

MSI Service in SMART Navigation Project



29 August, 2019

Korea Research Institute of Ships & Ocean Engineering
Sewoong OH

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01 | Overview of SMART Navigation Project

INTRODUCTION

The SMART-Navigation implements the concept of IMO's e-Navigation, providing additional services for Non-SOLAS ships such as fishing boats, coastal vessels and small ferries.



**IMO'S MSP-based
e-Nav. services**



**Specialized services
for Korean maritime
traffic environment**

Non-SOLAS

Fishing boats
Dangerous cargo ship
Ferry
Etc.

LTE-Maritime

ENC service
Multimedia data

01 | Overview of SMART Navigation Project



▪ Vision

The SMART-Navigation Project aims to :

- 01** • improve the quality & efficiency of maritime transport while enhancing the quality of life for mariners at sea
- 02** • contribute to IMO's strategic implementation of e-Navigation
*Developing e-Navigation technologies, Verifying effectiveness of e-Navigation services
- 03** • enhance mutual benefits of world maritime community via-e-Navigation
*Reducing maritime accidents, Enhancing shipping efficiency, Maritime Domain Awareness, and etc.

01 | Overview of SMART Navigation Project

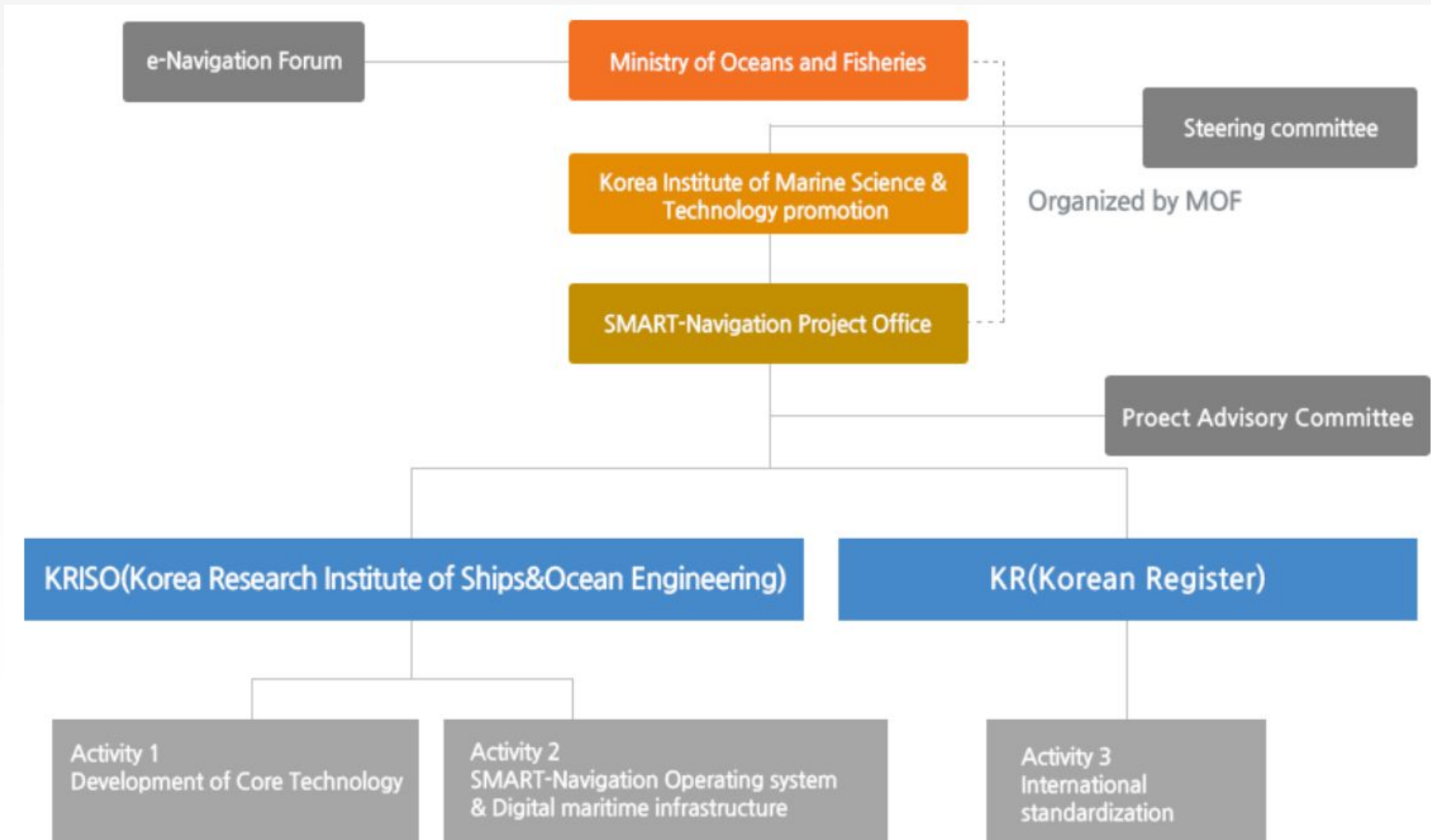


■ Project Information

- ✓ **Project Name**
SMART-Navigation Project
- ✓ **Organized and Funded by**
Ministry of Oceans and Fisheries, Republic of Korea
- ✓ **Project Office**
SMART-Navigation Project Office at KRISO
Jin Hyoung PARK, Email | jin.h.park@kriso.re.kr TEL | +82.42.866.3608
- ✓ **Period**
March 2016-December 2020
- ✓ **Budget**
USD 115M

01 | Overview of SMART Navigation Project

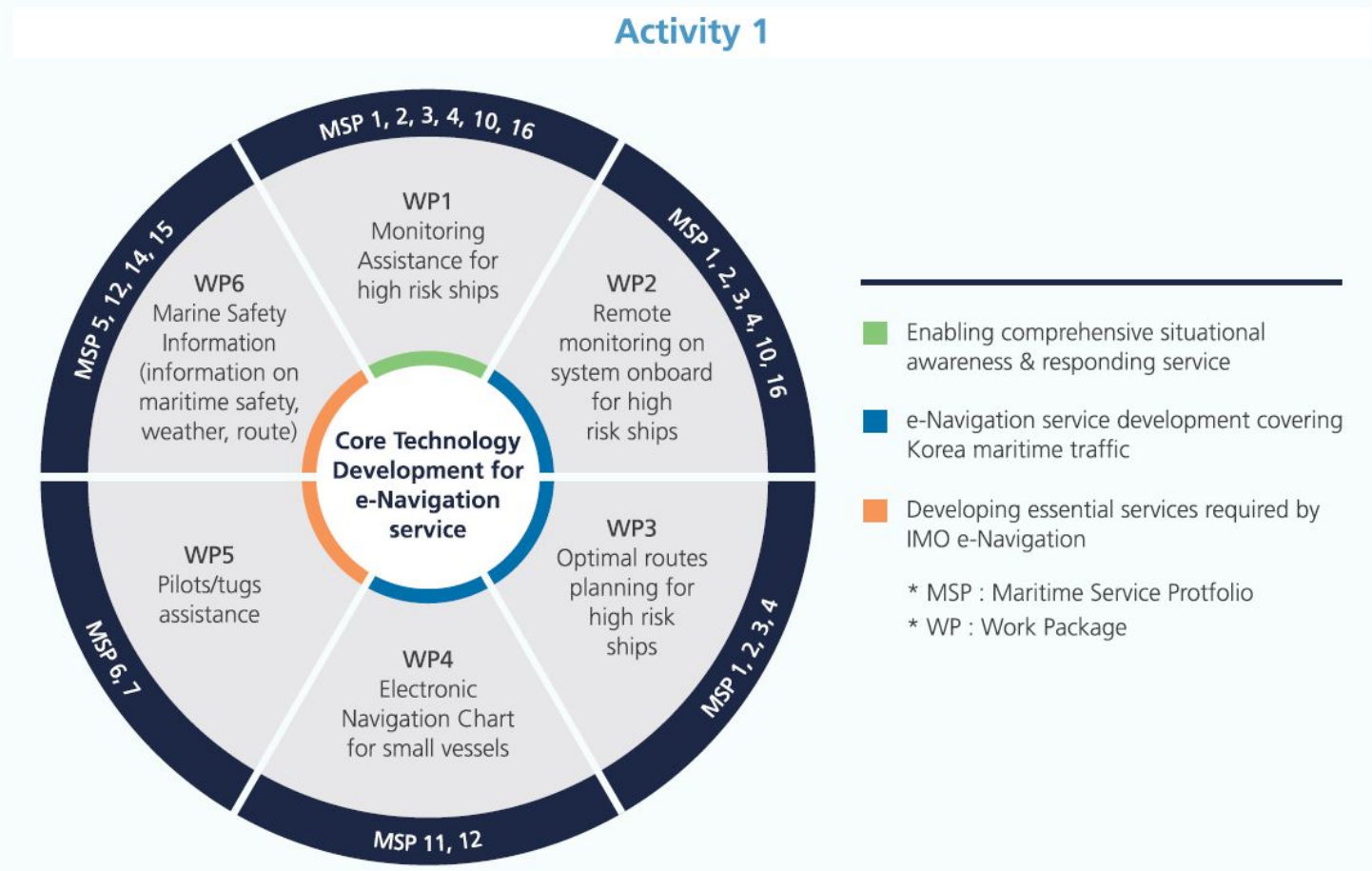
■ Organizational Structure



01 | Overview of SMART Navigation Project

■ Project Activities

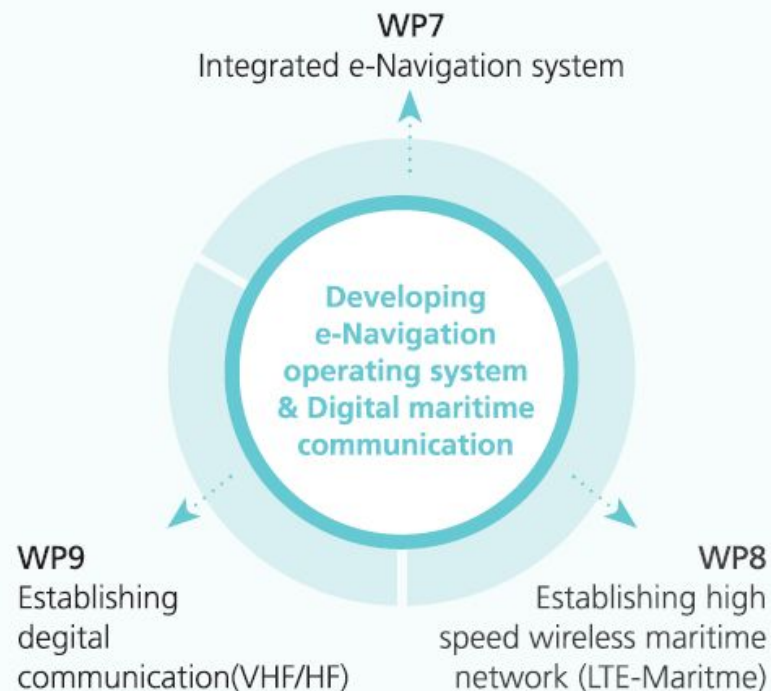
The SMART-Navigation Project is divided into three activities, which consist of 13 Work Packages.



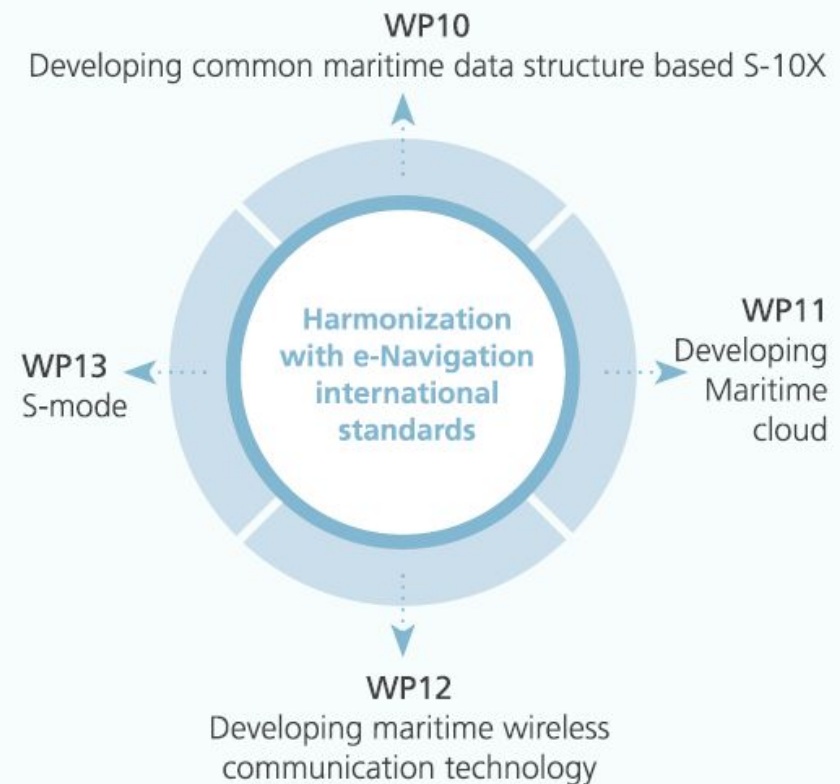
01 | Overview of SMART Navigation Project

■ Project Activities

Activity 2



Activity 3



01 Overview of SMART Navigation Project



01 | Overview of SMART Navigation Project



- Introduction Movie

SMART-Navigation_PRVideo_Expert_Eng.Version
(http://www.smartnav.org/eng/board/bbs_download.php?idx=66&download=1)

SMART-Navigation_PRVideo_Public_Eng.Version
(http://www.smartnav.org/eng/board/bbs_download.php?idx=62&download=1)

02 | SMART Navigation Services

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

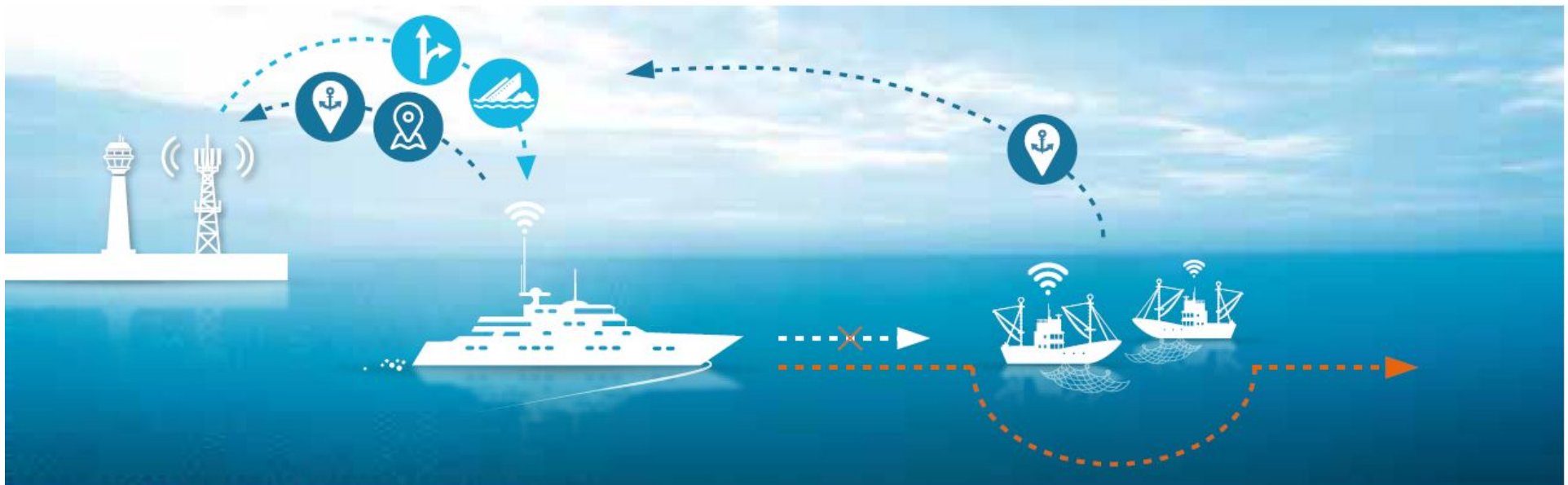
02 | SMART Navigation Services

- WP1 : Navigation Monitoring & Assistance Service (NAMAS)

NAMAS monitors navigation of vulnerable ships and gives alarm for navigation assistance to prevent collision and grounding.

It uses positional information of ships and their route information when available. LTE-Maritime and VDES/D-HF are being considered as physical communication links for NAMAS

- **NAMAS** Navigation Monitoring & Assistance Service



02 | SMART Navigation Services

- **WP2 : Ship-borne System Monitoring Service(SBSMS)**

SBSMS monitors on-board systems of passenger ships with Korean flag and other ships requesting the service to detect hazardous events within the ships such as flooding, fire and engine failure.

LTE-Maritime and VDES/SAT are being considered as physical communication links for SBSMS but not limited to these. Other communication links available on-board of service

- **SBSMS** Ship-borne System Monitoring Service



02 | SMART Navigation Services

- **WP3 : Safe & Optimal Route Planning Service (SORPS)**

SORPS provides safe and optimal routes plan when requested. It can be used for voyage planning by merchant ships or for emergency route guidance for small vessels without navigation-aid systems such as radar and AIS.

LTE-Maritime and VDES/SAT are being considered as physical communication links for SORPS but not limited to these

- **SORPS** Safe & Optimal Route Planning Service



02 | SMART Navigation Services

- **WP4 : Real-time Electronic Navigational chart Distribution & Streaming Service (REDSS)**

REDSS provides ENC of Korean waters for Non-SOLAS ships when requested.

**It supports streaming as well for small ships without on-board electronic chart system (ECS).
Only LTE-Maritime is being considered as physical communication links for REDSS**

- **REDSS** Real-time Electronic Navigational Chart Distribution & Streaming Service



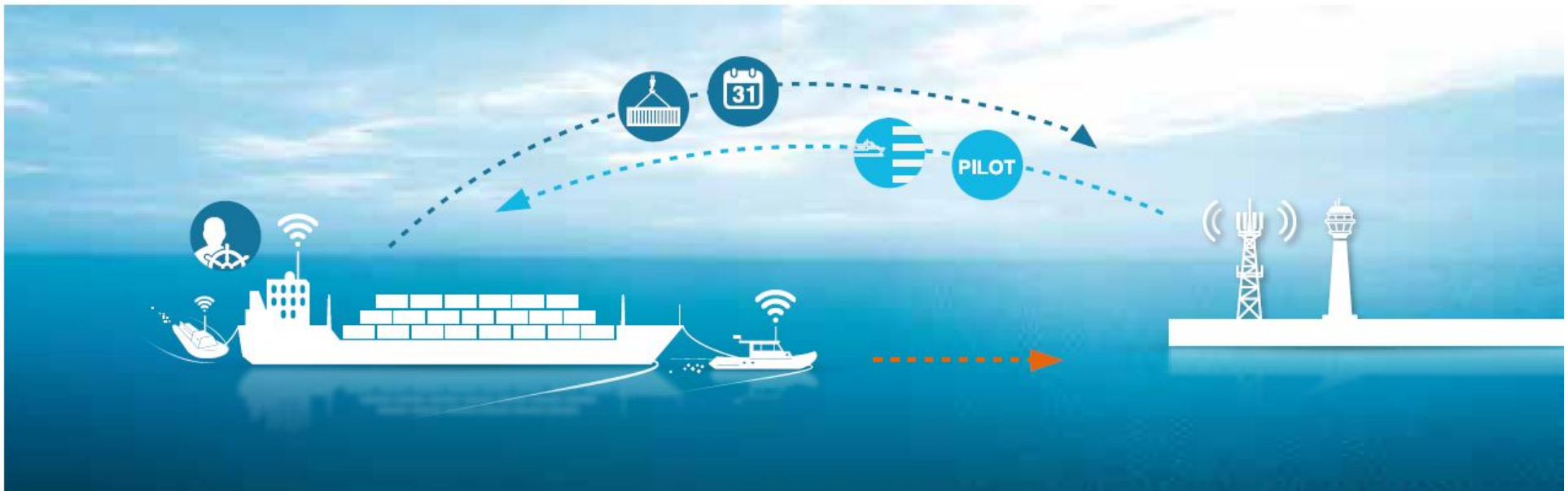
02 | SMART Navigation Services

- WP5 : Pilot & Tugs Assistance Service (PITAS)

PITAS supports pilotage by providing pilots and tugs with information needed for pilotage.

Only LTE-Maritime is being considered as physical communication links for PITAS

- PITAS** Pilot & Tug Assistance Service



02 | SMART Navigation Services

- **WP6 : Maritime Environment and Safety Information Service (MESIS)**

MESIS provides maritime safety information including navigational warning, weather information, hydrographic information and maritime environment information.

LTE-Maritime and VDES/D-HF/SAT are being considered as physical communication links for MESIS but not limited to these.

- **MESIS** Maritime Environment and Safety Information Service



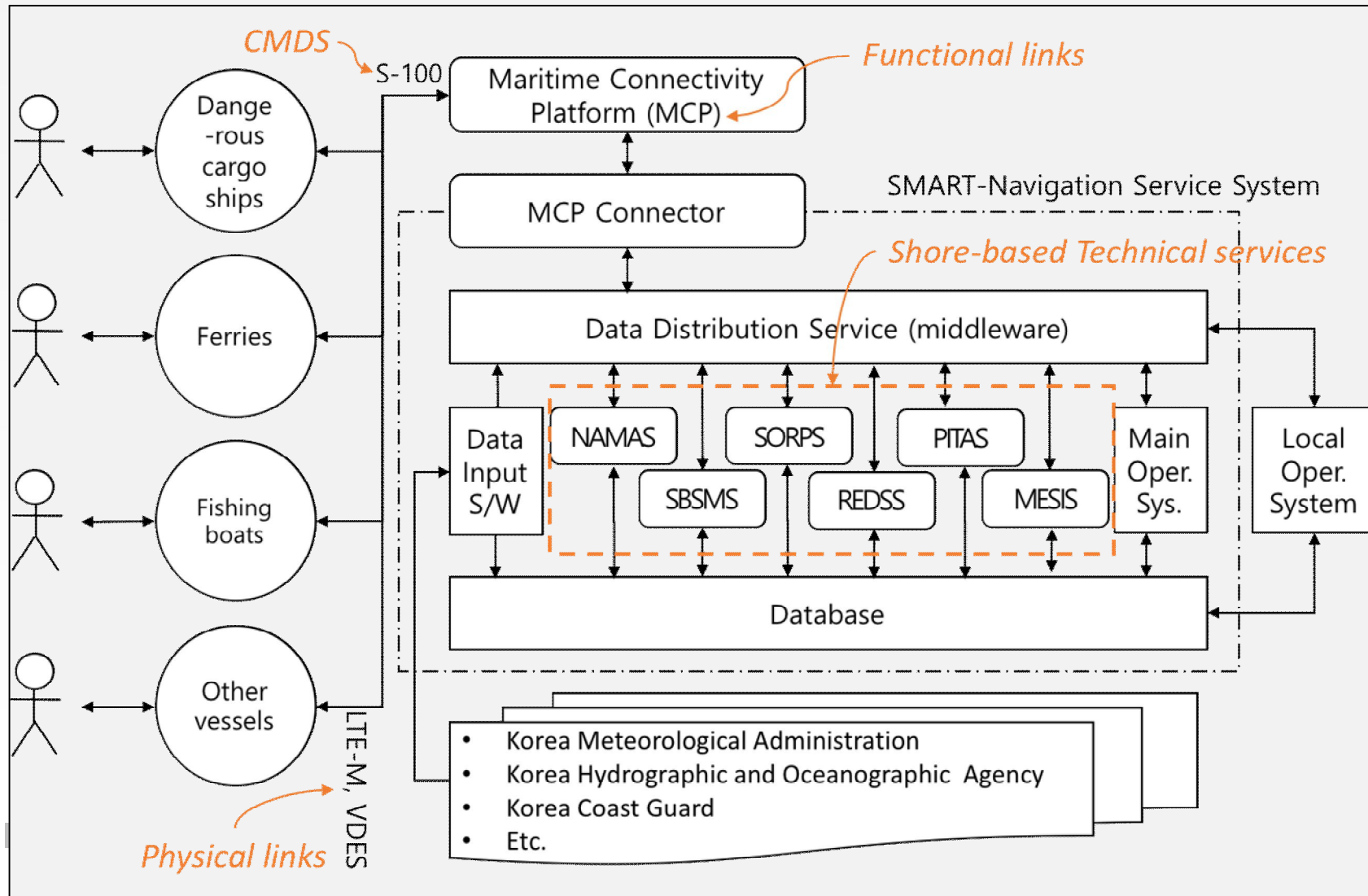
02 | SMART Navigation Services

■ Comparison between MS and SMART Services

No	Identified Services	SMART
MSP 1	VTS Information Service (IS)	S1/S2/S3
MSP 2	Navigational Assistance Service (NAS)	
MSP 3	Traffic Organization Service (TOS)	
MSP 4	Local Port Service (LPS)	
MSP 5	Maritime Safety Information Service (MSI)	S5-2
MSP 6	Pilotage service	S5-1
MSP 7	Tugs Service	
MSP 8	Vessel Shore Reporting	-
MSP 9	Telemedical Assistance Service (TMAS)	-
MSP 10	Maritime Assistance Service (MAS)	S1/S2
MSP 11	Nautical Chart Service	S4
MSP 12	Nautical Publications Service	S5-2
MSP 13	Ice Navigation Service	-
MSP 14	Meteorological Information Service	S5-2
MSP 15	Real-time Hydrographic and Environmental Information Service	
MSP 16	Search and Rescue Service	S1/S2

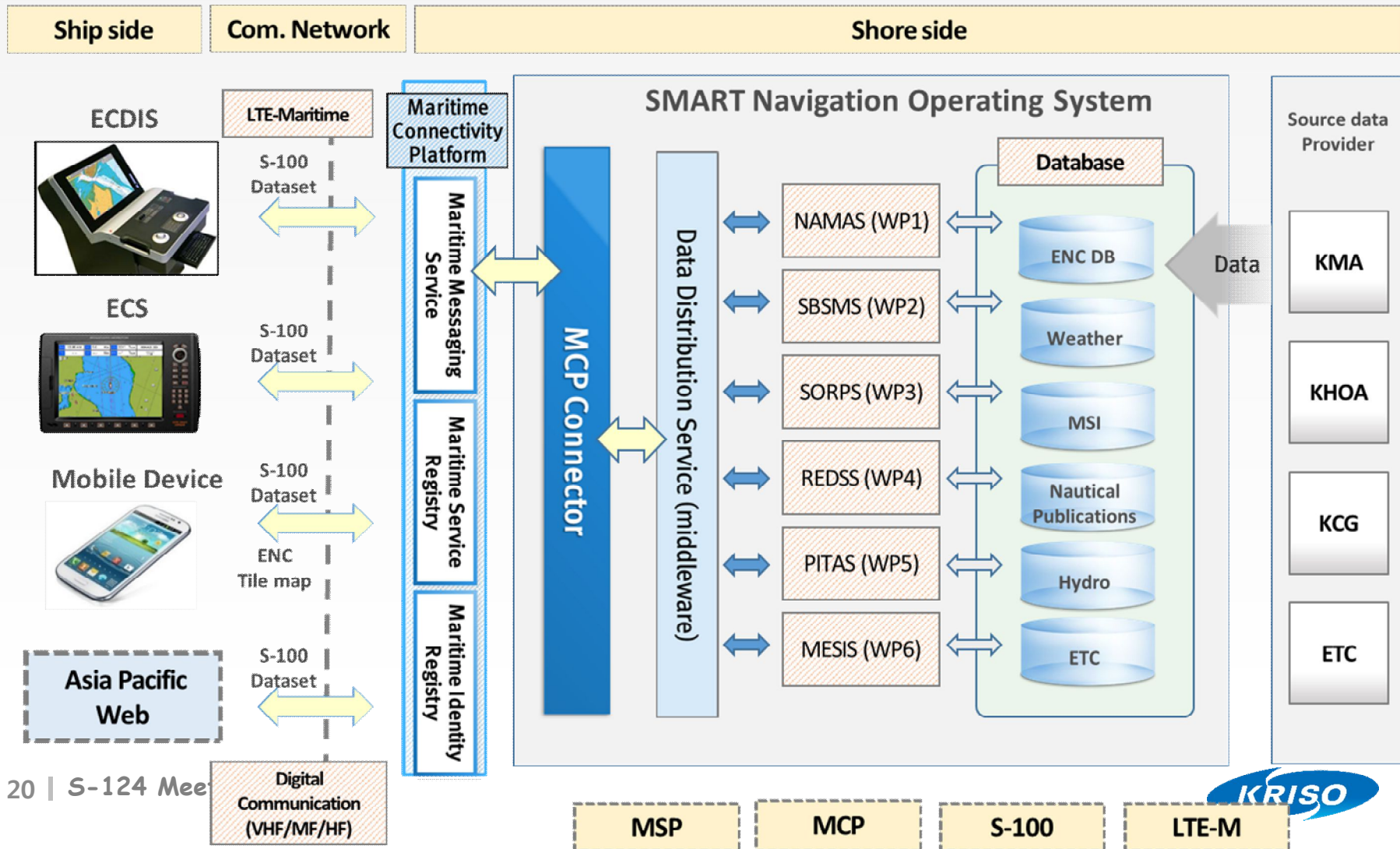
02 SMART Navigation Services

■ SMART Navigation Architecture



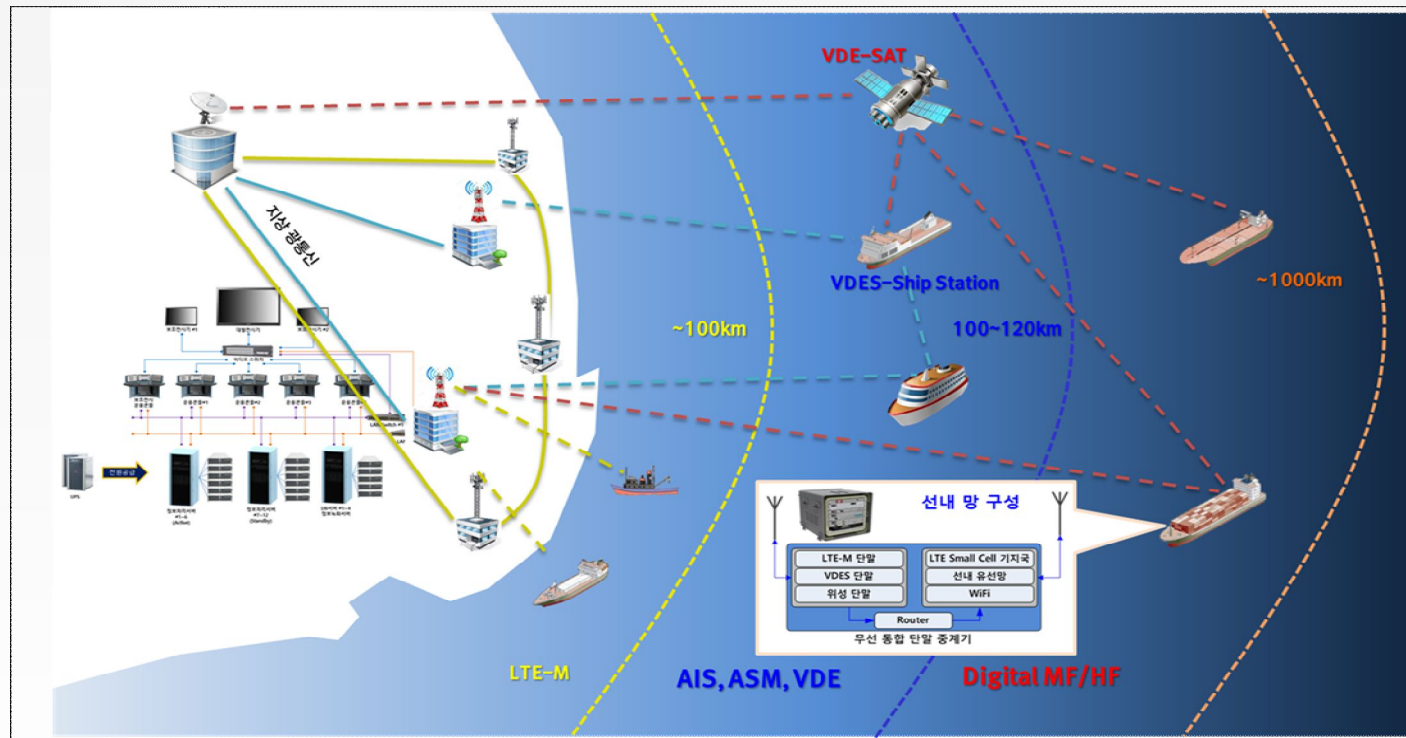
02 SMART Navigation Services

SMART Navigation Architecture



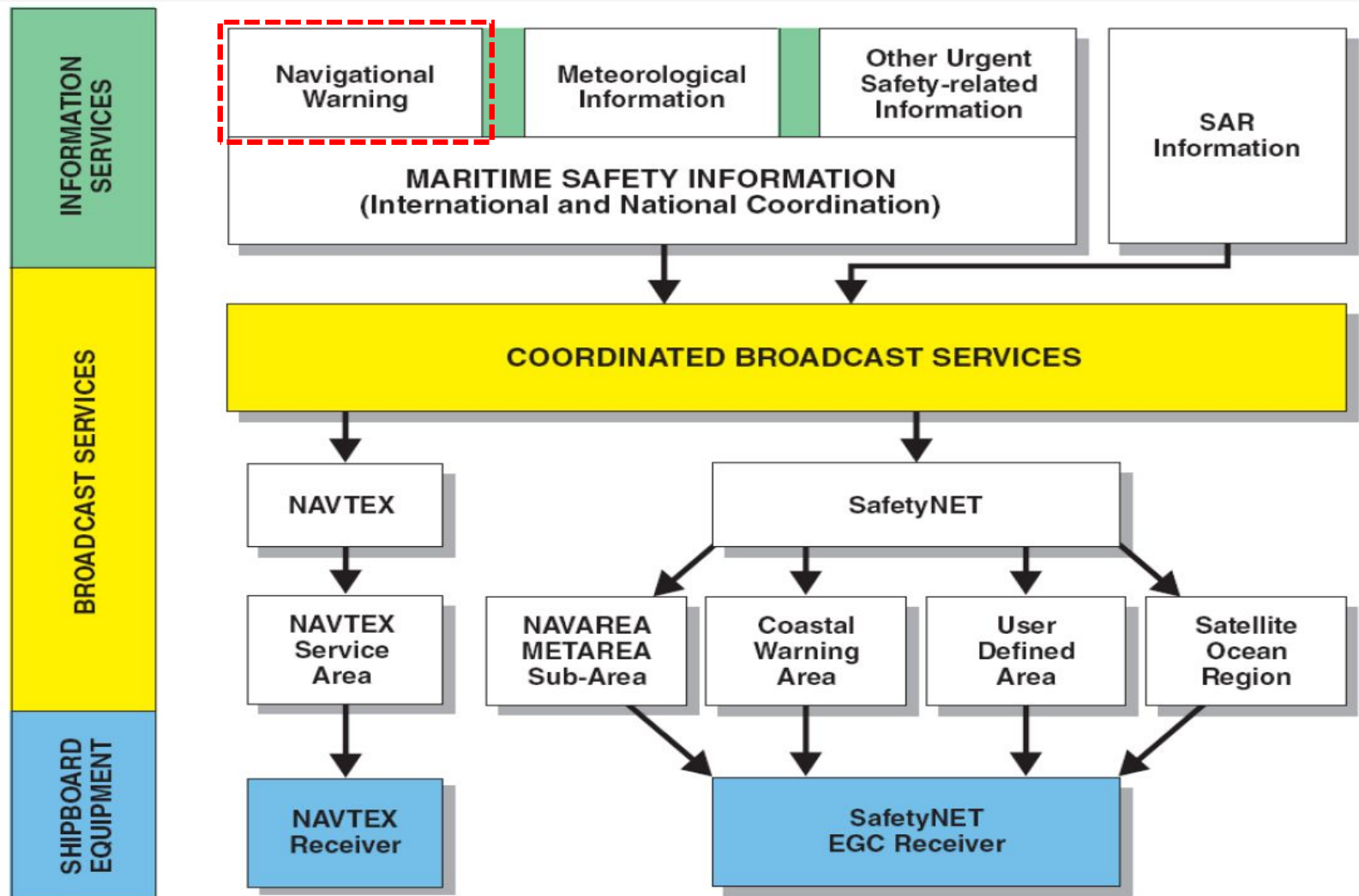
02 SMART Navigation Services

■ Communication network



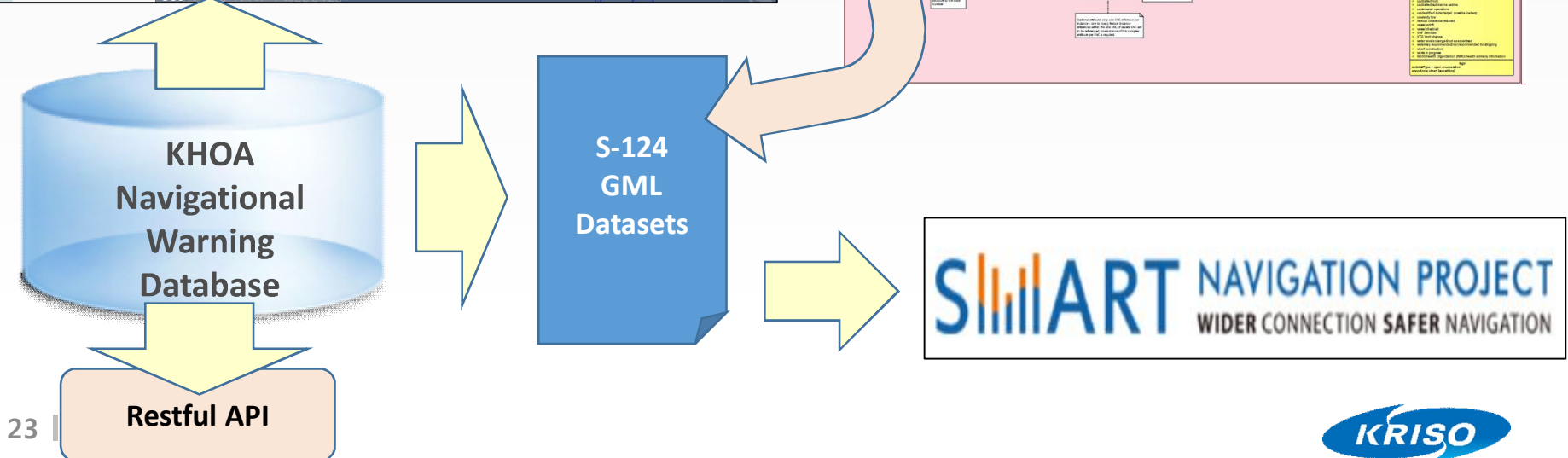
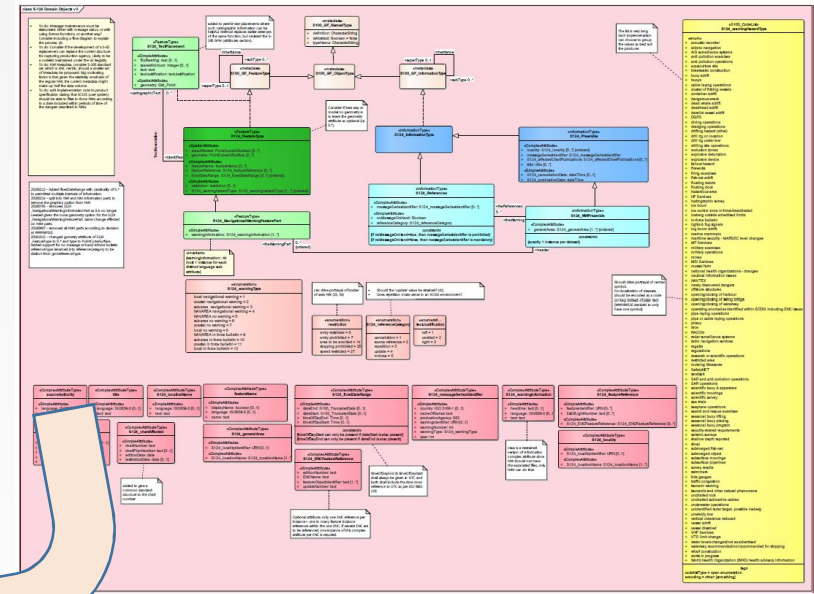
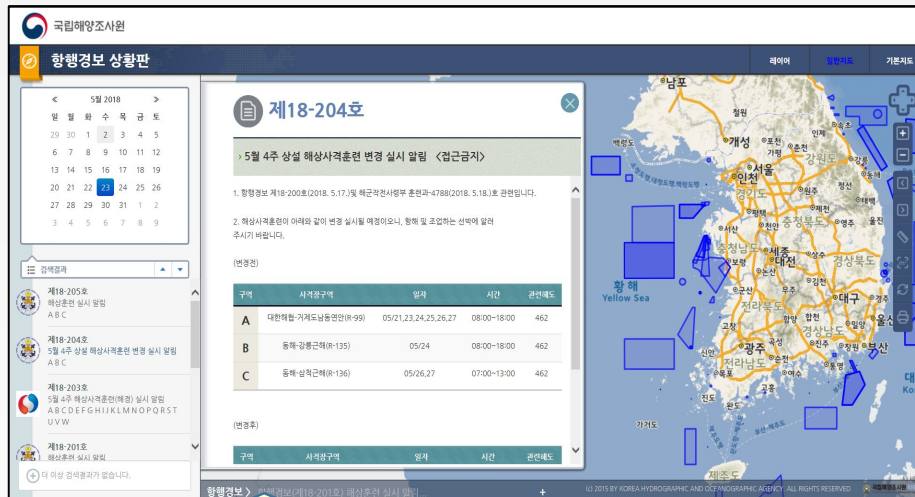
	Frequency	Range	Max. Speed	Usage	Business Scope
LTE-Maritime	700MHz band	100km	10Mbps	Domestic vessel within 100km	Nationwide
VDES	VHF	120km	307Kbps	Foreign vessel (International standard)	Pilot
Digital-HF	HF	1000km	51Kbps	Domestic vessel outside 100km	Pilot

- S-53. MSI (Maritime Safety Information)



03 | S-124 NW Service

■ Navigational Warnings system of KHOA



■ Navigational Warnings of KHOA


국립해양조사원


항행정보 상황판

레이어
일반지도
기본지도

5월 2018

일 월 화 수 목 금 토

29 30 1 2 3 4 5

6 7 8 9 10 11 12

13 14 15 16 17 18 19

20 21 22 23 24 25 26

27 28 29 30 31 1 2

3 4 5 6 7 8 9

검색결과

제18-205호

해상훈련 실시 알림

A B C

제18-204호

5월 4주 상설 해상사격훈련 변경 실시 알림

A B C

제18-203호

5월 4주 해상사격훈련(해경) 실시 알림

A B C D E F G H I J K L M N O P Q R S T U V W

제18-201호

해상훈련 실시 알림

+ 더 이상 검색결과가 없습니다.

제18-204호

5월 4주 상설 해상사격훈련 변경 실시 알림 <접근금지>

1. 항행정보 제18-200호(2018. 5.17.) 및 해군작전사령부 훈련과-4788(2018. 5.18.)호 관련입니다.

2. 해상사격훈련이 아래와 같이 변경 실시될 예정이오니, 항해 및 조업하는 선박에 알려 주시기 바랍니다.

(변경전)

구역	사격장구역	일자	시간	관련해도
A	대한해협-거제도남동연안(R-99)	05/21,23,24,25,26,27	08:00~18:00	462
B	동해-강릉근해(R-135)	05/24	08:00~18:00	462
C	동해-삼척근해(R-136)	05/26,27	07:00~13:00	462

(변경후)

구역	사격장구역	일자	시간	관련해도
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항행정보 > 항행정보(제18-201호) 해상훈련 실시 알림...

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03 | S-124 NW Service

Restful API service of KHOA

DATA 공공데이터포털
.GO.KR

[로그인](#)
[회원가입](#)
[사이트맵](#)
[ENGLISH](#)

[데이터셋](#)
[제공신청](#)
[활용사례](#)
[정보공유](#)
[이용안내](#)

[홈](#) / [데이터셋](#) / [오픈API](#)

오픈 API

·제공기관

해양수산부 국립해양조사원

·관리부서명

해도수로과

·관리부서 전화번호

051-400-4333

·등록일

2016-10-28

XML

해상사격훈련구역

개발자네트워크

활용신청

닫기

오류신고

★

XML

항행경보 현황

개발자네트워크

활용신청

상세정보

오류신고

★

※ 서비스 오류가 있을시 오류신고 버튼을 이용해주세요.

해상사격훈련구역

End Point	http://apis.data.go.kr/1192136/Seatn		
데이터포맷	XML	API 유형	REST
비용부과유무	무료	활용신청 건수	5

스크랩

■ Navigational Warnings

Korea Hydrographic and Oceanographic Agency



351 Haeyang-ro Yeongdo-gu
 BUSAN 49111, Rep. of KOREA
 Tel. +82-51-400-4331

RECEIVER	SENDER
NAVAREA XI Coordinator Hydrographic and Oceanographic Department of J.C.G, JAPAN	Nautical Chart Division of KHOA, Republic of KOREA E-Mail : ntmkhoa@korea.kr
Fax. No. +81-3-5500-7171	Fax. No. +82-51-400-4349
Page(Including this one) : 1 Sheet	Date : May 18, 2018

Korean Navigational Warning(No.18-202)

Marine operations will be conducted as follows. Mariners are advised to navigate with caution.

☐ West Coast - Mokpo Hang - Marine Operations

- Period : ~ May 19 18:00
- Position (WGS-84) : area within 0.2 NM radius of 34-47.3130N, 126-14.8320E
- Affected Chart : 3162
- Vessel Name : D-01
- Remark: Searching for anchor, anchor chain and nylon loops

Korea Hydrographic and Oceanographic Agency



351 Haeyang-ro Yeongdo-gu
 BUSAN 49111, Rep. of KOREA
 Tel. +82-51-400-4331

RECEIVER	SENDER
NAVAREA XI Coordinator Hydrographic and Oceanographic Department of J.C.G, JAPAN	Nautical Chart Division of KHOA, Republic of KOREA E-Mail : ntmkhoa@korea.kr
Fax. No. +81-3-5500-7171	Fax. No. +82-51-400-4349
Page(Including this one) : 1 Sheet	Date : May, 21, 2018

Korean Navigational Warning(No.18-205)

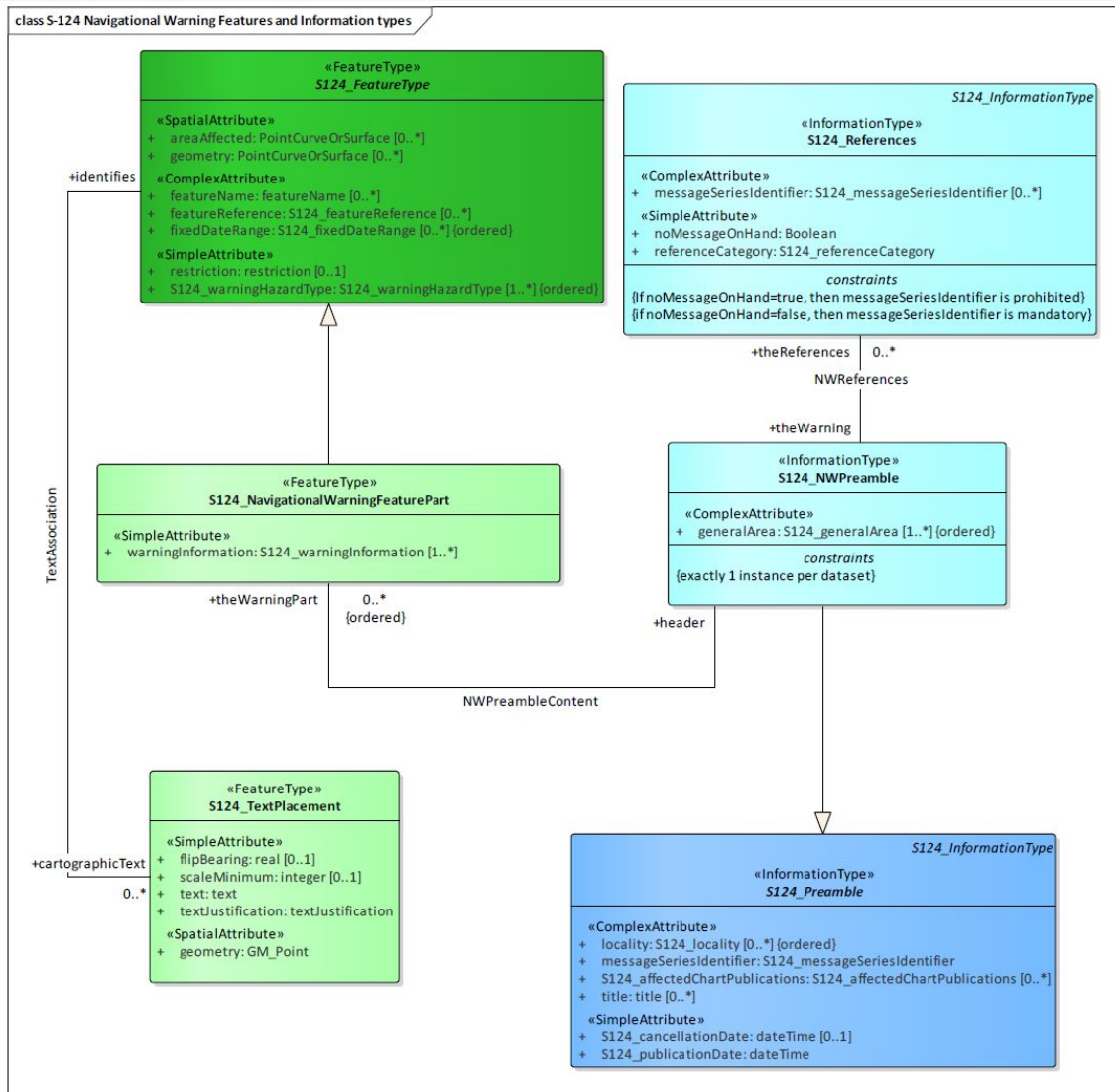
Maritime exercises will be conducted as follows. Mariners are advised to navigate with caution in these areas.

☐ Maritime exercises

No.	Area (WGS-84)	Date	Time (KST)	Chart Affected
A	East Sea - South part of East Sea Area bounded by line joining belows ① 36-00-00.0N, 129-50-00.0E ② 36-00-00.0N, 130-52-00.0E ③ 35-10-00.0N, 130-11-00.0E ④ 35-10-00.0N, 129-50-00.0E	May. 23 ~ 29	00:00 ~ 24:00	1600 1014
B	East Sea - Approches to Pohang Hang 36-10-01N, 129-28-22E Area within 2 NM radius of	May. 29	13:00 ~ 17:00	1711
		May. 31	18:30 ~ 21:30	
C	South Coast - Korea Strait 33-09-00N, 127-20-00E Area within 5 NM radius of	May. 29 06:00 ~ May. 30 18:00		2400

03 | S-124 NW Service

■ S-124 Data model (GML encoding)



INTERNATIONAL HYDROGRAPHIC ORGANIZATION



**IHO GEOSPATIAL STANDARD
FOR NAVIGATIONAL WARNINGS**

Working Draft – 2.0.0

2019-07-12

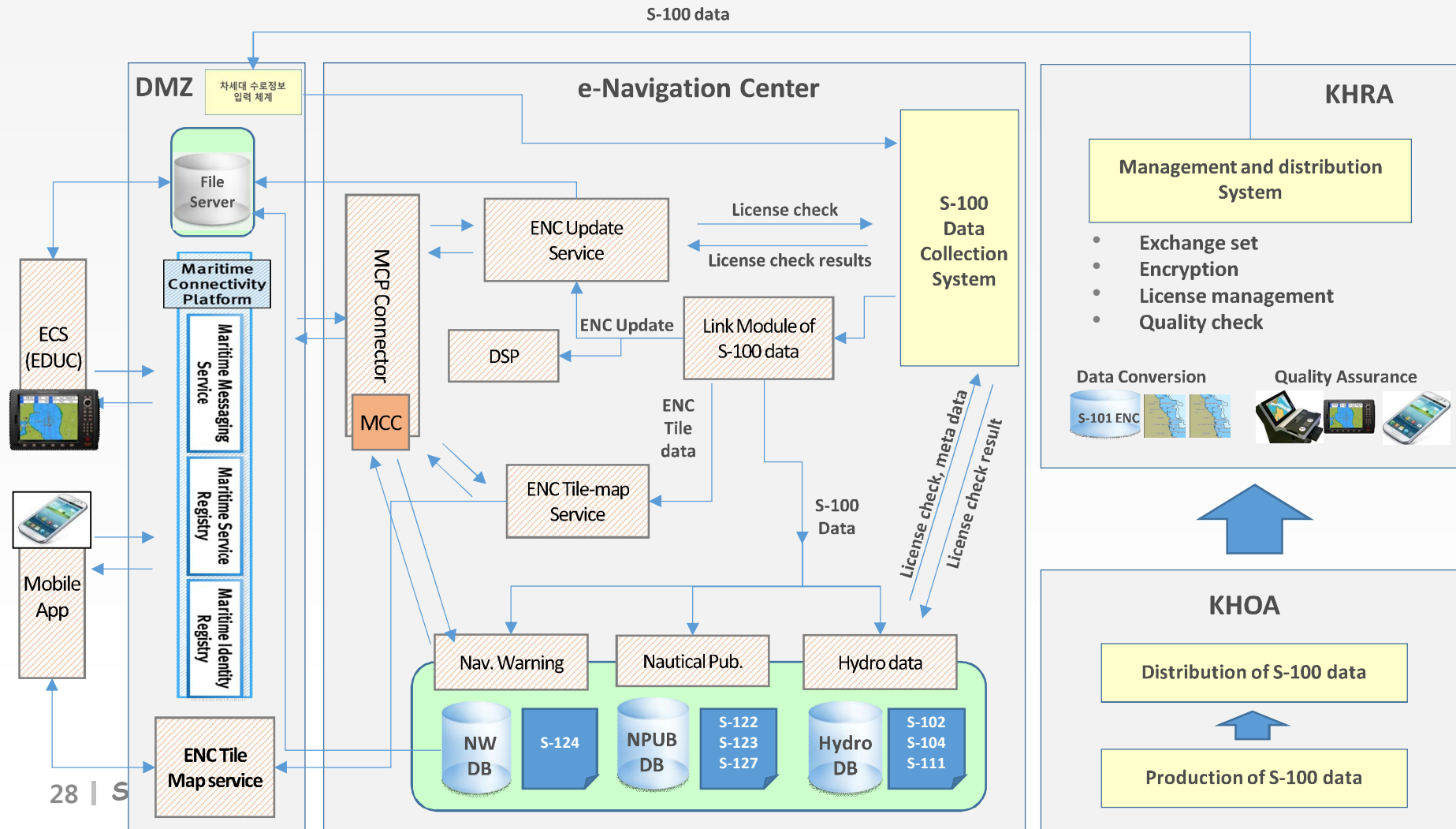
Special Publication No. S-124
Navigational Warnings - Product Specification

Published by the
International Hydrographic Organization
MONACO



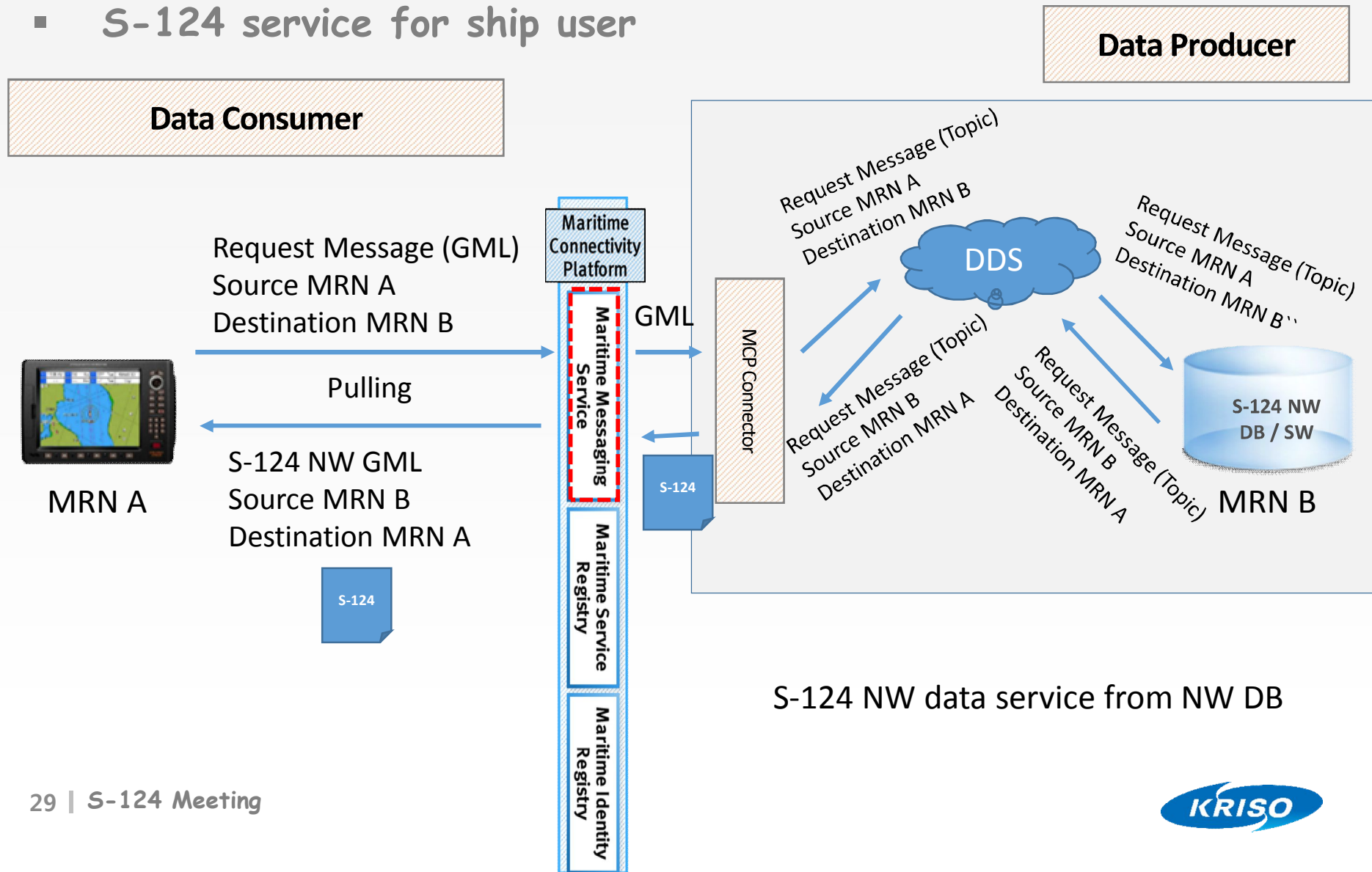
03 | S-124 NW Service

■ MSI Service process



03 | S-124 NW Service

- S-124 service for ship user



■ MCP (MMS, MIR)

Request message

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03 | S-124 NW Service

■ MCP (MMS, MIR)

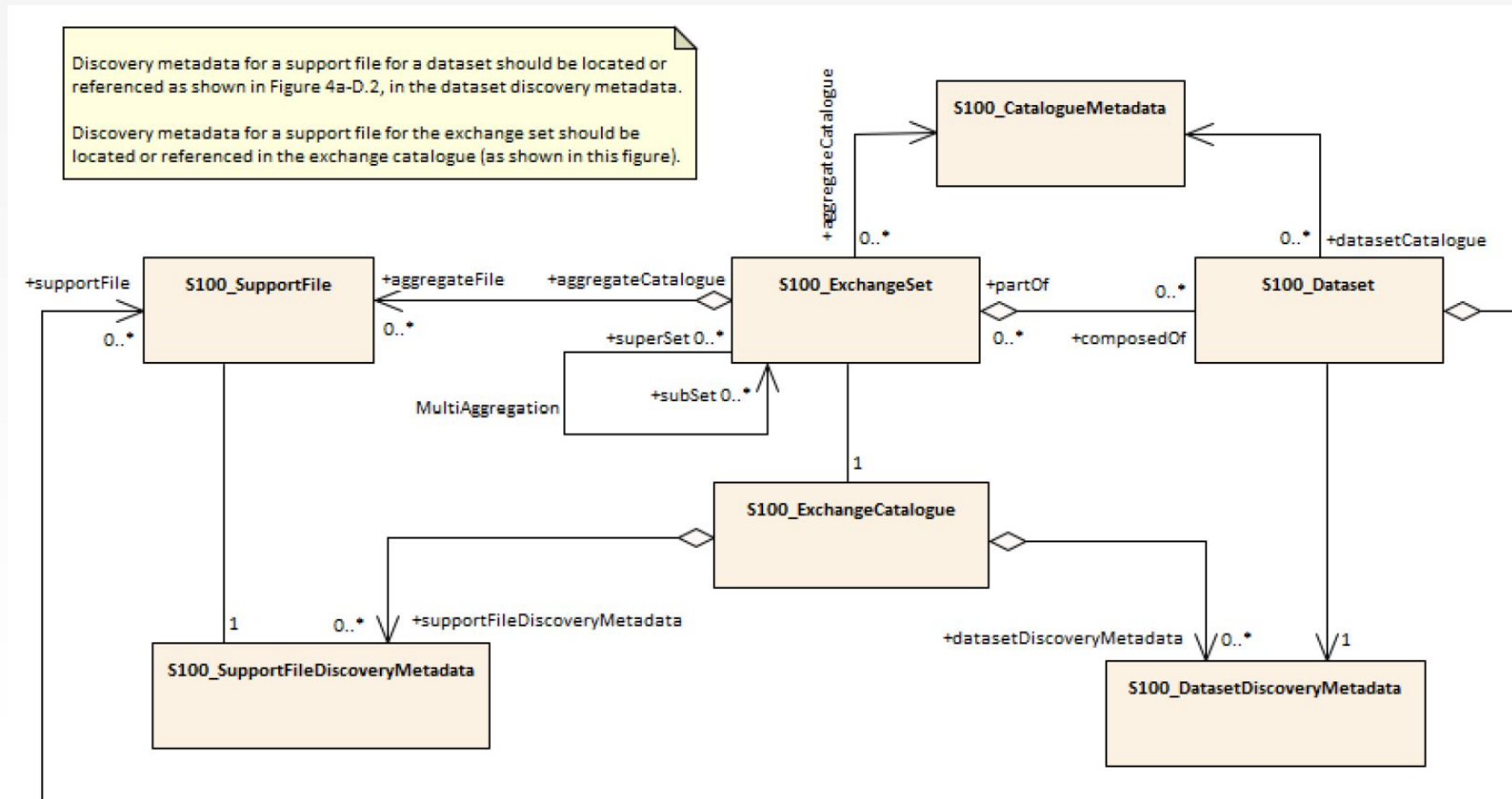
Received S-124 NW GML

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34.13493572847643</gml:posList>
                </gml:LinearRing>
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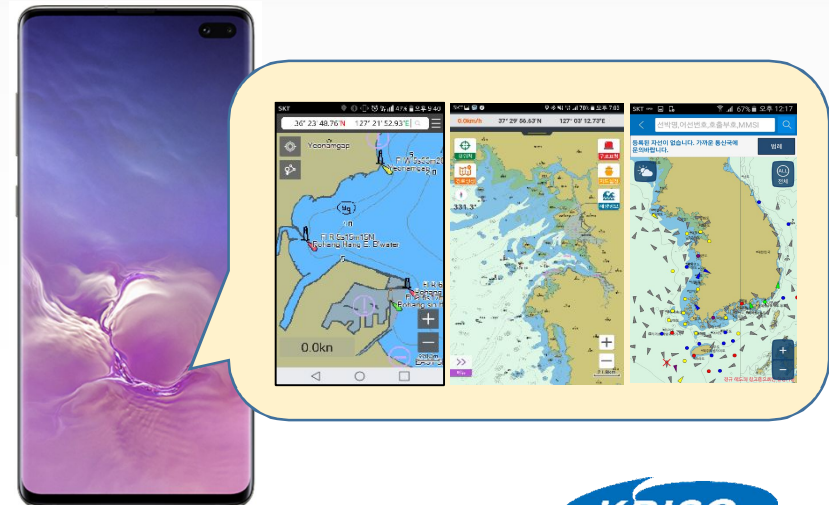
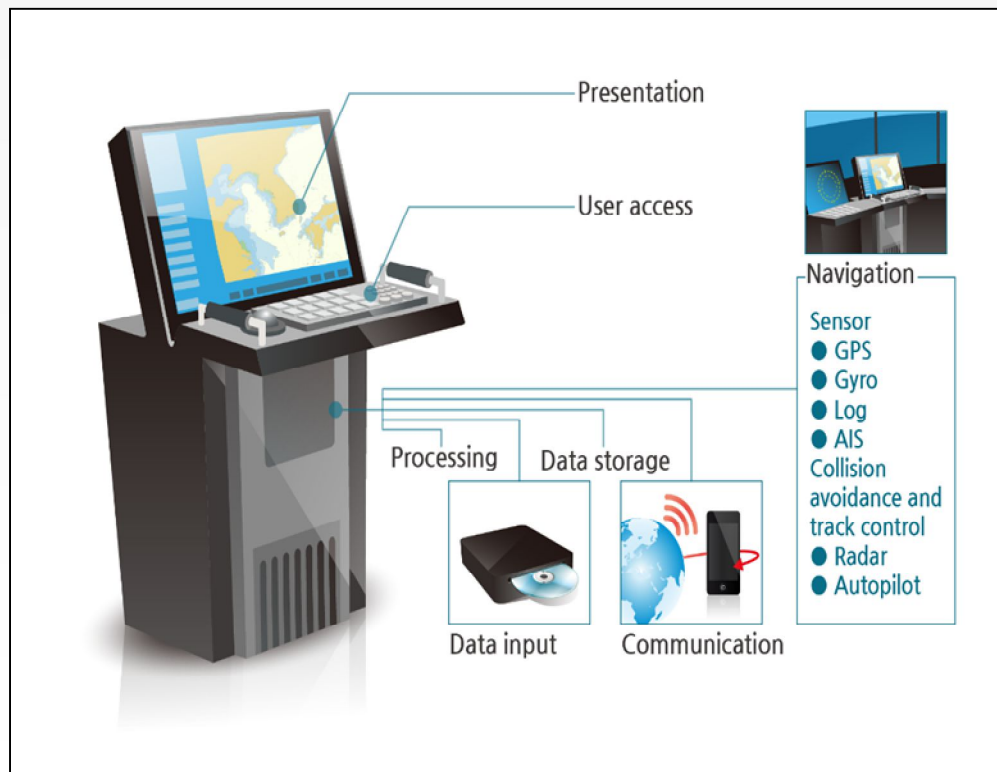
03 | S-124 NW Service

- S-124 Exchange data set



04 | Shipborne user system

- ECDIS, ECS, Mobile App



04 | Shipborne user system

- **ECS Standards**

- IEC 62376 - ECS(Electronic chart system) - Operational and performance requirements, methods of testing and required test results (Withdrawn in 2013)
- RTCM Standard 10900.6 for ECS (July 1, 2015)

- **Normative references for ECS Standard**

- IEC 60945: 2002, Maritime navigation and radio communication equipment and systems - General requirements - Method of testing and required test results
- IEC 61162 (all parts), Digital interfaces
- IEC 62288: Presentation of navigation related information
- IEC 61174: 2015, ECDIS - Operational and performance requirements, methods of testing and required test results

04 | Shipborne user system

■ Overview of ECS Standard for SMART Navigation

ECS Standard for SMART Navigation

This Standard specifies the minimum operational, performance and technical requirements and methods of testing for SMART Navigation compliant ECS

IEC 60945
(General requirements)

IEC 62288
(Presentation of navigation related info)

IEC 61174
(ECDIS requirements and testing method)

Class B level of
ECS and
Additional
Requirements

IEC 61162-1, 61162-2
(Digital interfaces)

S-101 and S-10X datasets

- ▶ S-101 ENC
- ▶ S-104 Water level for Navigation
- ▶ S-111 Surface Current
- ▶ S-124 Navigational Warnings
- ▶ S-12X Nautical Publications

SMART Navigation Service Based on S-100

- ▶ Message service for collision and grounding accident
- ▶ Optimal route planning service
- ▶ ENC service
- ▶ Marine information service

Interoperability Requirement

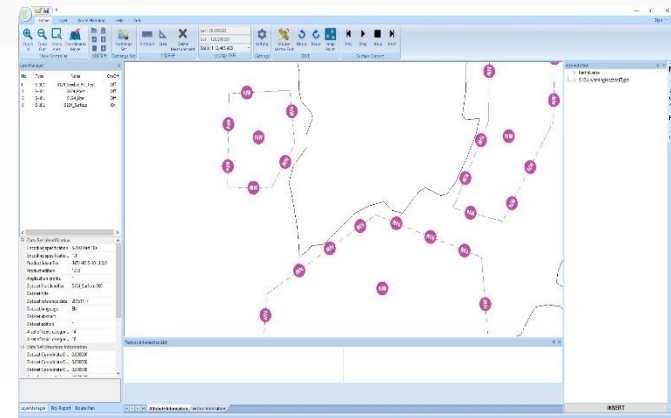
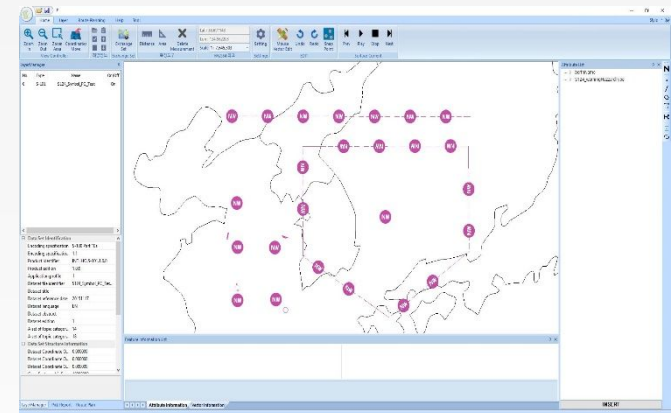
- ▶ Interoperability catalogue
- ▶ Files describing how an ECS must combine data products conforming to different product specifications for display purposes

LTE-M Router Interface

- ▶ Define the digital interfaces to link to the LTE-M Router

04 | Shipborne user system

- Portrayal catalogue of S-124 NW



04 Shipborne user system

■ Creation of FC/PC based on the latest NW data model

```
<S100FC:S100_FC_FeatureCatalogue xmlns:S100FC="http://www.iho.int/S100FC"
xmlns:S100Base="http://www.iho.int/S100Base" xmlns:S100CI="http://www.iho.int/S100CI"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:S100FD="http://www.iho.int/S100FD"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.iho.int/S100FC
S100FC.xsd">
  <S100FC:name>S-124 NW</S100FC:name>
  <S100FC:scope/>
  <S100FC:versionNumber/>
  <S100FC:versionDate>2019-08-19</S100FC:versionDate>
  <S100FC:producer> </S100FC:producer>
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- AreaFills
- ColorProfiles
- Fonts
- LineStyles
- Pixmap
- Rules
- Symbols

portrayal_catalogue.xml

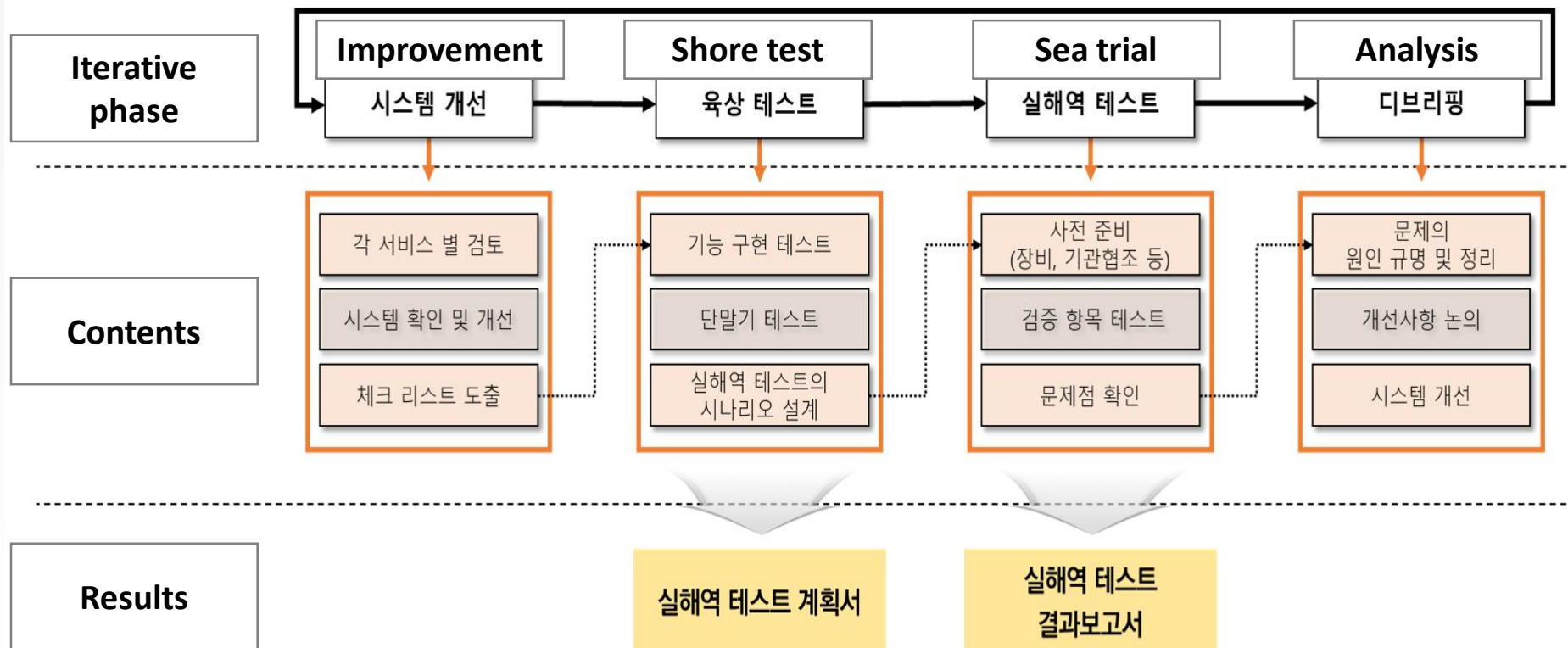
- _Default_COMMON.xml
- attributeRules.xml
- main.xml
- S124_NavigationalWarningFeaturePart.xml
- S124_TextPlacement.xml
- simpleLineStyle.xml
- textStyle.xml



```
1 <?xml version="1.0" encoding="utf-8" standalone="yes"?>
2 <?xml-stylesheet href="SVGStyle.css" type="text/css"?>
3 <svg xmlns="http://www.w3.org/2000/svg" version="1.2" baseProfile="tiny" xml:space
  rendering:geometricPrecision; fill-rule:evenodd; width="10.86mm" height="10.86mm" viewBox="-5.42 -5.44 10.86 10.86">
4   <title>NW</title>
5   <desc>pattern of symbol</desc>
6   <metadata>
7     <S100SVG xmlns:iho="http://www.iho.int/SVGMetadata">
8       <Description publisher="IHB" creationDate="2019-08-01" source="S52PresLib4.0" format="S100SVG" version="0.1" />
9     </S100SVG>
10    </metadata>
11    <rect class="symbolBox layout" fill="none" x="-5.42" y="5.420001" height="10.86" width="10.86" />
12    <rect class="svgBox layout" fill="none" x="-5.42" y="-5.44" height="10.86" width="10.86" />
13    <path d=" M 1.38,-4.75 L 1.07,-4.82 L 0.76,-4.88 L 0.5,-4.91 L 0.23,-4.92 L 0.01,-4.94 L -0.34,-4.92 L -0.64,-4.89 L
    -0.94,-4.84 L -1.25,-4.77 L -1.52,-4.69 L -1.82,-4.58 L -2.08,-4.46 L -2.29,-4.36 L -2.59,-4.19 L -2.89,-3.99 L
    -3.15,-3.79 L -3.32,-3.64 L -3.49,-3.47 L -3.68,-3.27 L -3.84,-3.08 L -4.02,-2.84 L -4.19,-2.59 L -4.35,-2.31 L
    -4.48,-2.05 L -4.59,-1.78 L -4.69,-1.5 L -4.79,-1.14 L -4.86,-0.8 L -4.9,-0.51 L -4.92,-0.2 L -4.92,0.08 L -4.91,0.4
    -4.87,0.72 L -4.82,0.99 L -4.77,1.22 L -4.67,1.54 L -4.57,1.84 L -4.48,2.04 L -4.38,2.25 L -4.27,2.45 L -4.11,2.71 L
    -3.95,2.94 L -3.77,3.17 L -3.58,3.38 L -3.4,3.56 L -3.24,3.71 L -3.05,3.87 L -2.84,4.03 L -2.53,4.23 L -2.28,4.37 L
    -1.93,4.54 L -1.64,4.65 L -1.34,4.75 L -1.04,4.82 L -0.68,4.89 L -0.34,4.92 L 0.01,4.92 L 0.28,4.92 L 0.67,4.89 L
    1.03,4.83 L 1.32,4.76 L 1.66,4.65 L 2.14,4.46 L 2.43,4.3 L 2.75,4.1 L 3.04,3.9 L 3.33,3.66 L 3.57,3.43 L 3.84,3.13 L
    4.11,2.76 L 4.28,2.49 L 4.44,2.19 L 4.6,1.85 L 4.69,1.56 L 4.79,1.27 L 4.86,0.95 L 4.91,0.66 L 4.94,0.4 L 4.94,0.01 L
    4.94,-0.32 L 4.92,-0.57 L 4.86,-0.96 L 4.78,-1.3 L 4.69,-1.59 L 4.59,-1.86 L 4.48,-2.08 L 4.36,-2.34 L 4.15,-2.7
    3.98,-2.94 L 3.77,-3.21 L 3.56,-3.44 L 3.32,-3.67 L 3.08,-3.87 L 2.82,-4.06 L 2.56,-4.23 L 2.27,-4.39 L 1.94,-4.55 L
    1.62,-4.67 L -0.69,-2.24 L -1.08,-2.24 L -1.08,0.81 L -2.87,-2.24 L -3.77,-2.24 L -3.78,2.22 L -2.87,2.22 L -2.87,1.16 L
    -2.87,-0.71 L -1.07,2.24 L -0.16,2.24 L -0.17,-2.24 L -0.69,-2.24 L 1.62,-4.67 L 0.51,-2.24 L 0.4,-2.24 L 0.28,-2.24 L
    1.19,2.24 L 1.79,2.24 L 2.2,-0.4 L 2.64,2.24 L 3.24,2.24 L 4.1,-2.24 L 3.36,-2.24 L 2.94,0.42 L 2.51,-2.24 L 1.88,-2.24 L
    1.48,0.42 L 1.04,-2.24 L 0.51,-2.24 L 1.62,-4.67 L 1.62,-4.67" class="FMARMG" style="stroke-width:0.32;" />
14 </svg>
```

05 | 2nd Sea trial test

■ Process of sea trial



05 | 2nd Sea trial test

- **Scope**
 - Time : 20th August, 2019
 - Test Place



05 | 2nd Sea trial test

- Site 2 (Tongyoung - Hansando)



05 | 2nd Sea trial test

- Site 2 (Tongyoung - Hansando)



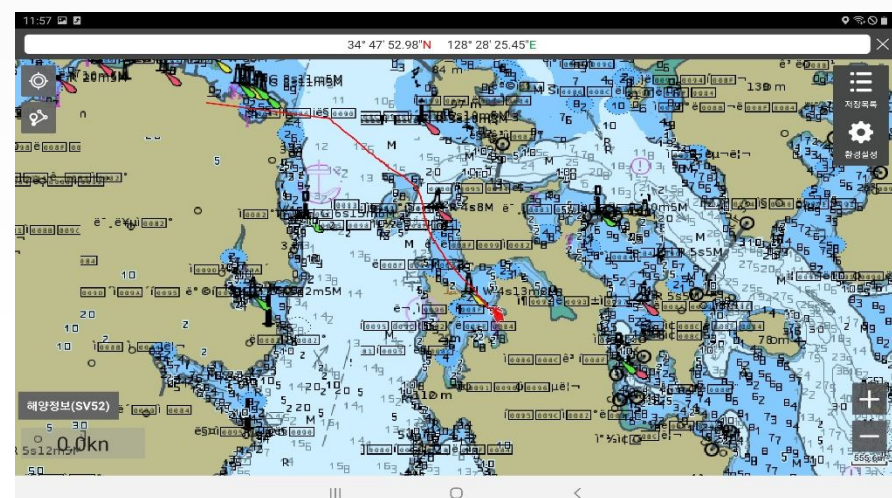
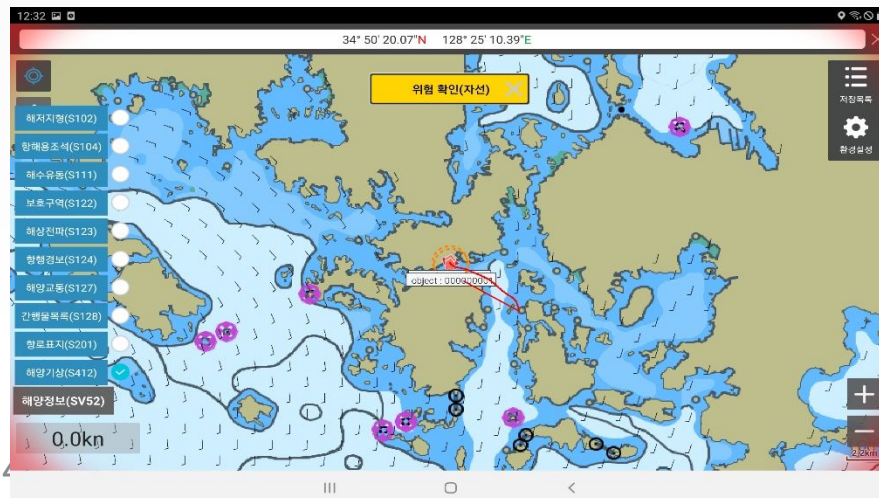
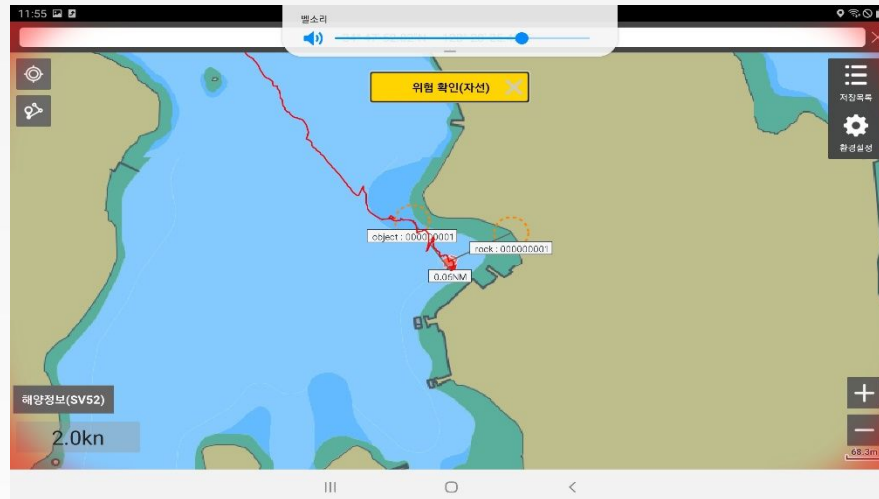
05 | 2nd Sea trial test

- Site 2 (Tongyeong - Hansando)



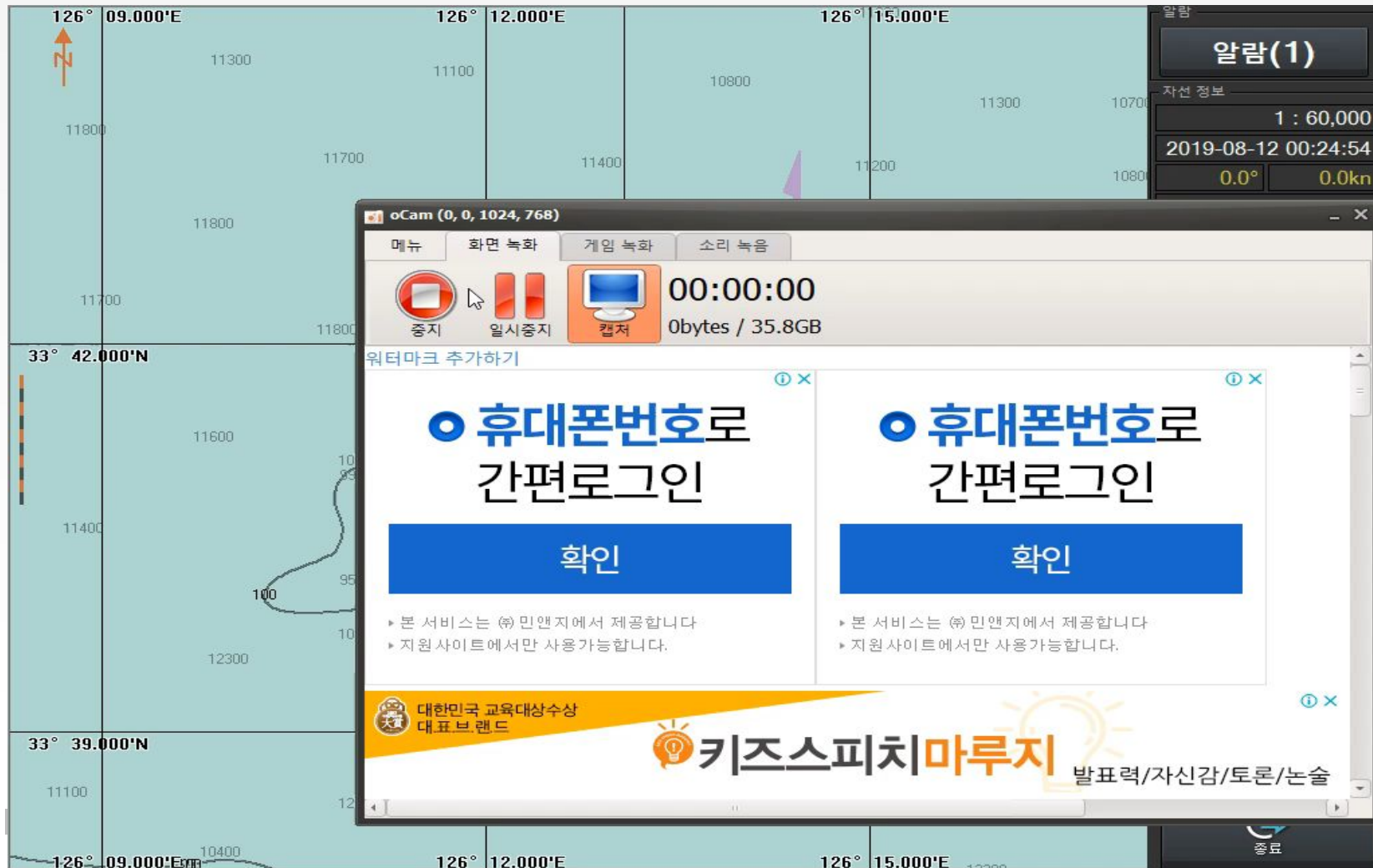
05 | 2nd Sea trial test

- Site 2 (Tongyoung - Hansando)



05 | 2nd Sea trial test

■ Site 2 (Tongyoung - Hansando)



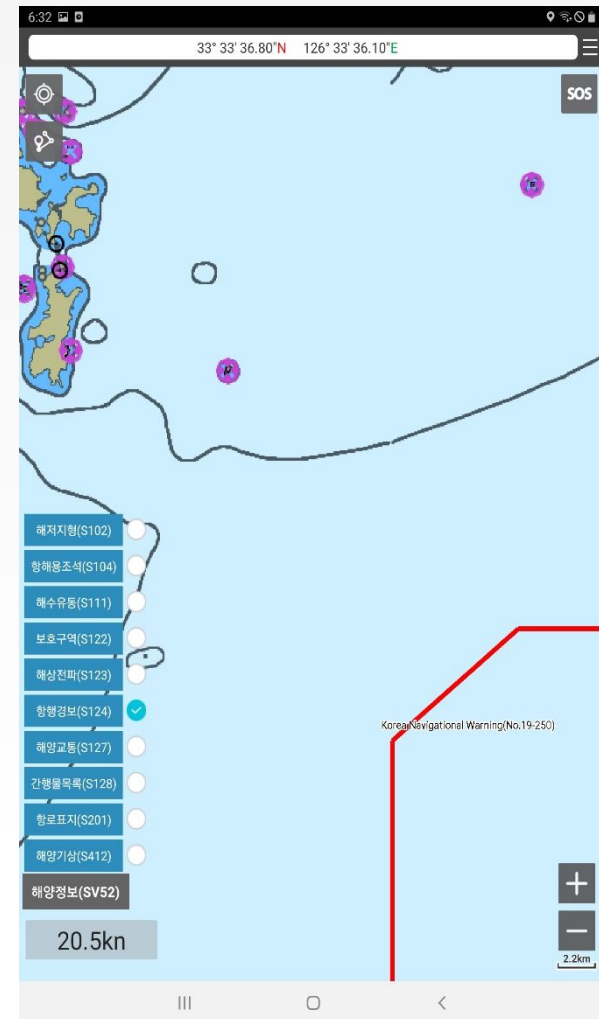
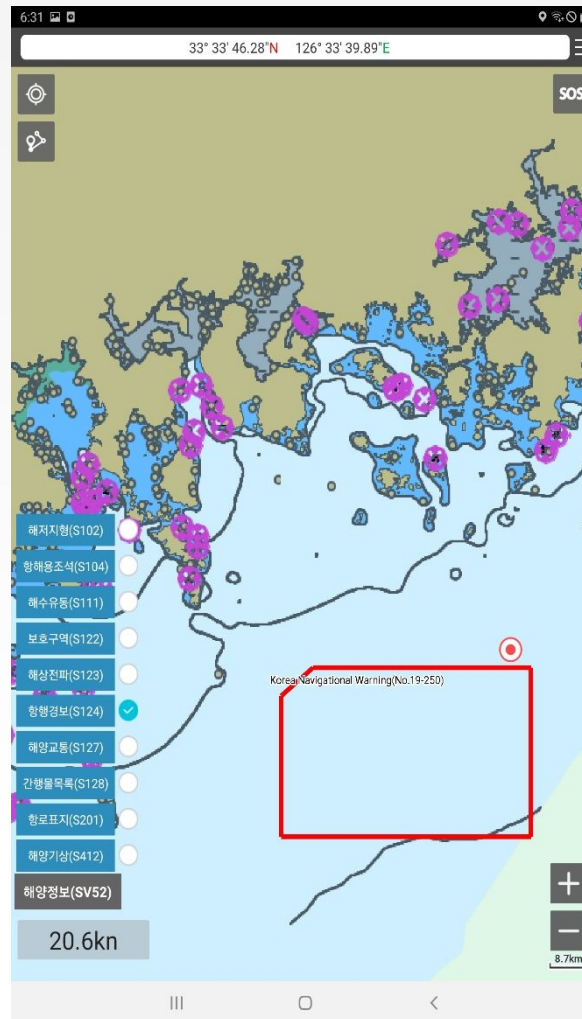
05 | 2nd Sea trial test

- Site 3 (Wando - Jeju)



05 | 2nd Sea trial test

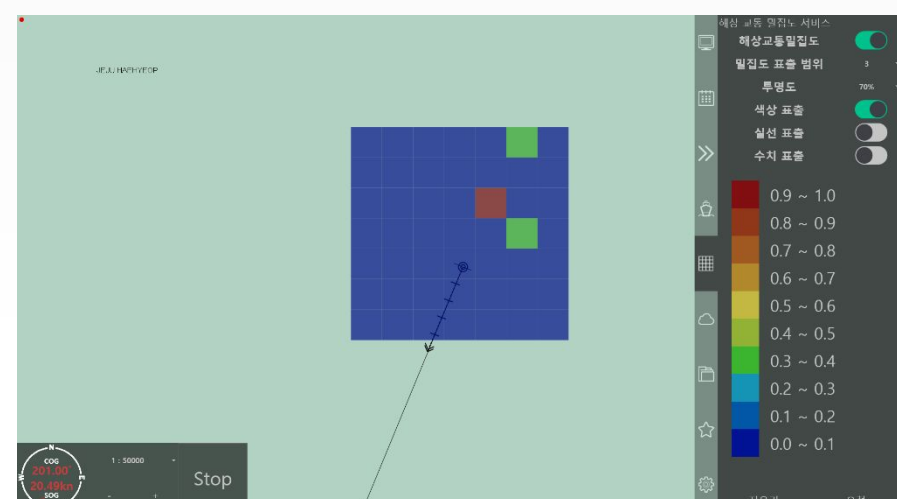
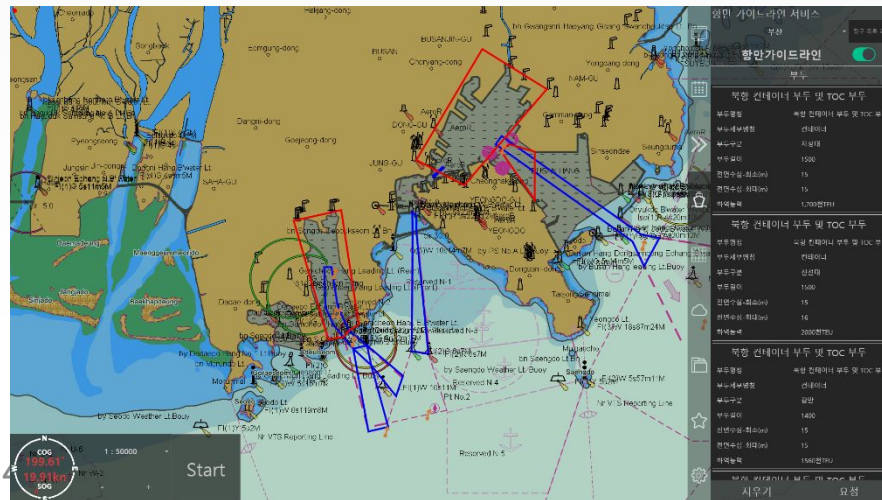
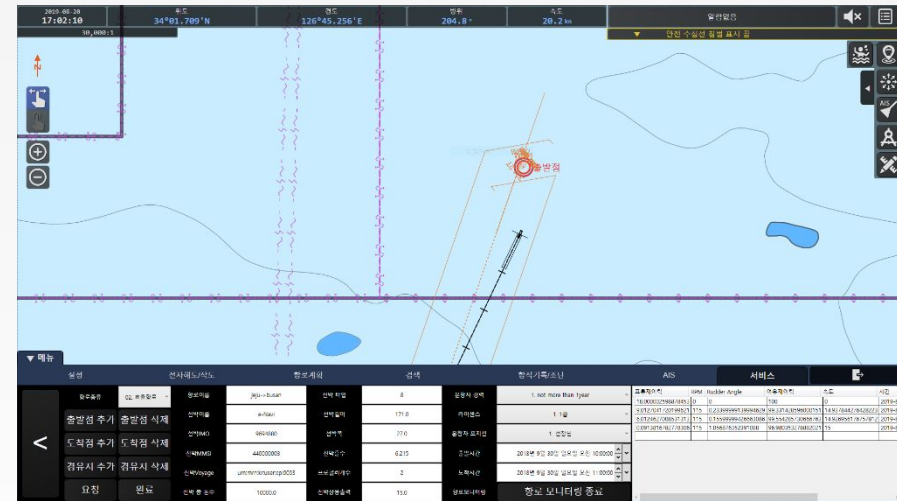
■ Site 3 (Wando - Jeju)



05 | 2nd Sea trial test



- Site 3 (Wando - Jeju)



05 | 2nd Sea trial test

■ S-124 NW Test cases

