



THE INTERNATIONAL HYDROGRAPHIC ORGANIZATION

**THE UNIVERSAL HYDROGRAPHIC DATA MODEL S-100:
S-100 AND S-200 PRODUCTS DEVELOPMENT**

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IHO DIRECTOR



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THE EVOLUTION OF REPRESENTATION OF MARITIME ENVIRONMENT

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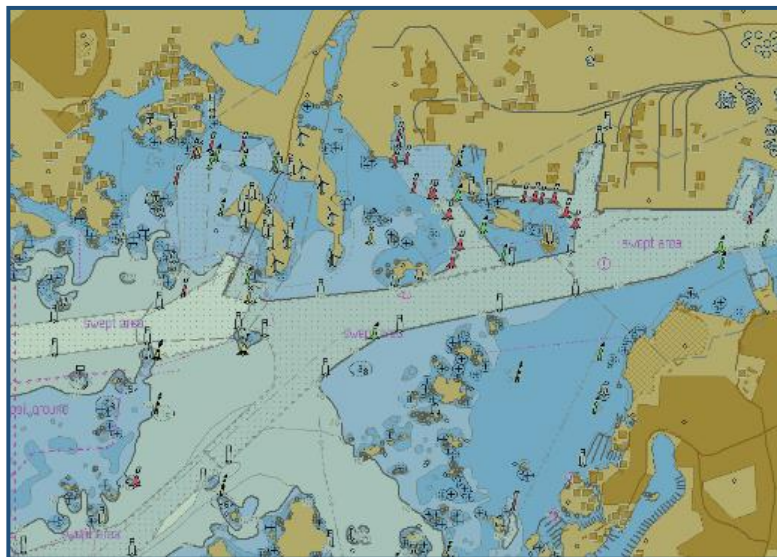
4D ECDIS

2D ECDIS

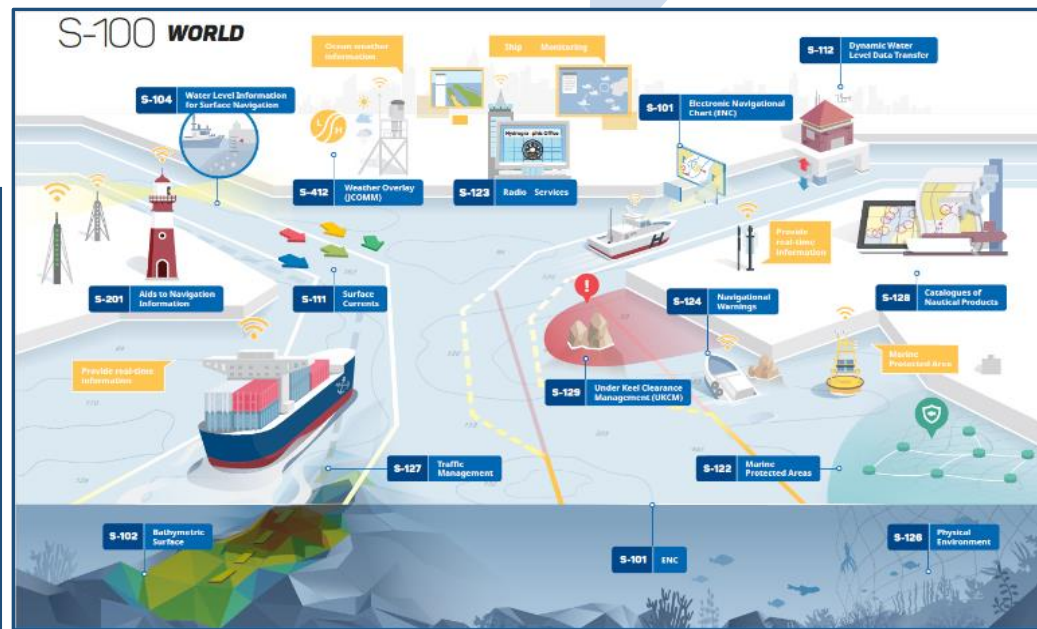
PAPER CHARTS



SINCE EVER



SINCE EARLY '90s: ENC S-57 FORMAT



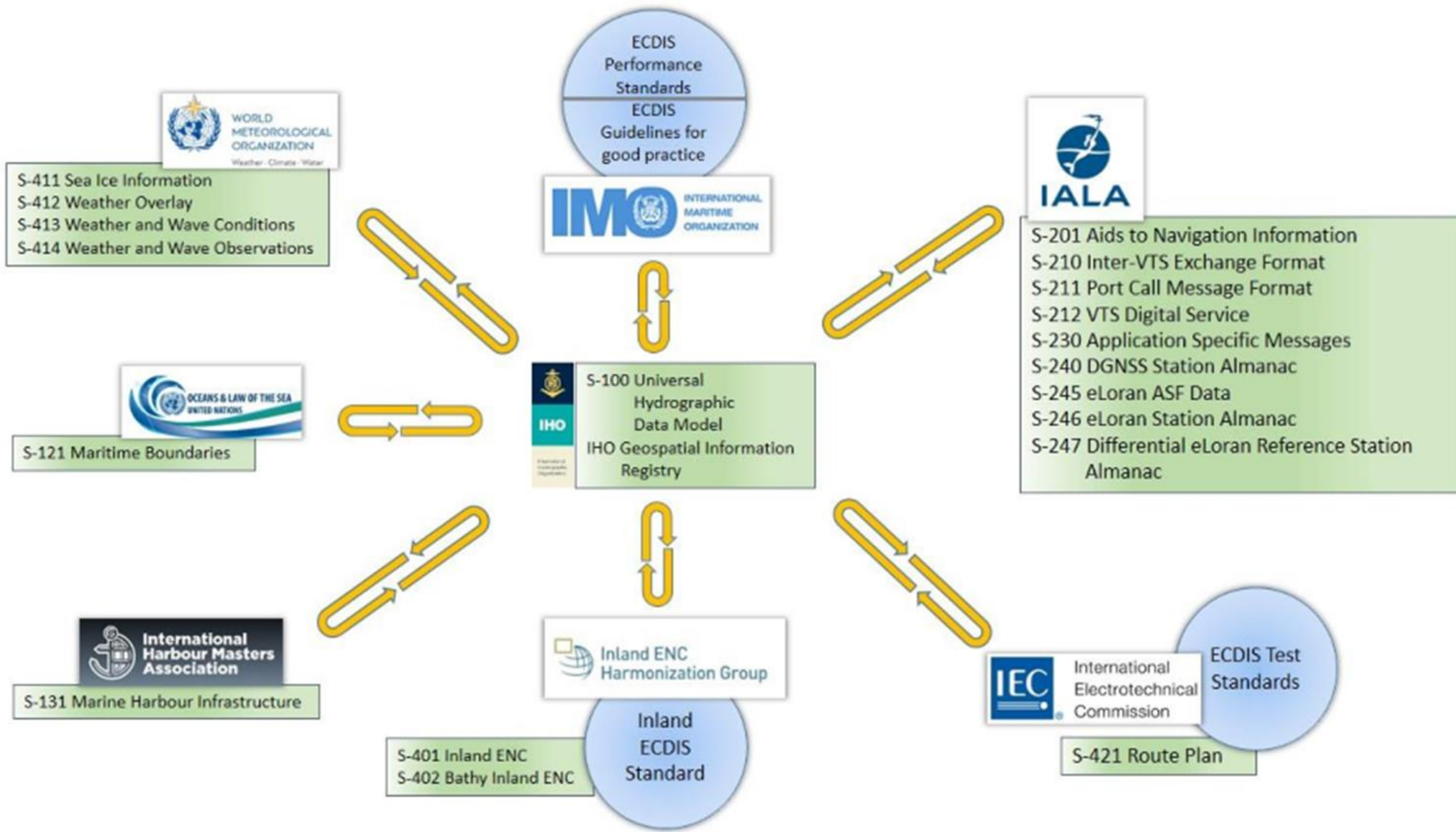
THE FUTURE: S-100 (BY 2030)



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S-100 IS A RECOGNIZED UNIVERSAL DATA MODEL!!!

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S-100 STANDARD AND PRODUCT SPECIFICATIONS

- All S-100 based Product Specifications are registered in IHO GI Registry (<https://registry.iho.int/productspec/list.do>)

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The screenshot shows the IHO Geospatial Information Registry interface. The top navigation bar includes the IHO logo, the text 'IHO Geospatial Information Registry', and options for 'Please sign in', 'Sign in', and 'Join'. On the right, there is a logo for KHOA (Korea Hydrographic and Oceanographic Agency). A left-hand sidebar contains a menu with categories: HOME, HELP&GUIDANCE, GI REGISTERS (with sub-items: Concept Register, Data Dictionary Register, Portrayal Register, Meta Data Register, Product Specification, Producer Code Register), PROPOSAL, and TEST BED. The main content area is titled 'Product Specification' and includes a breadcrumb trail: Home / GI REGISTERS / Product Specification. Below this is a table listing various product specifications.

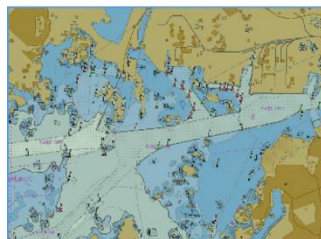
Idx	Product ID	Name	Version	Status	Domain	Date updated
194	S-100	Universal Hydrographic Data Model	5.0.0	Published	IHO Hydro	2023-01-31
195	S-101	Electronic Navigational Chart	1.1.0	Published	IHO Hydro	2023-05-09
199	S-102	Bathymetric Surface	2.2.0	Published	IHO Hydro	2023-07-05
198	S-104	Water Level Information for Surface Navigation	1.1.0	Published	IHO Hydro	2023-06-09
178	S-111	Surface Currents Product Specification	1.2.0	Published	IHO Hydro	2023-06-09
177	S-121	Maritime Limits and Boundaries	1.0.0	Published	IHO Hydro	2021-10-29
73	S-122	Marine Protected Areas	1.0.0	Published	IHO Hydro	2021-05-06
74	S-123	Marine Radio Services	1.0.0	Published	IHO Hydro	2021-05-06
181	S-124	Navigational Warnings	1.0.0	Published	IHO Hydro	2023-07-28
175	S-127	Marine Traffic Management	1.0.0	Published	IHO Hydro	2021-05-06
192	S-128	Catalogue of Nautical Products	1.0.0	Published	IHO Hydro	2022-06-30
176	S-129	Under Keel Clearance Management Product Specification	1.0.0	Published	IHO Hydro	2020-08-21
201	S-130	Polygonal Demarcations of Global Sea Areas	1.0.0	Published	IHO Hydro	2023-07-20
193	S-131	Marine Harbour Infrastructure	1.0.0	Published	IHO Hydro	2023-07-14
200	S-201	Aids to Navigation (AtoN) Information	1.1.0	Published	IALA AtoNs	2023-04-27
189	S-240	DGNSS Station Almanac	1.0.0	Published	IALA AtoNs	2021-09-17
180	S-401	Inland ENC Product Specification	1.0.0	Published	Inland ENC	2020-11-24
185	S-421	Route Plan	1.0.0	Published	IEC	2021-07-02
191	S-98	Data Product Interoperability in S-100 Navigation Systems	1.0.0	Published	IHO Hydro	2022-05-23



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THE TRANSITION FROM S-57 TO S-100: A REALITY BY 2030!!!

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2D ECDIS



4D ECDIS, additional vertical and real time information dimension

S-100 ECDIS legal to use after:
1ST JAN 2026



Now

- IHO S-57/S-52

ECDIS/ENC Transition

- S-101 is ready with some coverage
- Global S-57 is maintained

S-100/S-101 Only

- End of Transition Period
- No Requirement for S-57 support
- All users have S-100 ECDIS
- DF mode can be disabled



Preparation / Migration

- (Some) producers develop operational S-101 production capability
- **OEMs develop S-100 ECDIS + DF mode**
- IMO/IEC Documents updated for S-100
- Development of validation and distribution network

ECDIS Rollout

- OEMs rollout S-100 ECDIS + DF mode
- Producers release S-101 alongside S-57
- (All) remaining producers develop and implement full production capability
- Those not on S-100 ECDIS use S-57

S-100 ECDIS must comply with the
new IMO Resolution on ECDIS
Performance Standards from:

1ST JAN 2029

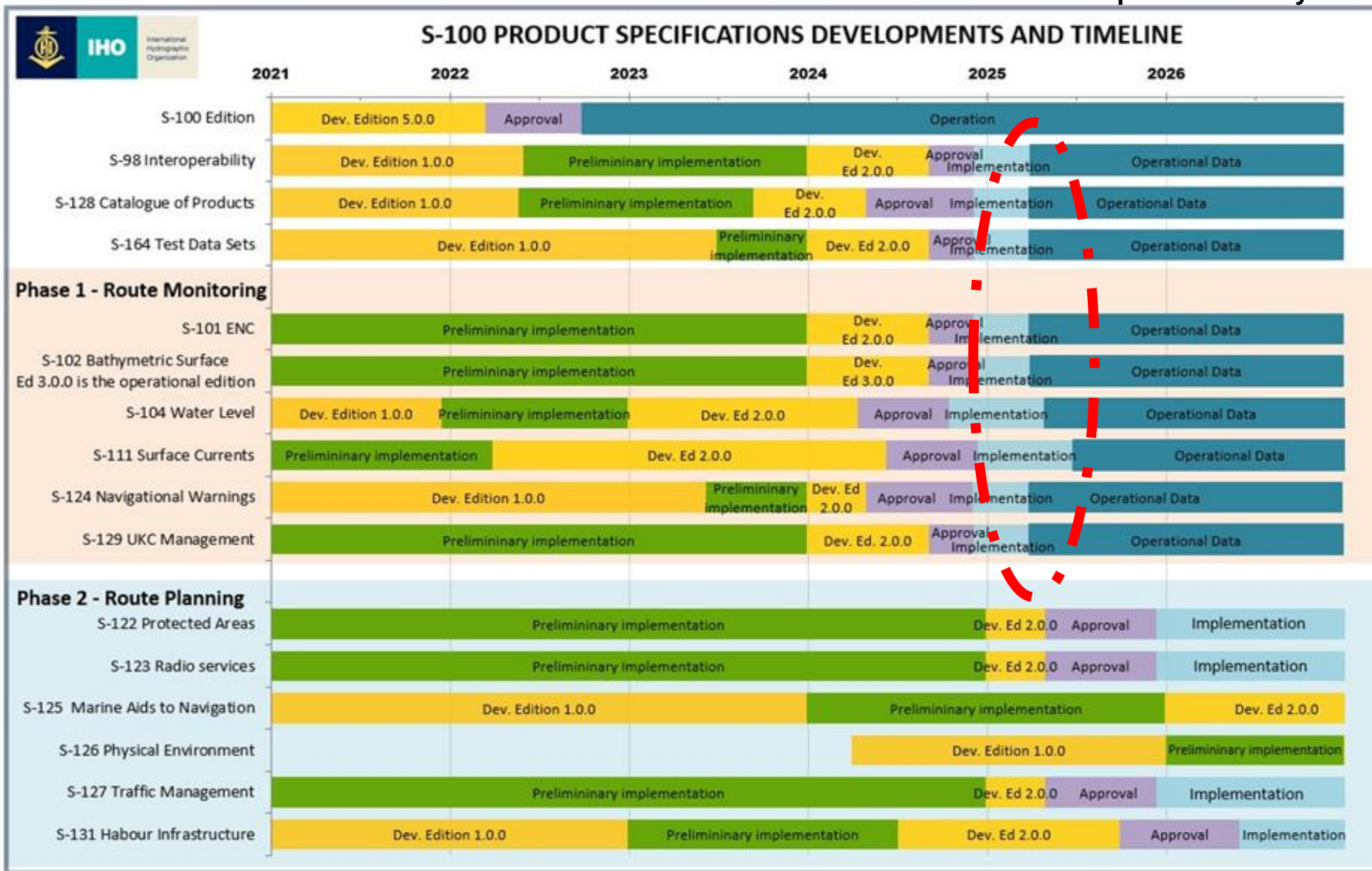
S-100 ECDIS legal to use after:
1ST JAN 2026



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S-100: TIMELINE FOR THE PRIORITIZED IHO PRODUCT SPECIFICATIONS

S-100 timeline is updated: 09 July 2023



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S-100: THE NEW PRODUCTS AND SERVICES

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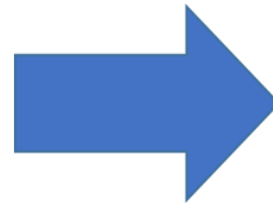
Phase 1 / Route Monitoring

Navigational Route Monitoring Mode

- S-101 ENC
- S-102 Bathymetry
- S-104 Water Level
- S-111 Surface Currents
- S-124 Navigational Warnings
- S-129 UKC Management

Critical Framework

- IHO Geospatial Information Registry
- S-98 Interoperability Specification
- S-100 Universal Hydrographic Data Model
- S-128 Catalogue of Nautical Products
- S-164 Test Data Set for S-100 and ECDIS
- Type Approval



Phase 2 / Route Planning

Navigational Route Planning Mode

- S-122 Marine Protected Areas
- S-123 Marine Radio Services
- S-125 Marine Aids to Navigation (AtoN)
- S-126 Marine Physical Environment
- S-127 Marine Traffic Management
- S-131 Marine Harbour Infrastructure
- S-411 Ice Information (WMO)
- S-412 Weather and Wave Hazards (WMO)

+ S-100 Products used in
Monitoring Mode



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S-98 - INTEROPERABILITY SPECIFICATION: A CORE COMPONENT OF S-100

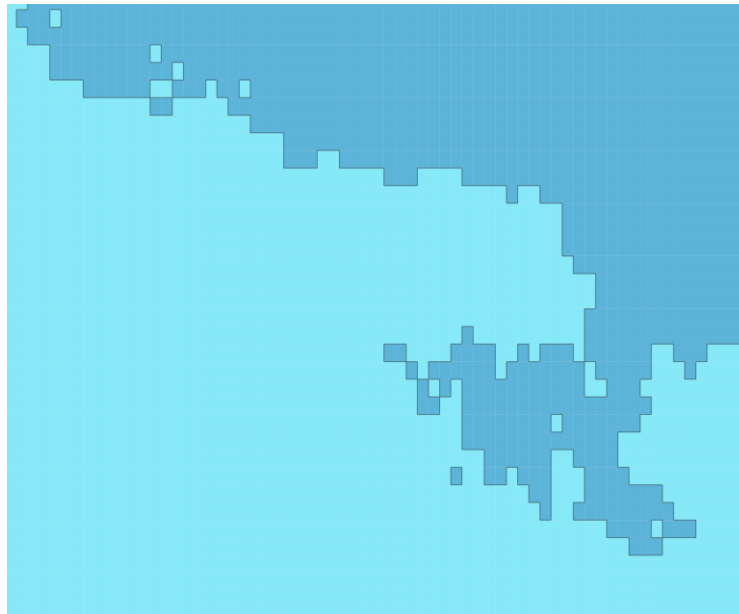
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- The single layer ENC S-57 will be replaced by multiple interacting layers of navigational products in S-100 ECDIS
- S-98 defines how multiple **layers interact** and how they are **portrayed**

S-98 defines how to draw a safety contour on a grid of S-102 depths

S-102 contains a grid of depth values with no predefined contours

S-102 supresses S-101 Depth Areas



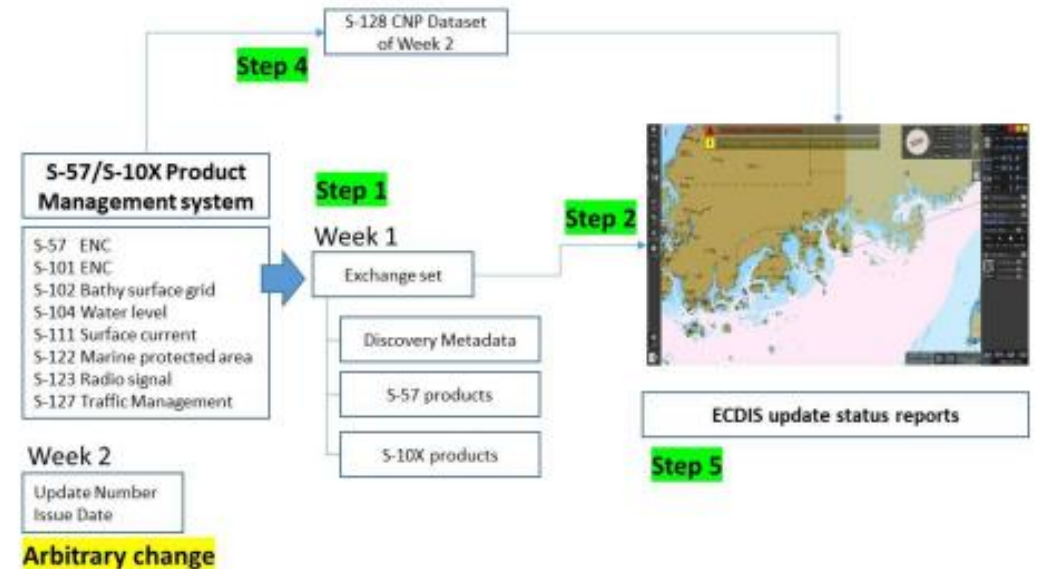


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S-128 – CATALOGUE OF NAUTICAL PRODUCTS

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- **S-128 catalogue of products** to provide a machine readable way to verify the up-to-dateness of the data in ECDIS
- Data producers may move the production of S-128 from **optional to mandatory** to fully provide the end users an accurate report of up-to-dateness of the onboard data



Report(S-128)

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

Version: 1.0

Members:

Update Reference Date: (from S-128)

Date of Report: 2022-09-13

Comment:

Chart Status

Product	Num	Dataset Name	Version	Update	Issue Date	Status
ALL	1	(S-57) 00110000	18	28	20220107	Up to Date
S-57	2	(S-57) 00204000	17	0	20220107	Up to Date
S-101	3	(S-57) 00214000	9	0	20220107	Up to Date
S-102	4	(S-57) 00214000	25	2	20220107	Up to Date
S-104	5	(S-57) 00214000	29	9	20220107	Up to Date
S-111	6	(S-57) 00214000	36	2	20220107	Up to Date
S-122	7	(S-57) 00214000	22	21	20220107	Up to Date
S-123	8	(S-57) 00214000	22	13	20220107	Up to Date
S-124	9	(S-57) 00214000	24	2	20220107	Up to Date
S-127	10	(S-57) 00214000	29	4	20220107	Up to Date
	11	(S-57) 00214000	24	0	20220107	Up to Date
	12	(S-57) 00214000	21	2	20220107	Up to Date

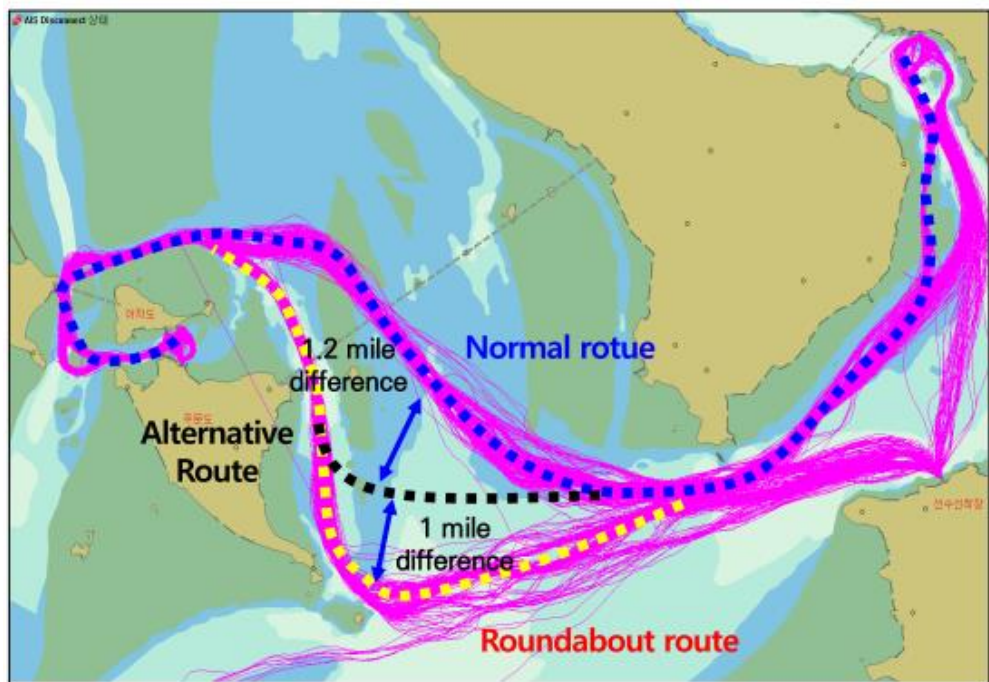


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S-100 TEST-BED (S-102, S-104, S-111)

ALTERNATIVE ROUTE:

- Safer and optimal alternative routes were identified for roundabout routes operated at low tide
- Time and distance were calculated



Economics analysis of coastal passenger ships

Passenger ship Route	Roundabout route	Alternative route explored using S-100 data service
Estimated distance (m)	4,157	2,306
Distance difference between normal and roundabout/alternative(NM)	2.2	1.2
Total number of navigation	2,190 rounds	
Expected number of roundabout/alternative route	1,196 rounds	
Fuel consumption per hour	1,000 liters	
Fuel cost per liter	\$1.25 per liter (include 0.01% MGO tax)	
Economics analysis of coastal passenger ships	$(\text{Route distance}) \times (\text{Numbers of Roundabout/Alternative route navigation}) / (\text{Vessel speed} - 12\text{kn}) \times (\text{Fuel consumption per hour}) \times (\text{Fuel cost per liter})$	
	(A) \$273,209	(B) \$149,023
	(A) - (B) = \$124,186 (45.5% savings) Total annual cost savings of \$124,186 (45.5% savings) would occur when the alternative route was used	

Source: KHOA (Rep. of Korea) S-100 Test bed Program



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THE ROLE OF IALA ON S-200 DEVELOPMENT

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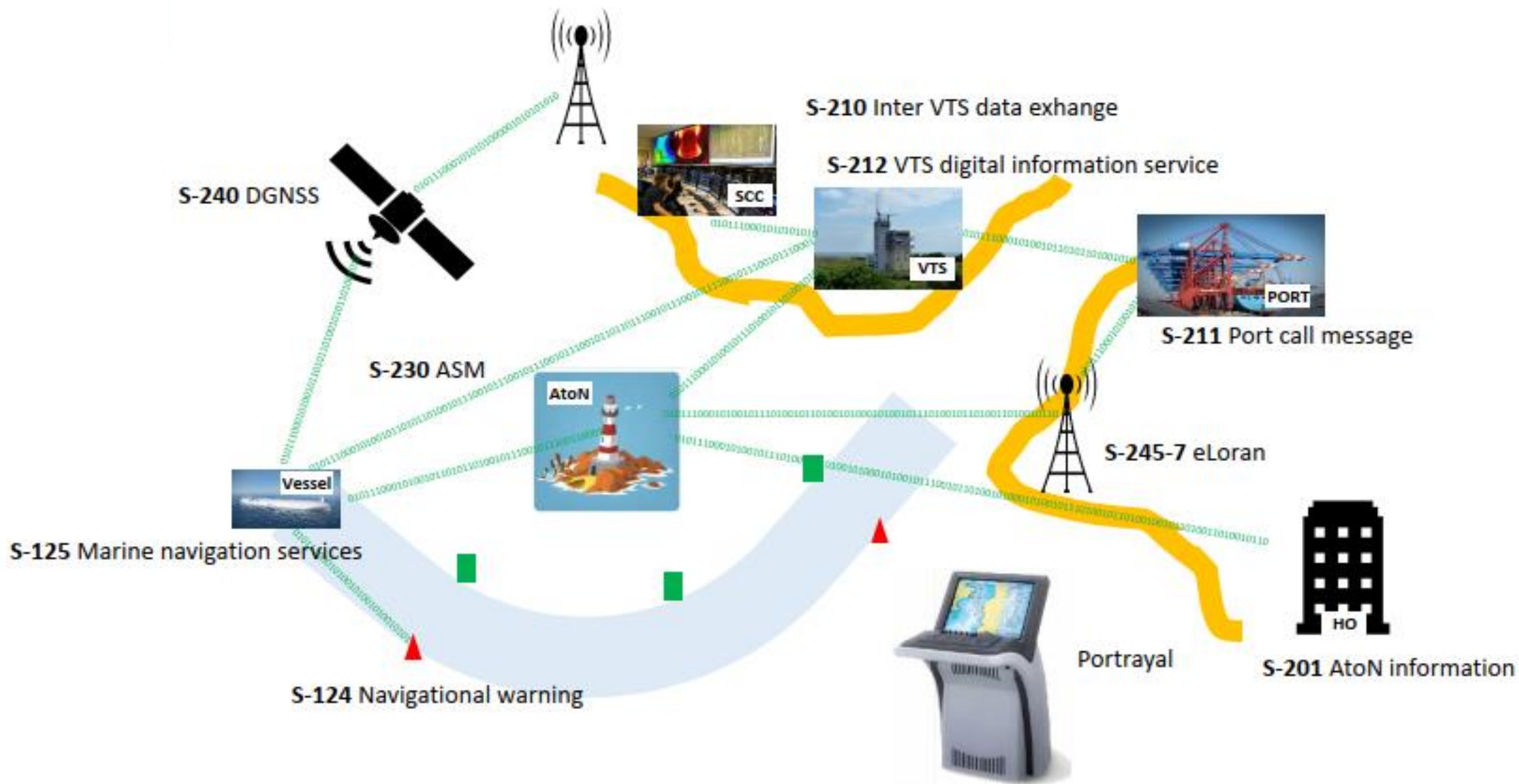
- IHO has approved IALA as a **Submitting Organization** and **Domain Controller**
- IALA Product Specifications compliant with the IHO S-100 standard, use the numbering series S-201 to S-299
- **IALA Domain covers:**
 - Aids to Navigation (AtoN)
 - Vessel Traffic Services (VTS)
 - Positioning Systems
 - Communication Systems
 - AIS, ASM, VDES
- **Publications**
 - IALA G1106 on the Development of Product Specifications
 - IALA G1087 on the Management of the IALA Domain
 - New guideline on the S-201 implementation guideline



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THE S-200 WORLD

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DEVELOPMENT STATUS OF S-200 PRODUCTS (JUNE 2023)

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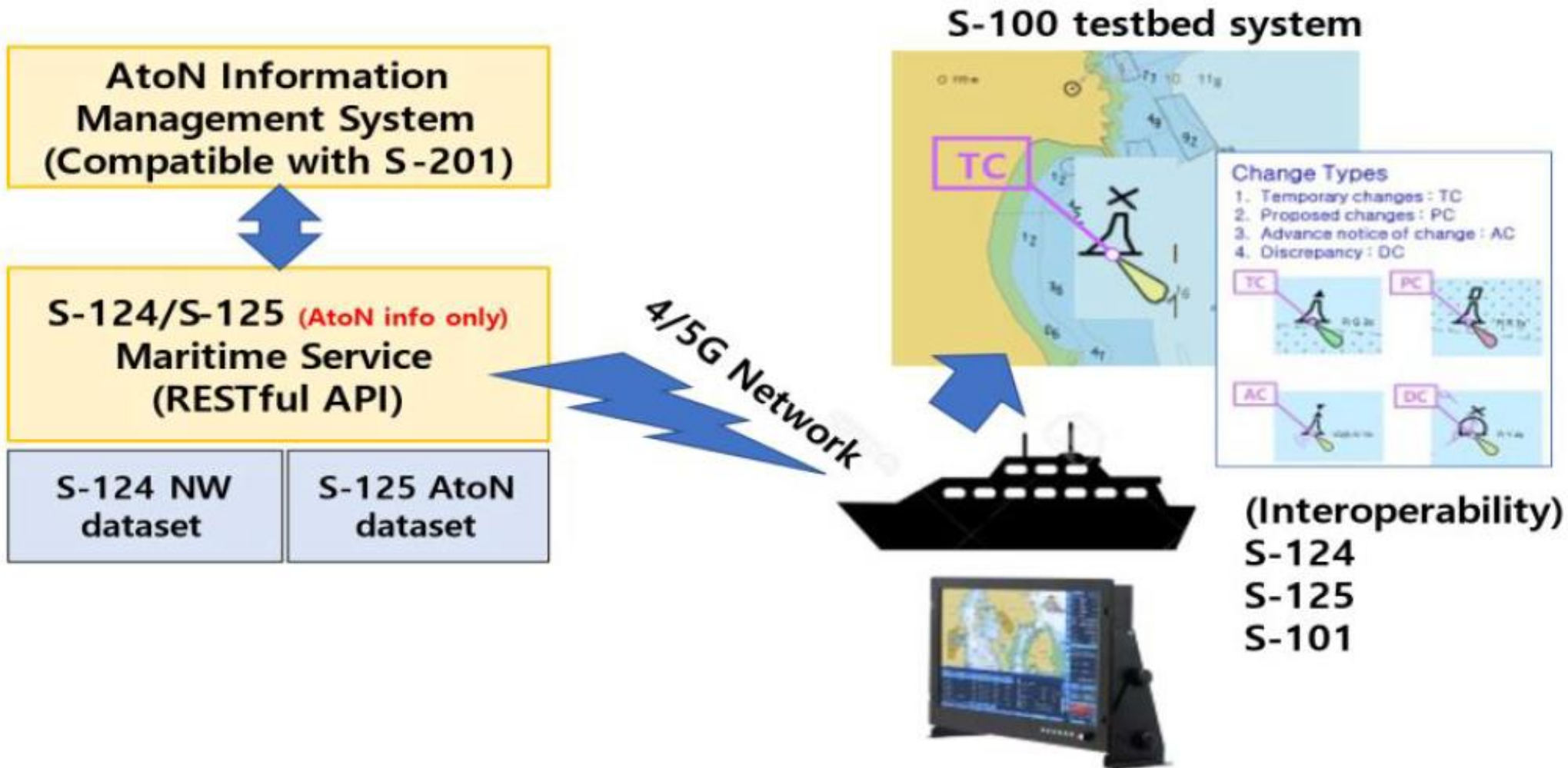
Domain	PS	Title	Developing Committee	Version
AtoN	S-201	AtoN information	ARM	1.1.0
	S-125	Maritime Navigational Service	NIPWG (ARM)	
Positioning	S-240	DGNSS almanac	ENG	1.0.0
	S-245	eLoran ASF	ENG	0.7.0
	S-246	eLoran almanac	ENG	1.0.0
	S-247	eLoran reference stations	ENG	1.0.0
Comms.	S-230	Application Specific Message (ASM)	DTEC	Planned
VTS	S-210	Inter VTS exchange	VTS	Started
	S-211	Port Call Message	IPCDMC	1.0.0
	S-212	VTS digital information service	VTS	0.6.4



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S-125 MARINE ATON, S-124 NAVIGATIONAL WARNINGS DATA SERVICE AND S-101

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S-125/S-124 AND S-101 DEMONSTRATION AT SEA

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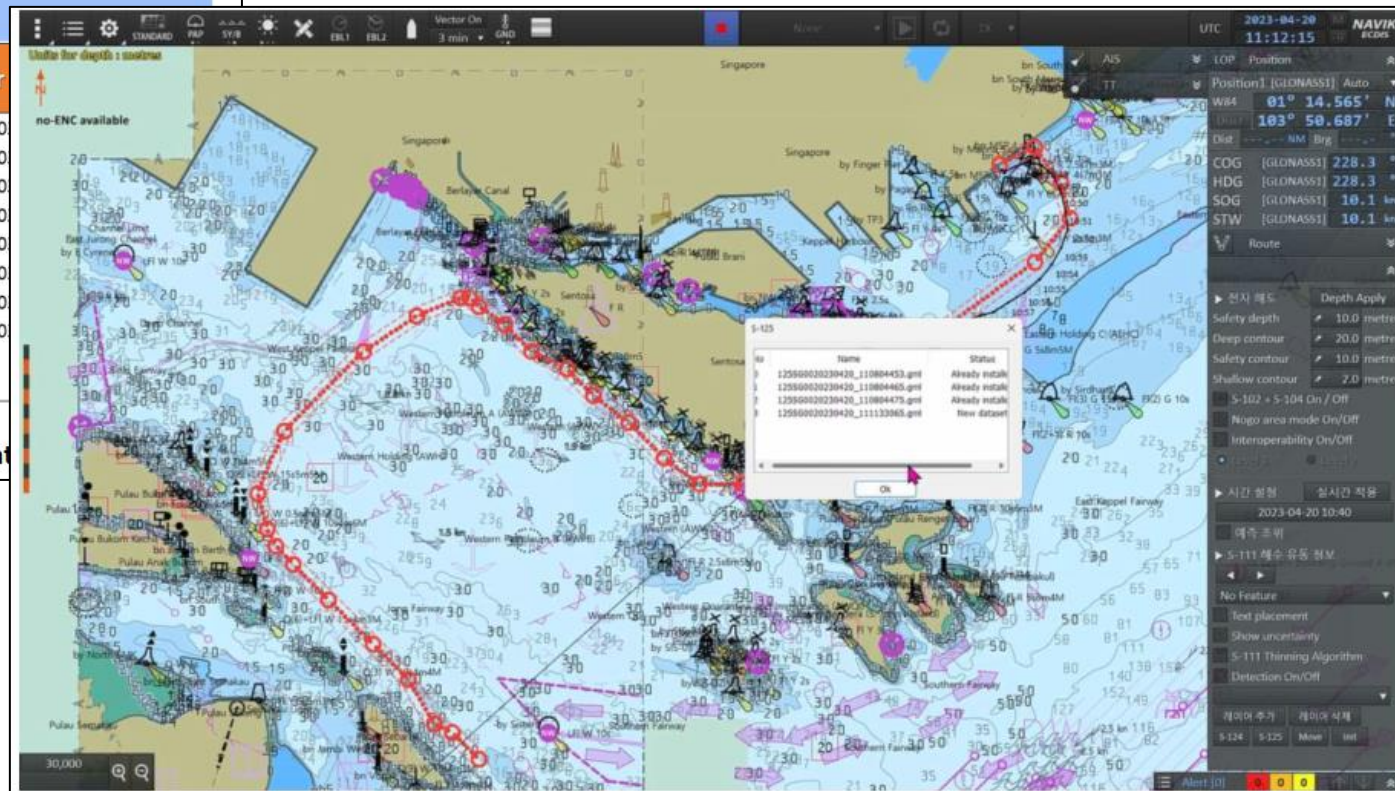
Targeting AtoNs for S-124 service

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 (103.83505 1.2341499)
Bedok	POINT (103.878 1.24465)
NE Corridor	POINT (103.9225 1.2486669)
SB 5	POINT (103.9245332 1.2749333)
South Sebarok	POINT (103.779 1.2266499)
Marina Safe	POINT (103.8233202 1.2438349)
SIS-05	POINT (103.8128833 1.2069832)
SC1	POINT (103.8315167 1.2376306)

Proposed Sea Route and Targeting AtoNs for Demonstration



Example of symbols of data registered by ECDIS are displayed on the screen



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CONCLUSIONS

- A. S-100 PROVIDES A COMPLETE 4D PICTURE OF THE MARINE ENVIRONMENT, USING DATA AND INFORMATION USEFUL FOR THE MARINERS**
- B. THE S-100 DEVELOPMENT IS HAPPENING WITH ALL THE INTERNATIONAL MARITIME STAKEHOLDERS**
- C. TWO IMPORTANT MILESTONES: 1st JAN 2026 & 1st JAN 2029 (CONFIRMED AT THE LAST IMO NCSR AND MSC MEETINGS IN 2022 AND 2023 MEETINGS)**
- D. PARAMOUNT ROLE OF THE COOPERATION BETWEEN IHO & IALA THROUGH TECHNICAL COOPERATION MEETINGS, WITH IALA READY TO ASSIST COASTAL AUTHORITIES WITH THEIR TRANSITION TO S-100 RELATED PRODUCTS**
- E. THE USE OF S-100 WILL IMPROVE THE RESPECT FOR THE MARINE ENVIRONMENT HAVING THE FOLLOWING BENEFITS:**



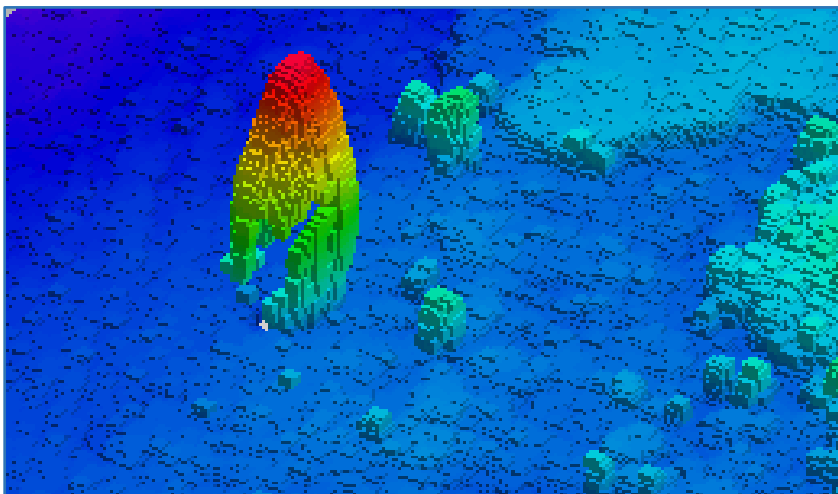
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CONCLUSIONS

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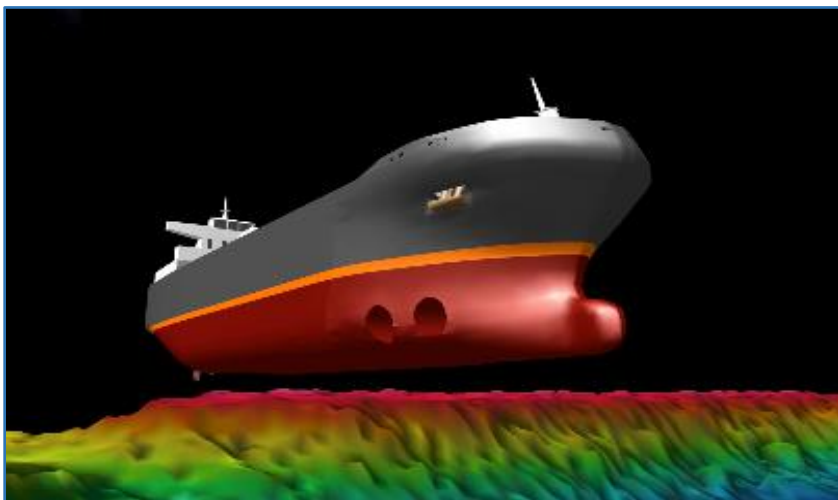
New dangers for navigation are discovered frequently when new modern detecting methods are used

More Safety

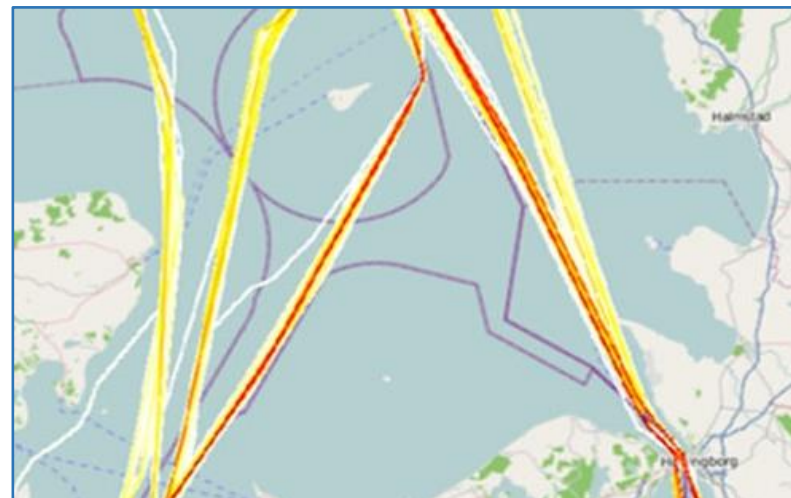


Charge optimization

Improvement of the underkeel clearance management with the use of S-100 and GNSS vertical positioning



Course and time optimization



Fuel consumption reduction thanks to the use of tides, currents and meteorological information in real time

Autonomous navigation



Nautical information machine readable to facilitate all levels of Maritime Autonomous Surface Ships (MASS) as defined by IMO



THANK YOU FOR YOUR ATTENTION

