IHO
International Hydrographic Organization

KHOA
Korea Hydrographic and Oceanographic Agency

MUCH MORE THAN JUST NAUTICAL CHARTS

S-100
IHO UNIVERSAL
HYDROGRAPHIC DATA MODEL

This document was produced with the kind support of the Korea Hydrographic & Oceanographic Agency (KHOA), Republic of Korea.

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KHOA

International Hydrographic Organization
Hydrographic Services and Standards Committee
S-100 Working Group

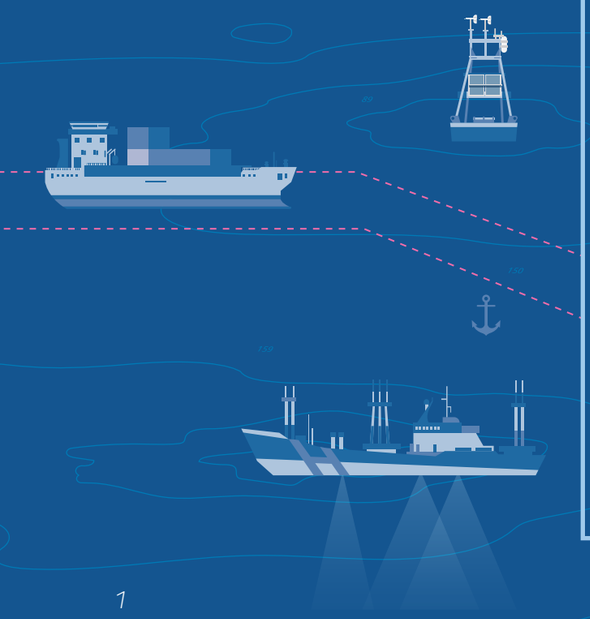
Korea Hydrographic & Oceanographic Agency (KHOA), Republic of Korea

FOREWORD

The International Hydrographic Organization (IHO) is an intergovernmental consultative and technical organization established in 1921 to support the safety of navigation, and to contribute to the protection of the marine environment.

One of the IHO's primary roles is to establish and maintain appropriate standards to assist in the proper and efficient collection and use of hydrographic data and information. ***Digital hydrographic information underpins all aspects of the sustainable use and protection of the maritime domain***. Consequently, IHO's objective to ensure greater uniformity and interoperability through standardizing hydrographic data and information addresses a variety of stakeholders beyond the community of national hydrographic offices.

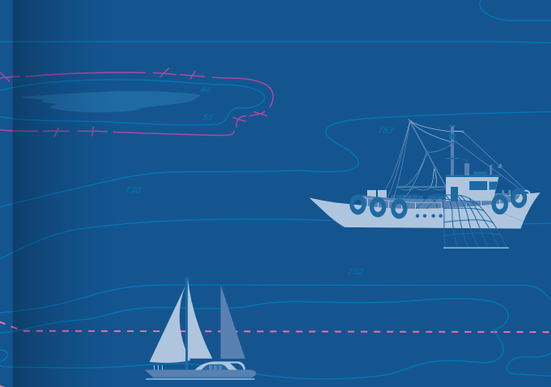
The first edition of IHO Publication S-100 - Universal Hydrographic Data Model - was published on 1 January 2010 as an international standard for the marine geospatial information era. The objective of S-100 is to address users' requirements to facilitate access to and use of digital hydrographic data through modern IT technology. The IHO and other organizations are now developing S-100-based product specifications such as S-101, the product specification for the next generation of electronic navigational charts (ENCs).



The purpose of this brochure is to explain "what is S-100?" and outline the expected implications for national hydrographic offices and other affected stakeholders preparing for the future. The brochure explains the basic concept of S-100 and the associated infrastructure. It introduces the new types of digital hydrographic products and services supported by S-100 and outlines the testbed processes used for developing S-100-based product specifications. It is intended to provide a better understanding of the standard.

We thank the IHO Secretariat, the Chair of the Hydrographic Services and Standards Committee and National Oceanic and Atmospheric Administration (NOAA) for their contribution to the development of this brochure.

We would also like to express our appreciation to the Director General and the members of staff of the Korea Hydrographic and Oceanographic Agency (KHOA) for their kind assistance in drafting and printing this document.



IHO S-100 Working Group

HISTORY OF S-100

⚓ How S-100 was initiated

History of S-57

The first IHO digital format for the exchange of hydrographic data (“CEDD format”) was adopted in 1987.

The first edition of IHO Publication S-57 - Transfer Standard for Digital Hydrographic Data - was published in 1992. Ed. 2.0 was published in 1994 and Ed. 3.0 in 1996.

After Ed. 3.1 was released in 2000, S-57 was frozen in order to provide stability for data producers and ECDIS manufacturers.

1987 › 1992 › 1996 ›

FORMAT CEDD

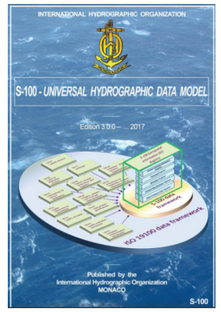
The first IHO digital format for the exchange of hydrographic data (“CEDD format”) was adopted

S-57 Ed 1.0

S-57 Transfer Standard for Digital Hydrographic Data Ed. 1.0

S-57 Ed 3.0

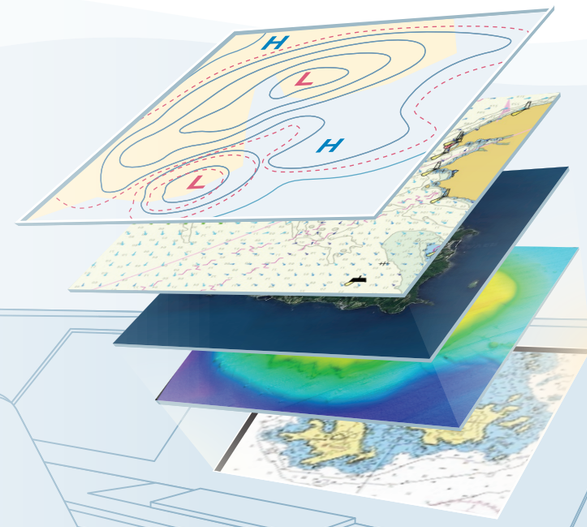
Updated to Ed. 3.0



S-57 Ed. 3.1 was primarily used for encoding electronic navigational charts (ENCs) and only supported ENCs which are static vector data.

After Ed. 3.1 was frozen, work commenced on the development of Ed. 4.0 to include additional data layers such as high resolution bathymetry and time-varying data such as water level information.

In order to avoid confusion between S-57 Transfer Standard and the ENC Product Specification, the 17th CHRIS meeting decided that the ISO-compliant S-57 Edition 4.0 would be known as S-100 Universal Hydrographic Data Model.



2000 › 2010 › 2015 › 2017

S-57 Ed 3.1

Ed. 3.1 was revised

S-57 Ed 3.1 supplement

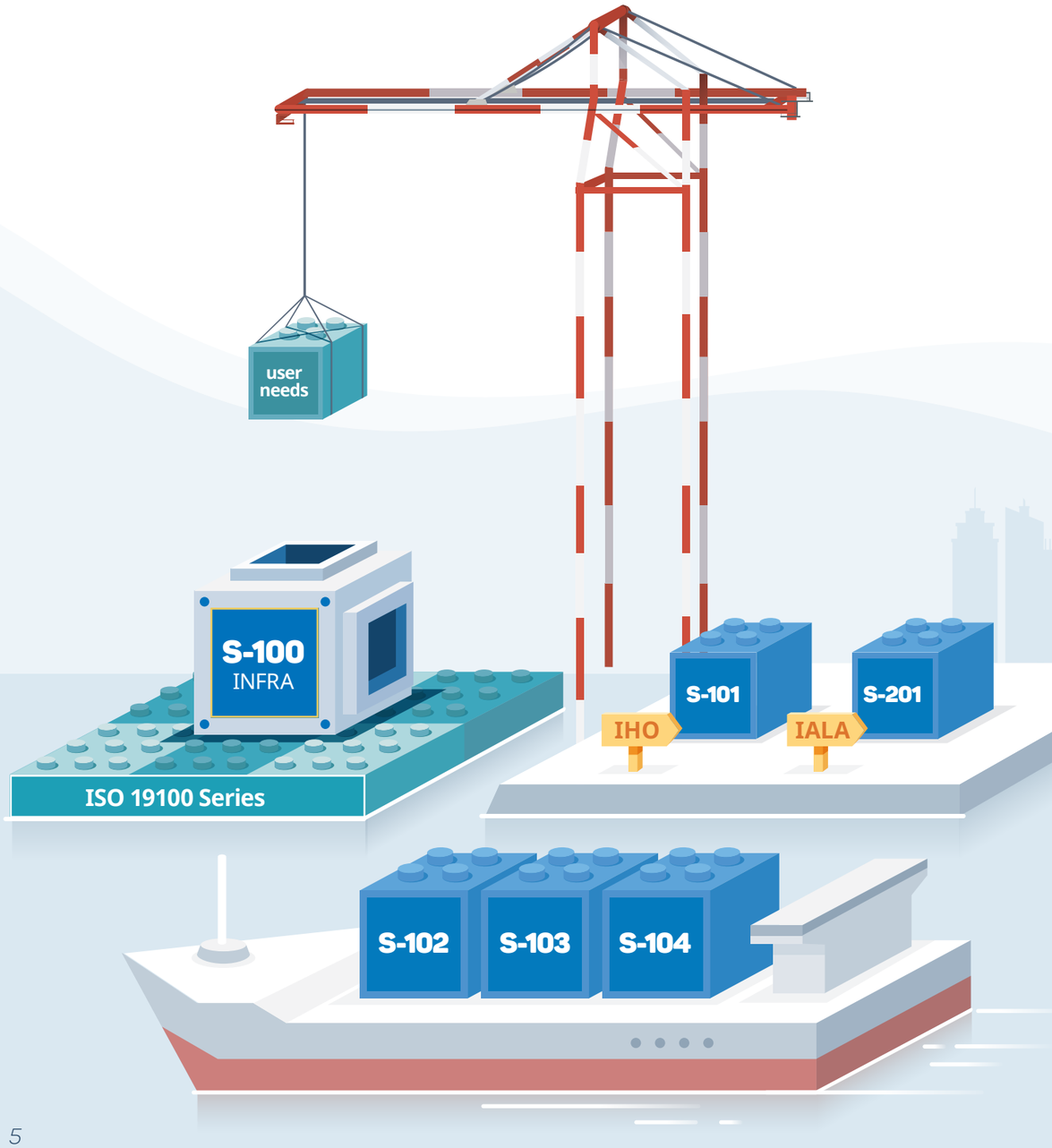
S-100 Ed 1.0.0

S-100 Ed 2.0.0

S-100 Ed 3.0.0

WHAT IS S-100

Provides the data ***framework*** for the development of the next generation electronic navigational charting products, as well as other digital products required by ***the hydrographic, maritime and GIS communities***.



WHY SWITCH TO S-100

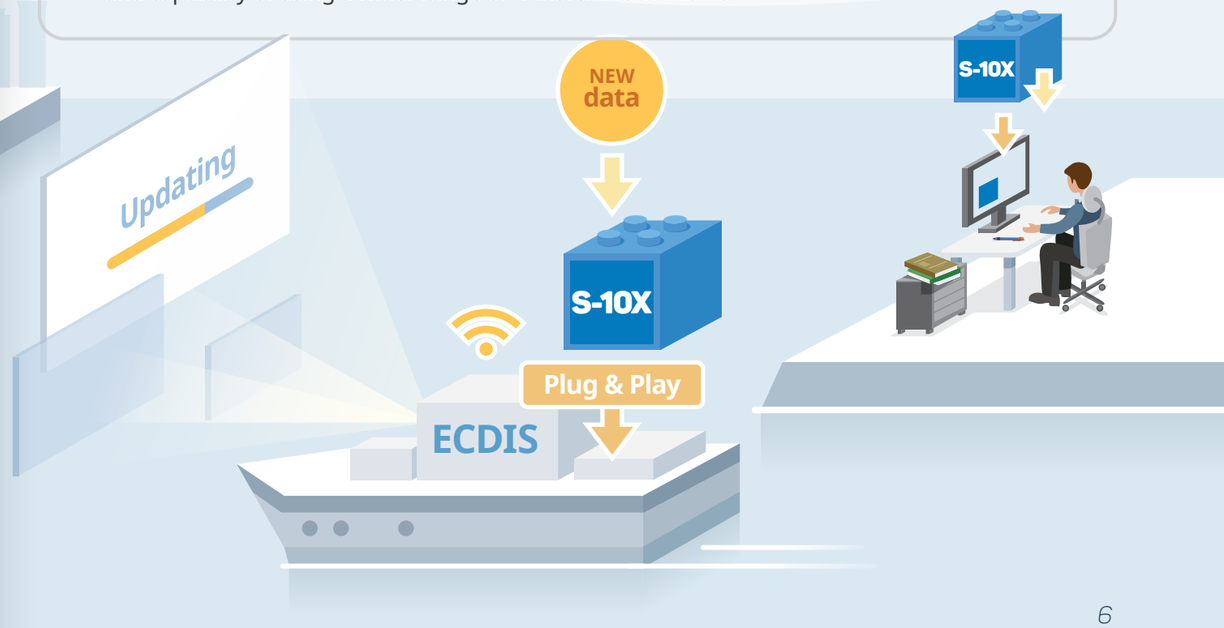
⚓ Characteristics of S-100

The primary goal of S-100 is to support a greater variety of hydrographic-related digital data sources, products, and customers. Some of the advantages include :

- Aligns with mainstream GIS
  (Maximizes access to COTS software and development)
- New components not developed in isolation
- Easier use of hydrographic data beyond Hydrographic Offices and Electronic Chart Display and Information System (ECDIS) users
  (Coastal zone mapping, security, inundation modeling ...)
- Plug-and-play updating of data, symbology and software enhancements

Limitations of S-57

- S-57 has been used almost exclusively for encoding ENCs for use in ECDIS
- S-57 is not a contemporary standard that is widely used in the GIS domain
- It has an inflexible maintenance regime. Freezing standards for lengthy periods is counter- productive
- As presently structured, it cannot support future requirements
  (e.g. gridded bathymetry, time-varying information)
- Embedding the data model within the encapsulation (i.e. file format) restricts the flexibility and capability of using a wider range of transfer mechanisms



WHAT CHANGES DO WE EXPECT FROM THE TRANSITION TO S-100

⚓ S-57 can only encode ENCs

With S-57, port ENCs, inland ENCs, AML and MIO can be encoded. However, harmonization or interoperability between different sets of data is not feasible.

S-100 enables the development of specifications for the provision of digital products such as electronic navigational charts, nautical publications, marine GIS and other e-Navigation related products and services. It includes multiple data encoding formats that are widely implemented and "fit for purpose". The S-100 extensible GI Registry provides a common repository of feature and attribute concepts and caters for different user communities.

⚓ Expected improvements to ECDIS Software

- Revised regulations on chart display enable more harmonized chart display
- New feature types and structure enable users to check details of ENCs using the pick report and to understand them better
- Newly added update feature types enable users to check updates to notices to mariners
- An easier method for calculating or displaying quality information of bathymetric data will be applied
- ECDIS will enable operation of additional information along with ENCs

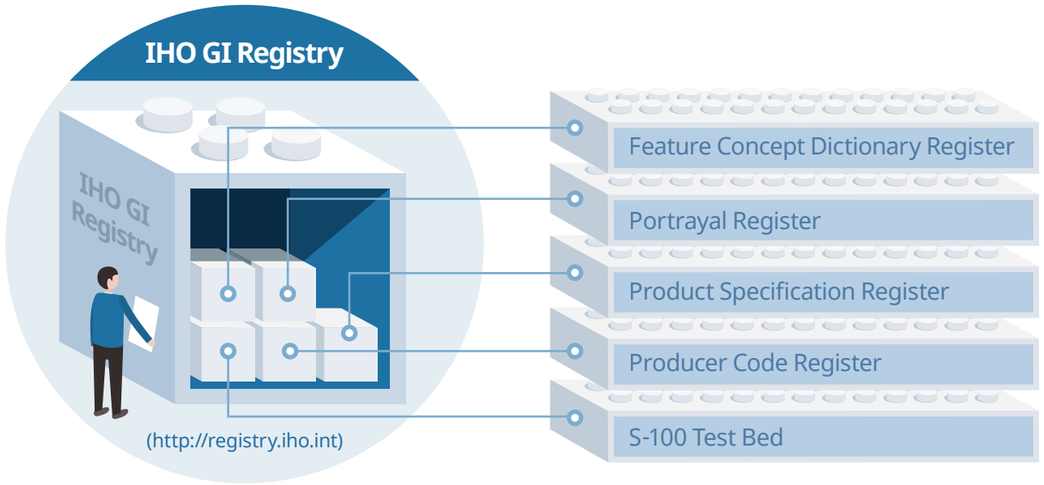
⚓ Expected improvements to maintenance of ECDIS Software

- As new features are included in product specifications such as for ENCs, it will be possible to issue new datasets, and corresponding updated (feature and portrayal) catalogues without having to update end user applications such as ECDIS

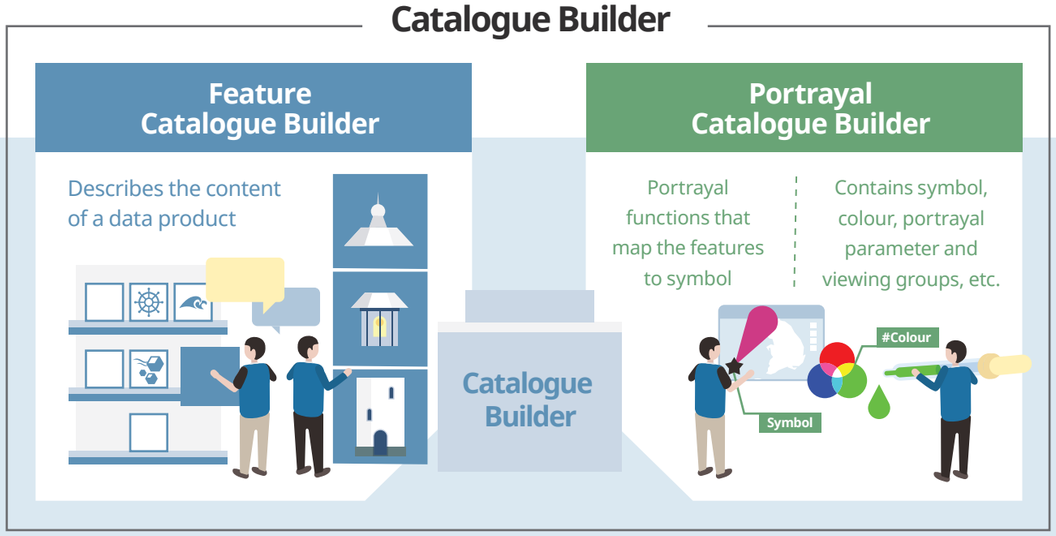
COMPONENTS OF S-100

⚓ S-100 Infrastructure

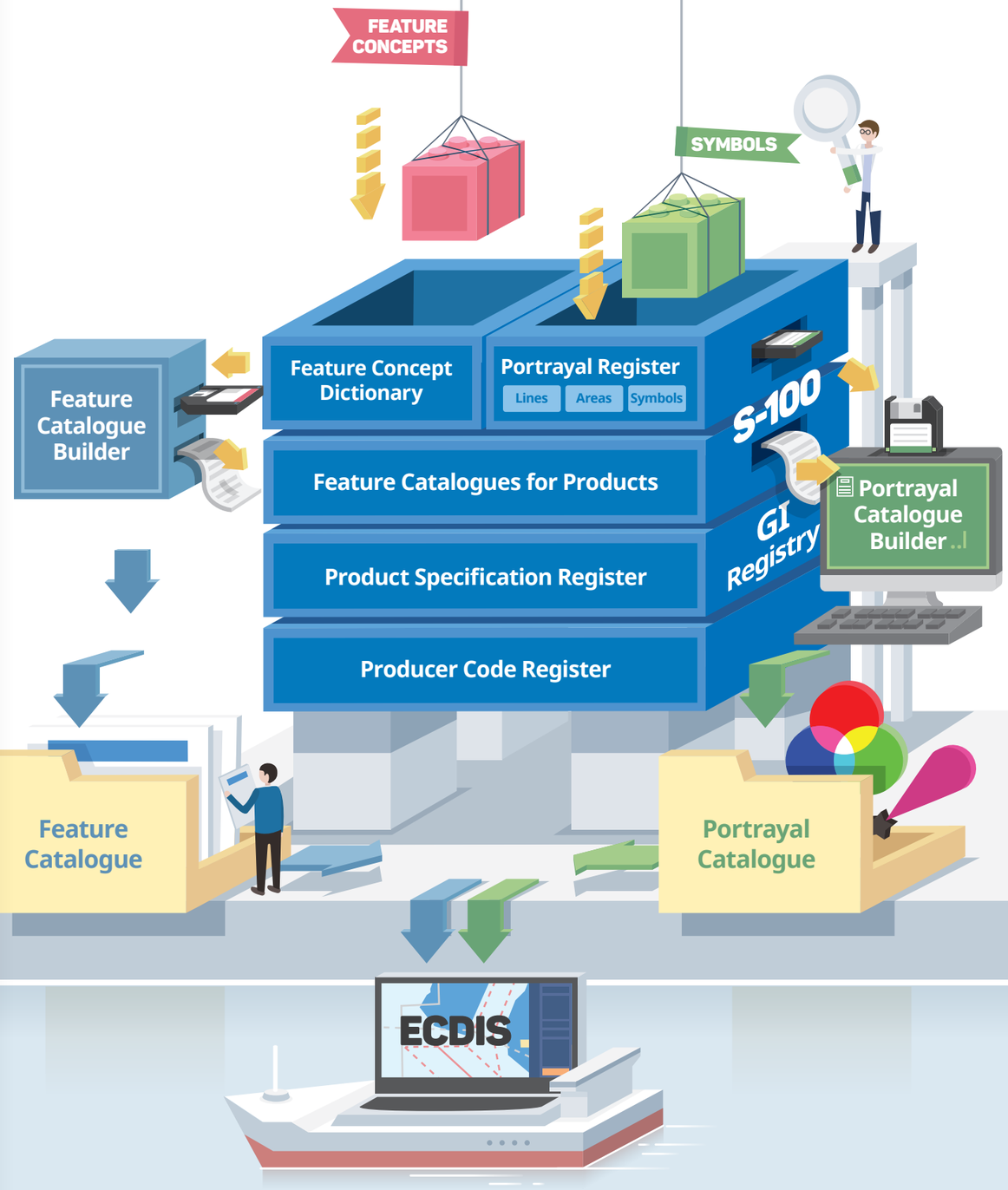
S-100 infrastructure consists of GI registry, Feature Catalogue Builder and Portrayal Catalogue Builder. IHO **Geospatial Information Registry** (GI Registry) is the entire information system (or location) in which a collection of registers are located. A register is a collection of tables in a database containing identifiers assigned to items with descriptions of the associated items. Descriptions may consist of many types of information including names, definitions and codes.



Catalogue Builder



⚓ S-100 Process



TEST BED S-100

Sea trials for S-100 based product specifications
Conducted for the First Time in the World

KOREA

27 Oct 2016
Gunsan Port

30 Nov 2016
Busan Port

PHASE 1
Catalogues

PHASE 2
Conversion

PHASE 3
Simple Viewer

PHASE 4
Preliminary Datasets

Draft
Draft
Draft
Draft

S-100
INFRA

ISO 19100

TEST

PHASE 5
Validation

S-10X

PHASE 6
Onshore Test

Shore Based ECDIS

S-10X
S-10X
S-10X
S-10X
S-10X

PHASE 7
Complete Datasets

PHASE 8
Validation

PHASE 9
Full ECDIS

S-10X
S-10X
S-10X
S-10X

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S-10X PRODUCTS AND SERVICES

S-101
Electronic Navigational Chart (ENC)

S-102
Bathymetric Surface

S-103
Sub-surface Navigation

S-104
Water Level Information for Surface Navigation

S-111
Surface Currents

S-112
Dynamic Water Level Data Transfer

S-121
Maritime Limits and Boundaries

S-122
Marine Protected Areas

S-123
Radio Services

S-124
Navigational Warnings

S-125
Navigational Services

S-126
Physical Environment

S-127
Traffic Management

S-128
Catalogues of Nautical Products

S-129
Under Keel Clearance Management (UKCM)

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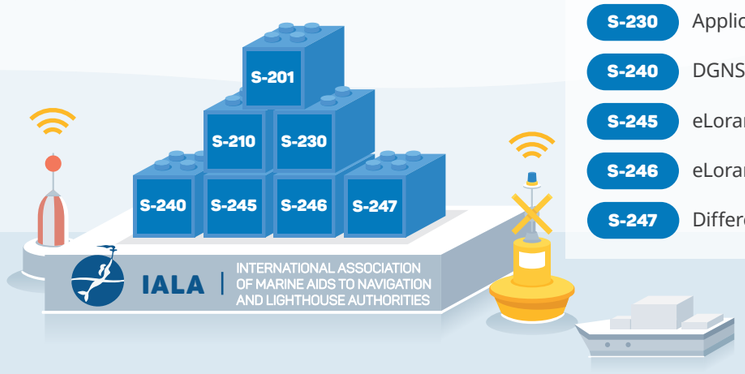
S-100 BASED PRODUCTS AND SERVICES

⚓ Product specifications being developed by IALA

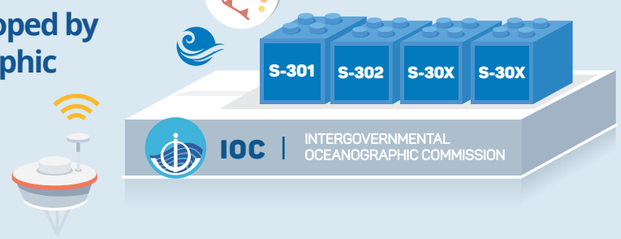
(Numbers S-201 to 299)



- **S-201** Aids to Navigation Information
- **S-210** Inter-VTS Exchange Format
- **S-230** Application Specific Messages
- **S-240** DGNSS Station Almanac
- **S-245** eLoran ASF Data
- **S-246** eLoran Station Almanac
- **S-247** Differential eLoran Reference Station Almanac

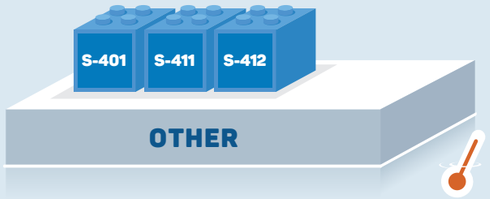
⚓ Product specifications being developed by the Intergovernmental Oceanographic Commission (IOC)

(Numbers S-301 to 399)



⚓ Product specifications being developed by other organizations

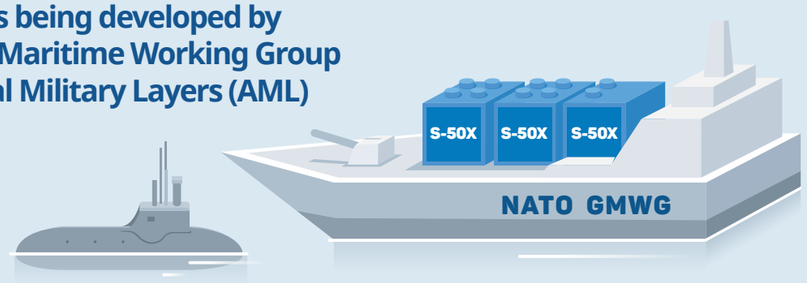
(Numbers from S-401)



- **S-401** Inland ENC
  (Inland ENC Harmonization Group [IEHG])
- **S-411** Ice Information
  (WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology [JCOMM])
- **S-412** Weather Overlay (JCOMM)

⚓ Product specifications being developed by the NATO Geospatial Maritime Working Group (GMWG) for Additional Military Layers (AML)

(Numbers S-501 to 525)



ORGANIZATIONS INVOLVED IN S-100

IHO

- Electronic Navigational Charts
- Nautical Publications
- Surface Currents
- Bathymetry

WMO

- Ice
- Weather forecast

IALA

- AIS
  Auto Identification System
- VTS
  Vessel Traffic Service
- AtoNs
  Aids to Navigation

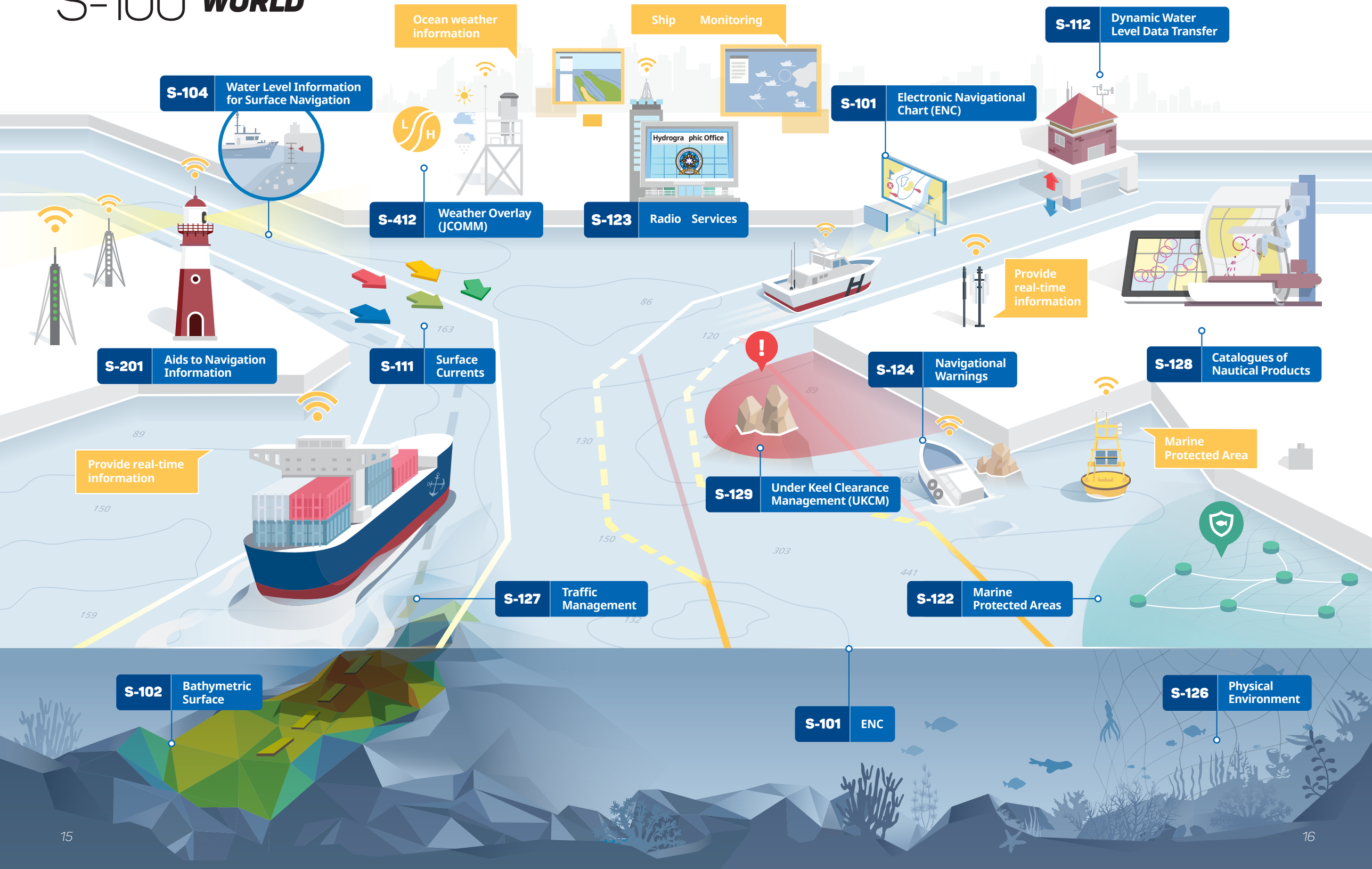
IMO

- e-Navigation

IEC

- Route exchange specification

S-100 WORLD


S-104 Water Level Information for Surface Navigation
Ocean weather information
S-412 Weather Overlay (JCOMM)
Ship Monitoring
Hydrogra phic Office
S-123 Radio Services
S-101 Electronic Navigational Chart (ENC)
S-112 Dynamic Water Level Data Transfer
Provide real-time information
S-201 Aids to Navigation Information
S-111 Surface Currents
S-124 Navigational Warnings
S-128 Catalogues of Nautical Products
Provide real-time information
S-129 Under Keel Clearance Management (UKCM)
Marine Protected Area
S-127 Traffic Management
S-122 Marine Protected Areas
S-102 Bathymetric Surface
S-101 ENC
S-126 Physical Environment