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Purpose of paper:

☐ Input  
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Agenda item <sup>2</sup> 8.4Technical Domain / Task Number <sup>2</sup> .....

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## Demonstration of Aton Service based on S-124/S-125 data model

### 1 SUMMARY

Joint IALA/IHO Workshop on S-100/S-200 development and portrayal was held in Ålesund, Norway, in September 2022. The two organizations discussed the Aton data model related to S-124/S-125. Workshop attendees agreed that a demonstration project was needed to help stakeholder groups understand the product specifications.

MPA proposed to KRISO to hold an S-124/S-125 demonstration project and workshop, and both organizations conducted a sea-trial test of the Aton information service in Singapore in April 2023 and held a workshop to discuss the test results.

#### 1.1 Purpose of the document

This document reports the results of sea-trial test of the Aton information service based on the S-124/S-125 data model jointly conducted by KRISO and MPA.

#### 1.2 Related documents

S-100 IHO Universal Hydrographic Data Model (Edition 5.0.0, December 2022)

S-124 Navigational Warnings (Edition 1.0.0, May 2023)

S-125 Marine Aids to Navigation (AtoN) (Edition 0.0.3, October 2022)

### 2 BACKGROUND

The International Hydrographic Organization established the S-100 implementation roadmap and divided the implementation priorities of S-100 based products into two phases. The S-124 navigational warning product was assigned to Phase 1, and the S-125 Marine Aton product was included in Phase 2. The S-124 navigational warning was developed by the S-124 project team of WNWWS under IHO IRCC, and was approved as Edition of testing version in 2023. The S-125 Marine Aton has been developed by the IALA ARM committee on behalf of IHO NIPWG. At the 16<sup>th</sup> ARM meeting held in October 22, S-125 Edition 0.0.3 was developed and IHO NIPWG provided comments after reviewing the developing S-125 document.

At the joint IALA/IHO workshop on S-100/S-200 development and portrayal held in September 2022, it was agreed that the relationship between the S-124/S-125 product specifications is important in generating and

<sup>1</sup> Input document number, to be assigned by the Committee Secretary

<sup>2</sup> Leave open if uncertain

providing Aton changes information, and discussed the need for sea-trial demonstration project according to each product specification (data model) developed so far.

### 3 DISCUSSION

KRISO and MPA agreed to conduct a sea-trial test of the Aton information service as part of the IHO-Singapore Innovation Laboratory project, and the test was conducted at the Port of Singapore in April 2023.

#### 3.1 Preparation activities for sea-trial test

This test aimed to verify on the S-124/S-125 data model and operation process of Aton information service, and the following network diagram was designed for the Aton information service.

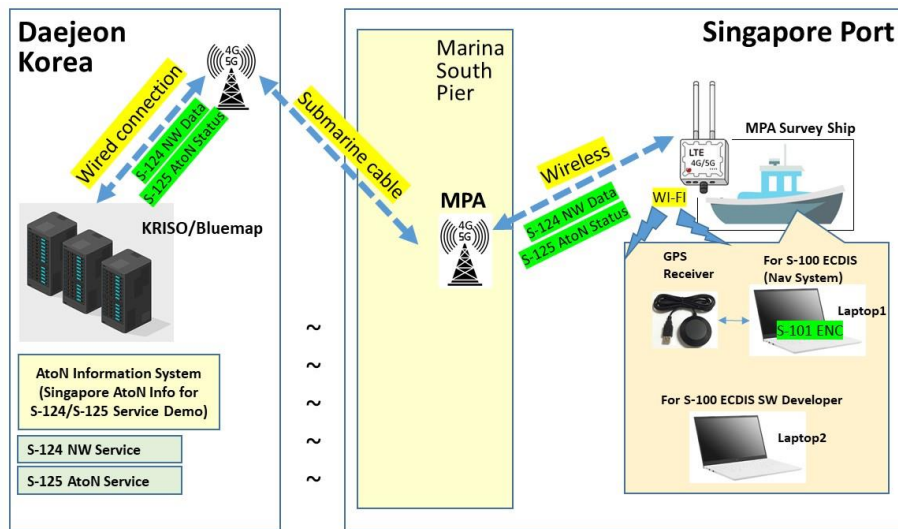


Figure 1. Network diagram of S-124/S-125 Service Sea Trial

Aton information from the Singapore Port was used in the test, and Aton was extracted from Singapore's ENC and entered into Korea's Aton information management system. From the system, the S-124 navigational warnings and S-125 Aton changes were created.

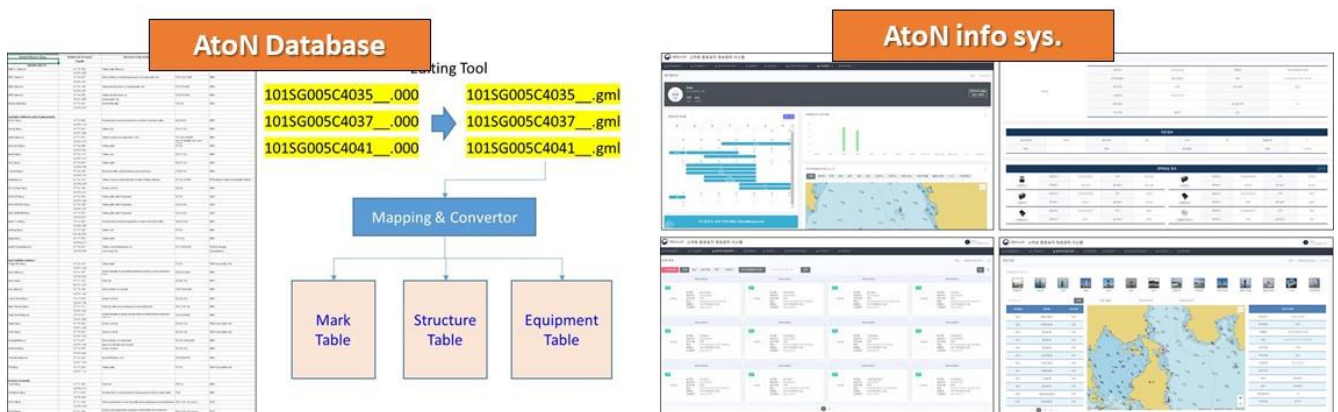


Figure 2. Aton data from Singapore ENCs and Aton Information management system

The S-100 Testbed developed by KHOA was used for the purpose of user system. The Aton changes requested and received through the LTE 4G/5G network provided by Singapore MPA were displayed according to the S-124 navigation warning and S-125 Aton information symbol specifications (Portrayal catalogue).

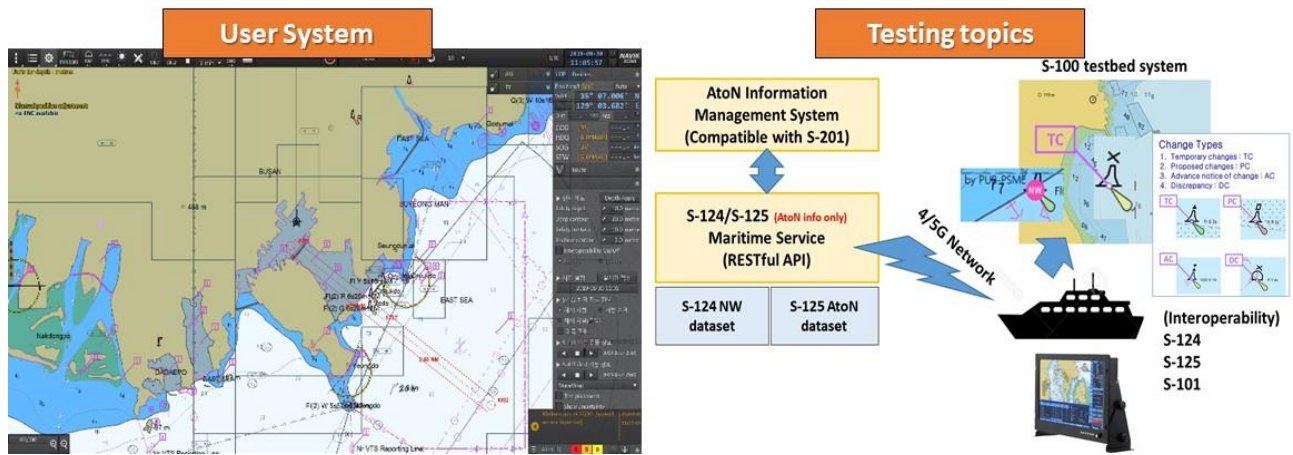


Figure 3. KHOA S-100 Testbed for use system and how to portray the S-124/S-125 data

### 3.2 Participating organizations and test dates

The following organizations participated in the Aton information service test, and the roles of each organization are as follows.

- KRISO: Leading Aton information service test
- MPA: Support for activities related to sea-trial testing by the IHO-Singapore innovation laboratory, Support the maritime communication network and test vessel
- CCG: Design of Aton information service and technical consultation
- Bluemap: Aton information management system, Operation of Aton Service and user system
- Suresoft: Record and prepare test documentation, software quality management

Test participants visited the ship the day before sea-trial to set up the environment, and the test was conducted on April 20th. The day after sea-trial, a mini-workshop attended by stakeholders in Singapore (VTS, NAVTEX, Aton manger etc.) was held to review the test results.

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

### 3.3 Major testing results

MPA proposed a route where Atons are located. Along to the proposed route, a scenario that can generate S-124 navigation warning and S-125 Aton changes was prepared in advance.

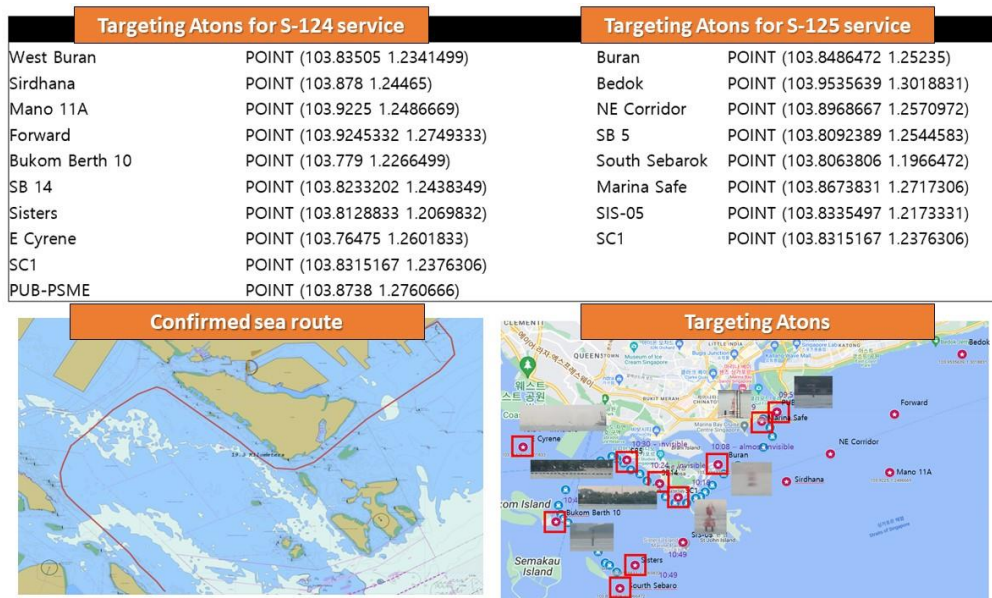


Figure 4. Target Aton for testing and Proposed route

KRISO/MPA/CCG research team designed following scenario.

Scenario 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

Scenario 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

Scenario 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

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


- 4-1. Transition test from S-124 dataset to S-125 dataset in sailing

The research team checked the data produced through the Aton information service for each scenario, the data received through the user system, and the screen displayed on the S-100 Testbed system. Some of the data during the Aton information service test are shown in the following figure.



TC-01-001

Receiving test of S-124 dataset in route + buffer



Test target AtonH [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 AtonH [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 AtonH [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 ECDS.



Test target AtonH [Near route]

- PUB-PSME
- West Buran
- Bukom Berth 10
- Sisters

Test Scenario		Dataset list in Information System								
Test Procedure	Expected Result	#	Type	Name of AtonH	Note	#	Type	Name of AtonH	Note	
1. Create S-124 data for S-124 cancellation in the AtonH information management system.  Create S-125 Near route 1 case  2. Request S-125 service from ECDS with route + buffer polygon  3. In the AtonH information management system, cancel one of the S-124 near the route of the TC-01-002 result. Create S-124 cancellation data.  Create S-124 cancellation Near route 1 case  4. Request S-124 service from ECDS with route + buffer polygon	1. Service transmits data near the route to ECDS. (Do not transmit out-of-route data)	1		PUB-PSME		1		Buran		
		2		West Buran		2		SB 1		
		3		Bukom Berth 10	Symbols are displayed on echo screen	3	relevant	South Sabarick	Symbols are displayed on echo screen	
		4	relevant	S Cymre		4		Marina Lahn		
		5		SB 14		5		SCY		
		6		SEA-ARROW-ASP		6		Bodok		
		7		Shidre	Symbol is removed on ECDS screen according to S-124 cancellation data	7	irrelevant	Inf Corridor	Symbols are not displayed on echo screen	
		8		JCTY		8		DS-DS		
		9	cancellation (irrelevant)	Sisters	cancel #6					
		10		SCY	cancel #7					
		11		Forward	Symbol is removed on ECDS screen according to S-124 cancellation data					
		12	irrelevant	Shidhana						
		13		Marina 11A	Symbols are not displayed on echo screen					
		14	cancellation (irrelevant)	Forward	cancel #10					
Total S-124 dataset		14 cases				Total S-125 dataset				8 cases
relevant S-124 dataset		8 cases				relevant S-125 dataset				5 cases
relevant S-124 cancellation dataset		2 cases								

Figure 5. Part of the Aton information service test results

Refer to the separate report for detailed test results.

### 3.4 Min-workshop with Stakeholder groups

Major lessons from the demonstration project

- 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 need to be provided to produce the nav warn and marine Aton data
- Logical process of issuing S-124/S-125 should be defined.

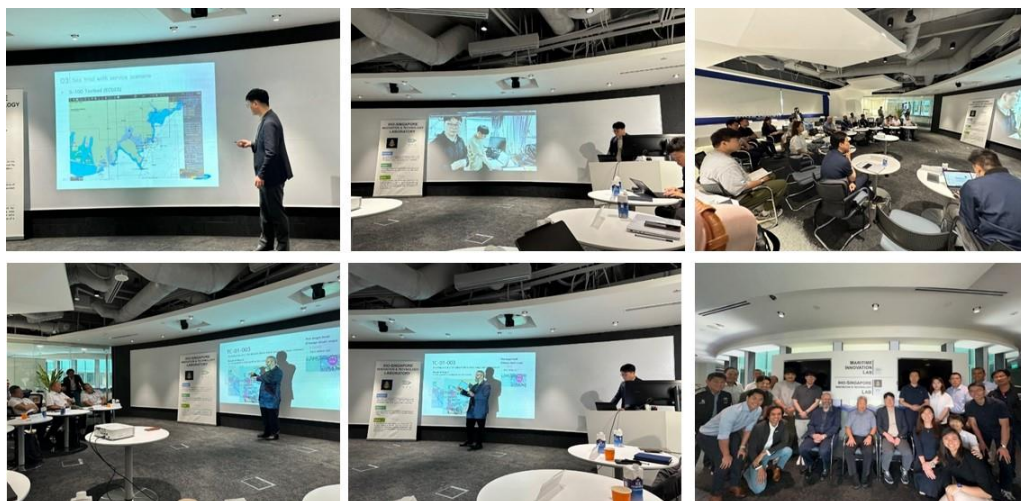


Figure 6. Mini workshop with stakeholder groups

## Discussed topics

Symbology of NAVWARN and AtoN status; are there improvements needed to the symbols defined? Maybe transparency in NAVWARN symbol, highlight in AtoN status information etc

Discussion for service providers; is a description of the system dependencies useful to highlight the interdependencies between a NAVWARN system and an AtoN information system?

Discussion for mariners; how often should system check for updates (e.g. is more often better or is for example every 8h enough?)

Discussion for mariners; 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.

Cognitive load; NAVWARN service and AtoN information service are both intended to improve the visual information presentation to end users. This means they intend to lessen administrative burden in information updating, and by being shown on same screen as ENC, reduce cognitive load for the user versus considering information from different sources and mentally combine the information.

The project would provide the AtoN authorities a chance to own their datasets (i.e. S-125), rather than rely on Hydrographic Offices (HOs). 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. The project team will operate the Aton digital service after the demonstration and contribute the S-124/S-125/S-201 PS and Service specification development

## 4 ACTION REQUESTED OF THE COMMITTEE

The Committee is requested to consider the demonstration of Aton service based on S-124/S-125 data model and take actions as appropriate.