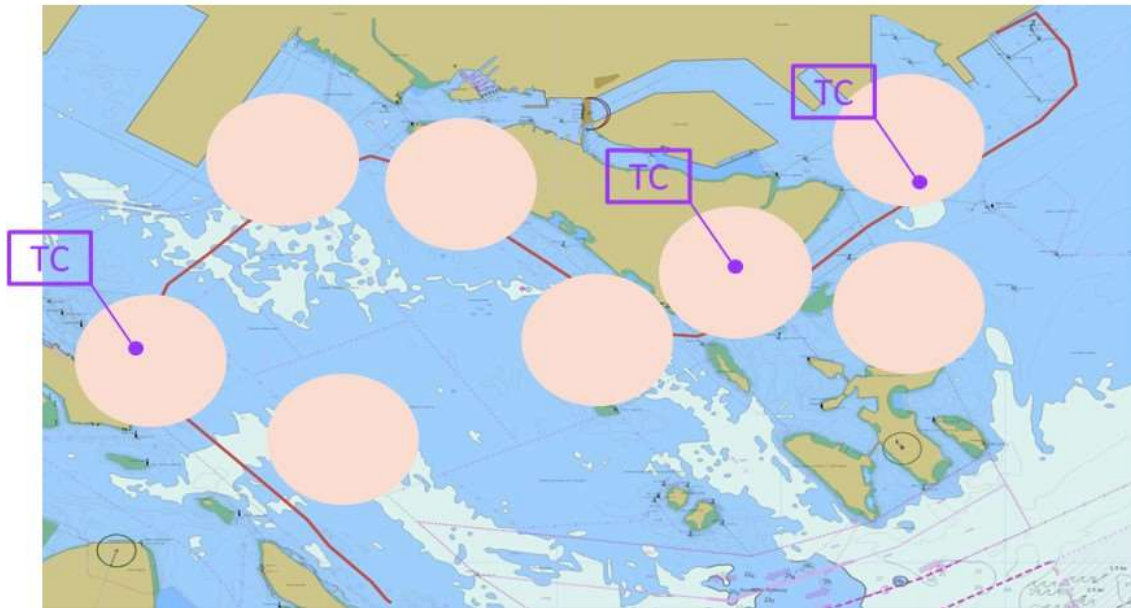Display the S-124 NW Symbol in the user system

- **Testing scenarios**

2. Request and receive S-125 before departure

    2-1. Receiving test of S-125 dataset in route + buffer

    2-2. Non-receiving test of S-125 dataset unrelated to route

Before departure, request the S-125 Marine Aton service

Receive the S-125 Aton changes for the planned route

Display the S-125 Aton changes Symbol in the user system

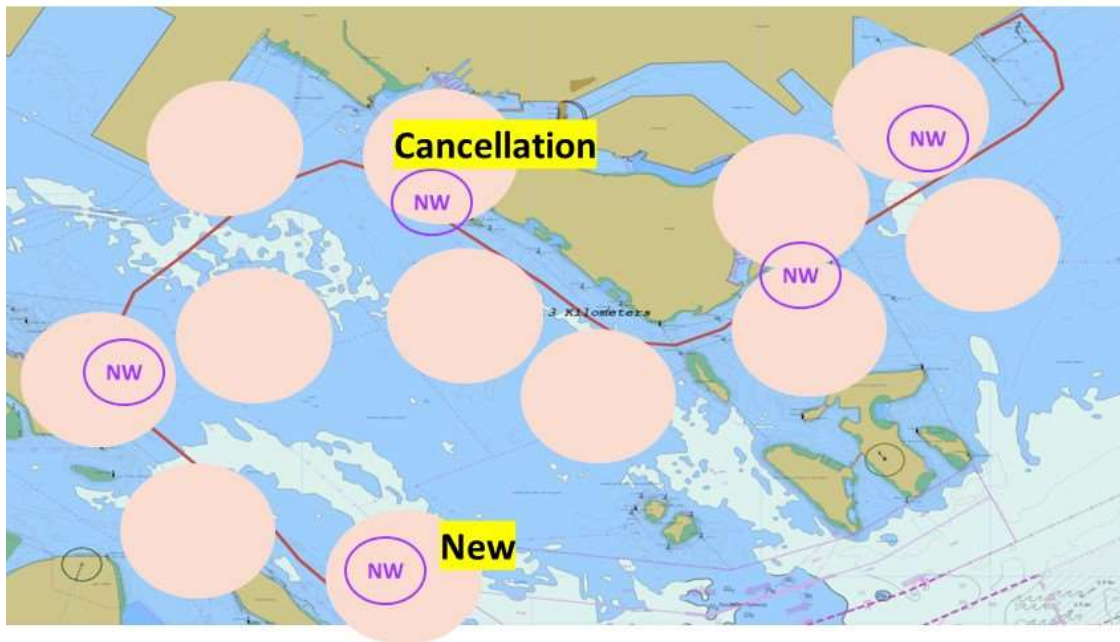## Testing scenarios

3. Update S-124 while sailing

3-1. Receiving test of new S-124 dataset in sailing

3-2. Receiving test of S-124 cancellation dataset in sailing

While sailing, request the S-124 NW Service

Receive the new S-124 NW and canceled S-124 NW

Display the new S-124 NW Symbol and confirms the canceled NW disappeared in the screen

04 S-124/S-125 Sea-trial

- **Testing scenarios**

4. Transit from S-124 to S-125 while sailing

4-1. Transition test from S-124 dataset to S-125 dataset in sailing
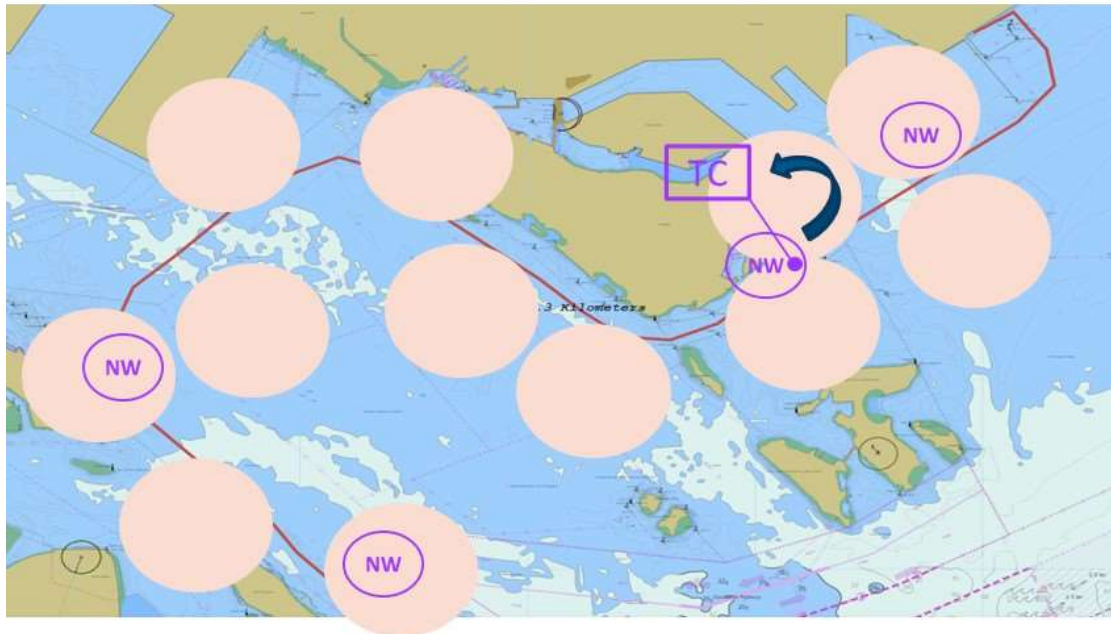
While sailing, request the S-124 NW Service and S-125 Marine Aton service

Receive the S-125 Aton changes and S-124 NW for same Aton

User confirms that NW symbol changes to Aton change symbol
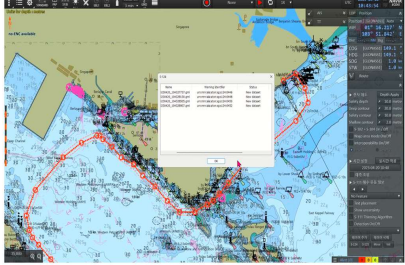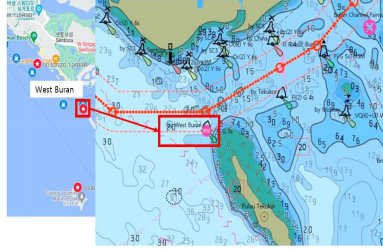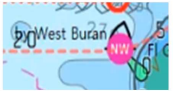
▪ Testing results

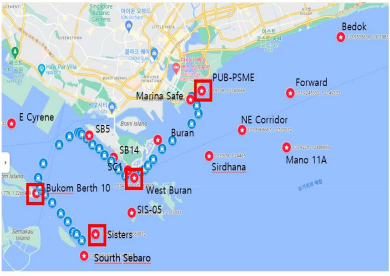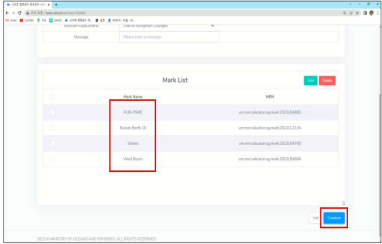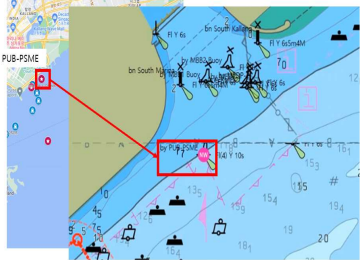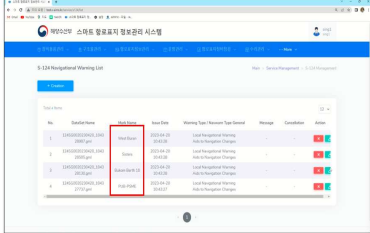|		Dataset list in Information System							
Test Scenario		**S-124**				**S-125**			
Test Procedure	**Expected Result**	**#**	**Type**	**Name of AtoN**	**Note**	**#**	**Type**	**Name of AtoN**	**Note**
1. Create S-125 data for S-124 cancellation in the AtoN information management system. [Create S-125] - Near route: 1 case 2. Request S-125 service from ECDIS with route + buffer polygon. 3. In the AtoN information management system, Cancel one of the S-124 near the route of the TC-03-002 result. (Create S-124 cancellation data) [Create S-124 cancellation] - Near route: 1 case 4. Request S-124 service from ECDIS with route + buffer polygon.	1. Service transmits data near the route to ECDIS. (Do not transmit out-of-route data) [Service response] - Added 1 case of S-124 cancellation near route to the result of TC-03-002 (8 cases in total) - Added 1 case of S-125 near route to the result of TC-02-002 (5 cases in total) 2. List and S-125 state flag of data registered by ECDIS are displayed on the screen. (Symbols of S-124 and S-125 are overlapped on same AtoN) 3. List and symbols of data excluding data canceled by ECDIS are displayed on the screen.	1	relevant	PUB-PSME	Symbols are displayed on ecdis screen	1	relevant	Buran	Symbols are displayed on ecdis screen
		2		West Buran		2		SB 5	
		3		Bukom Berth 10		3		South Sebarok	
		4		E Cyrene		4		Marina Safe	
		5		SB 14		5		SC1	
		6		NEA-WRM-MP		6	irrelevant	Bedok	Symbols are not displayed on ecdis screen
		7		*Sisters*	Symbol is removed on ECDIS screen according to S-124 cancellation data	7		NE Corridor	
		8		*SC1*		8		SIS-05	
		9	cancellation (relevant)	Sisters	cancel #6				
		10		SC1	cancel #7				
		11	irrelevant	*Forward*	Symbol is removed on ECDIS screen according to S-124 cancellation data				
		12		Sirdhana	Symbols are not displayed on ecdis screen				
		13		Mano 11A					
		14	cancellation (irrelevant)	Forward	cancel #10				
		Total S-124 dataset		14 cases		**Total S-125 dataset**		8 cases	
		relevant S-124 dataset		6 cases		**relevant S-125 dataset**		5 cases	
		relevant S-124 cancenllation dataset		2 cases					

- **Testing results**

TC-01-001

Receiving test of S-124 dataset in route + buffer

Test target AtoN
[Near route]
- PUB-PSME
- West Buran
- Bukom Berth 10
- Sisters

TC-01-001

Receiving test of S-124 dataset in route + buffer

Step 1.
Create S-124 in information system.

Test target AtoN
[Near route]
- PUB-PSME
- West Buran
- Bukom Berth 10
- Sisters

TC-01-001

Receiving test of S-124 dataset in route + buffer

Result of Step 2.
S-124 symbol is displayed on the screen.

Test target AtoN
[Near route]
- PUB-PSME
- West Buran
- Bukom Berth 10
- Sisters

TC-01-001

Receiving test of S-124 dataset in route + buffer

Result of Step 1.
List of S-124 in the information system.

Test target AtoN
[Near route]
- PUB-PSME
- West Buran
- Bukom Berth 10
- Sisters

TC-01-001

Receiving test of S-124 dataset in route + buffer

Step 2.
Request S-124 service on ECDIS.

Test target AtoN
[Near route]
- PUB-PSME
- West Buran
- Bukom Berth 10
- Sisters

TC-01-001

Receiving test of S-124 dataset in route + buffer

Result of Step 2.
S-124 symbol is displayed on the screen.

Test target AtoN
[Near route]
- PUB-PSME
- West Buran
- Bukom Berth 10
- Sisters

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04 | S-124/S-125 Sea-trial

- Sea trial recording

Last night, our team and Eivind discussed about NavWarn symbol

- **Sea trial recording**
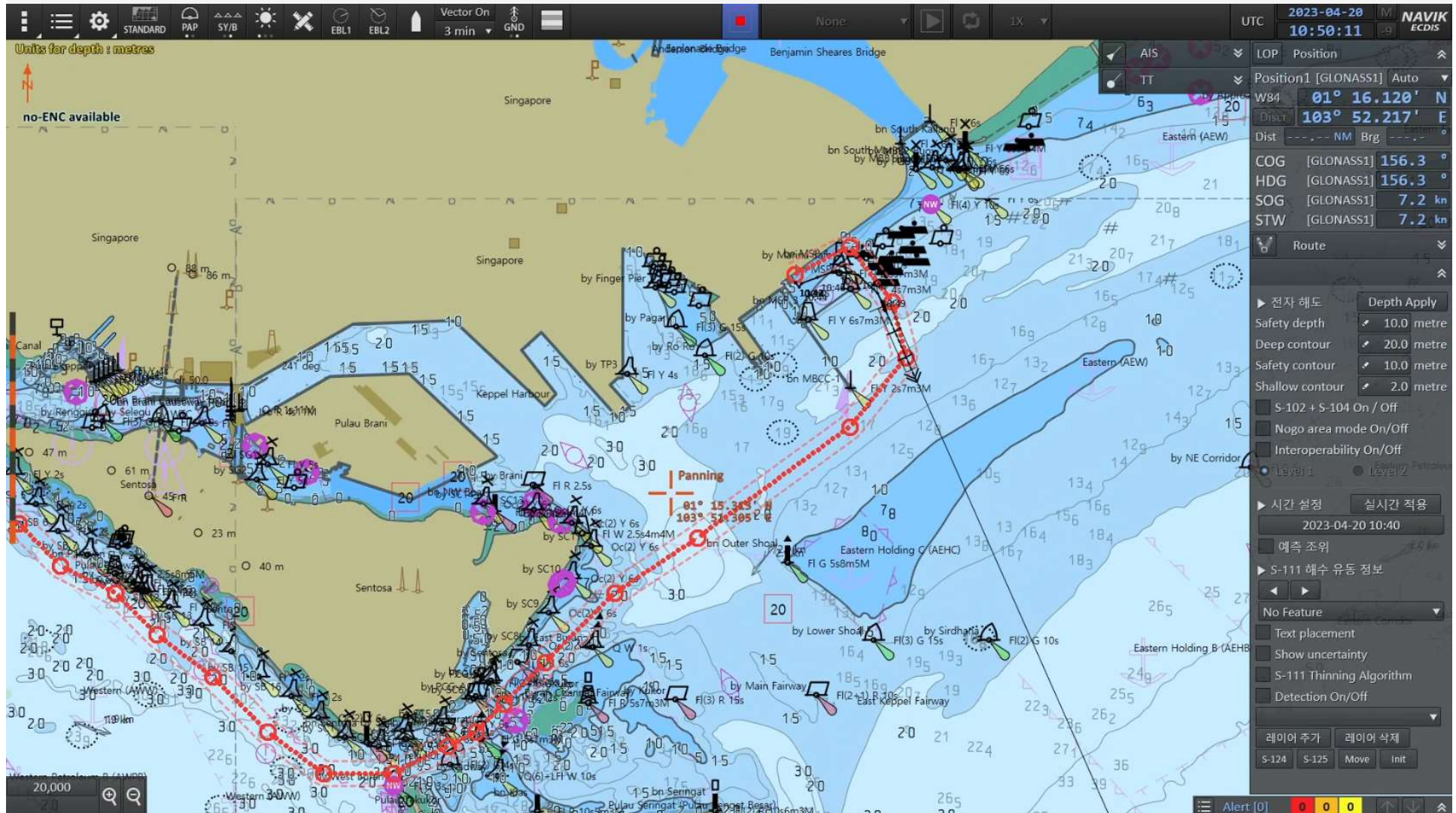
05 Major findings and recommendations

- Maritime communication network was good to test the service

- Shore side system and Ship side system were operated well

- Nav warn and Marine Aton service need to be improved

- User system should provide interfaces to manage the nav warn and marine aton data

- The symbol of navigational warnings and marine Aton should be improved based on the users feedback

- Recommendation and guideline needs to be provided to produce the nav warn and marine Aton data

- Logical process of issuing S-124/S-125 should be defined.

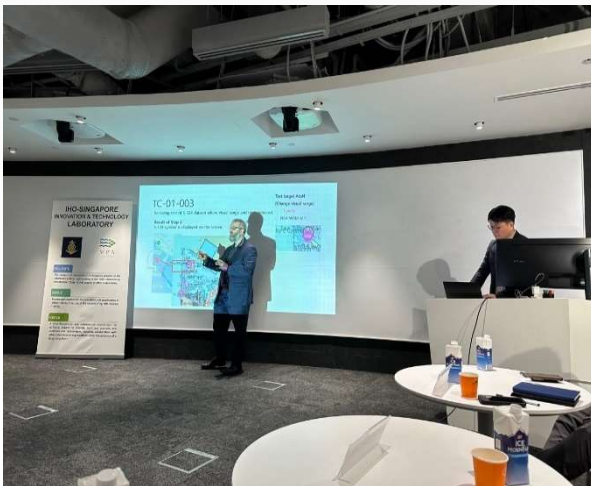# 05 | Major findings and recommendations

- **Focused group workshop**
  - Mr Eivind Mong, Chair of NIPWG led the discussion on proposed usage of new symbologies, for example use of magenta, translucence, boxes, shading, shapes etc.

  - The dialogue with shore-based personnel (Mariners, AtoN authority, Cartographers, Hydrographic Surveyors, Port Systems) provided significant value in terms of their different perspectives on the pros and cons for different forms of portrayal of the S-124/S-124 overlays onto S-101.

  - There is a need to support non-ECDIS systems and users, such as PPUs and ECS used by pilots and other users.

  - The project serves as an opportunity to kickstart dialogues between AtoN authorities and HOs to align respective responsibilities.

05 | Major findings and recommendations

- **Focused group workshop**

05 | Major findings and recommendations

- **Discussed topics**
  - <mark>Symbology of NAVWARN and AtoN status</mark>; are there improvements needed to the symbols defined?
  - <mark>Discussion for service providers</mark>; is a description of the system dependencies useful to highlight the interdependencies between a NAVWARN system and an AtoN information system?
  - <mark>Discussion for mariners</mark>; how often should system check for updates (e.g. is more often better or is for example every 8h enough?)
  - <mark>Discussion for mariners</mark>; user system GUI, how to present new information to user? What type of functions are needed to give user sufficient tools to discover changes and what they entail for situational awareness.
  - <mark>Cognitive load</mark>; NAVWARN service and AtoN information service are both intended to improve the visual information presentation to end users.

- Authorities need to consider developing a central S-201 database to support updating service and have it operationalized before January 2026.

- The protocols for sequencing and priority to send and display S-124 and S-125 needs to be further examined using Marine Resource Names for AtoN unique identity.

- The project also demonstrated a low barrier to entry. System requires only a simple cellular network connection for a wide spectrum of users onboard to adopt and benefit from these services.

- KRISO will operate the Aton digital service after research project and contribute the S-124/S-125/S-201 PS and Service specification development

06 | Conclusion

- The preliminary results were presented at the MPA-IALA ENAV-VTS Workshop held at the MPA Academy on 25th April 2023.

- As the Project was approved at the IHO-IALA Workshop in Norway, the final Project Report will be submitted to the relevant Committees of the IHO, IALA and Governing Board of the IHO-Singapore Lab.

- This collaborative project has provided a great opportunity to raise awareness of the value of the IHO-Singapore Lab in facilitating innovation works jointly embarked by the IHO and IALA.

06 | Conclusion

- **Cost summary**

Entity	EUR
MPA in-kind	8,820
MPA cash	1,580
PT in-kind	50,000
PT cash	22,300
MPA Total	**10,400**
PT Total	**72,300**
Grand Total	**82,700**

THANK YOU