
MACHC23 . Activities on S-100 Standards
Saint Louis, MO. November 2022
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THE SCIENCE OF WHERE™
IHO S-100 in Support of e-Navigation and Port-Shipping Operations
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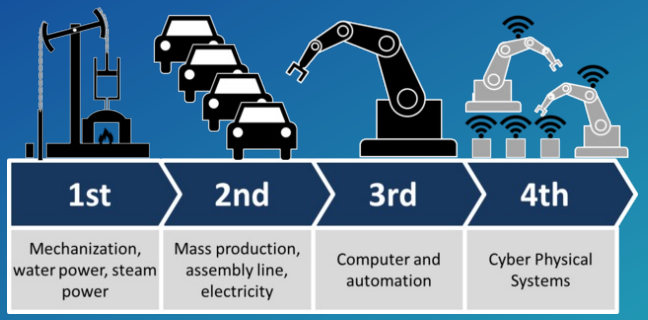
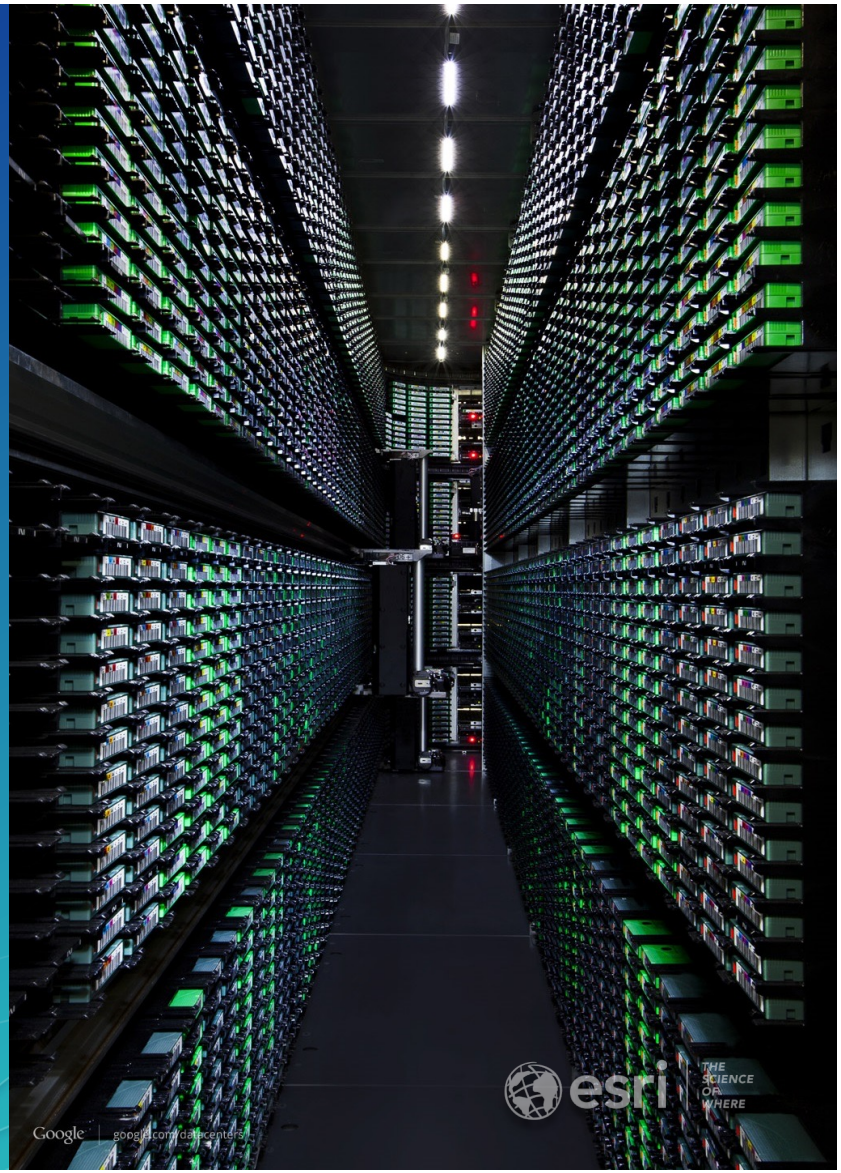
How technology is changing our lives:
The Fourth Industrial revolution



- Lineal Growth vs Exponential growth
- We can't use the past to predict the future
- Change is accelerating
  - Faster changes in the next 50 years than in the past few hundred
  - a new "*Seaconomics*" era
  - GDP and cargo volumes are decoupled
- Biotech, Cybertech, Robotics and AI – interconnectivity and interdependence
- Smartphones, Web, the Internet of Things and ancillaries are crucial to our networked lives
- Change creates new opportunities – new technologies
- A Digital Vision → powered by Data (in time and space)

Key IT technological factors

- Big Data
  - Volume, Velocity and Variety
- Internet of Things (IoT)
- Artificial Intelligence (AI)
  - Deep Learning
- Digital Twin – Digitalization
- Cloud systems
- Kubernetes (containerized services)
- Virtual Reality, Augmented Reality, Mixed Reality



In the shipping industry:
Maritime Autonomous Surface Ships (MASS)

Fast developments
around the world

Bigger, more efficient, more complex: new machine readable products

Smart Ports

More Automation!

- Maasvlakte2 terminal in the Port of Rotterdam
- Unmanned electric Automated Guided Vehicles (AGVs)
- 80% of automated cranes
- The rest remotely operated

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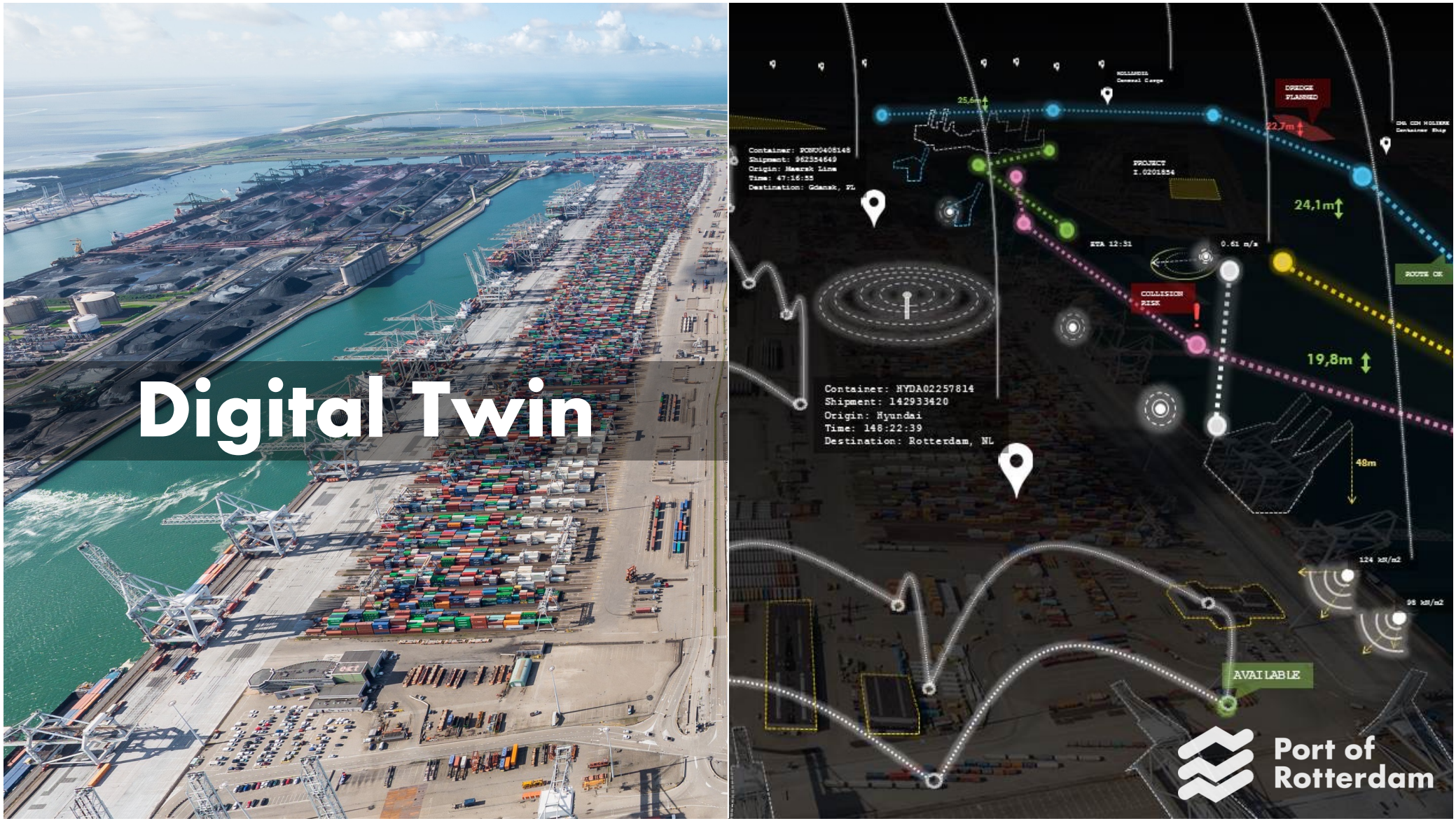
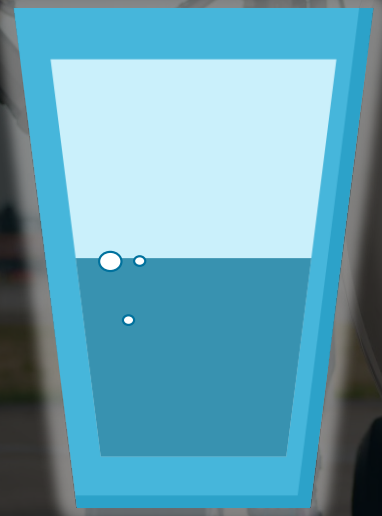

Digital Twin
Container: FCBU0408148
Shipment: 962354649
Origin: Maersk Line
Time: 47:16:55
Destination: Gdansk, PL
25,6m
22,7m
DREDGE PLANNED
24,1m
ETA 12:51
0.61 m/s
COLLISION RISK
ROUTE OK
19,8m
Container: HYDA02257814
Shipment: 142933420
Origin: Hyundai
Time: 148:22:39
Destination: Rotterdam, NL
48m
124 kN/m2
AVAILABLE
Port of Rotterdam

Digital Twin

… as of Industrial Revolution 4.0



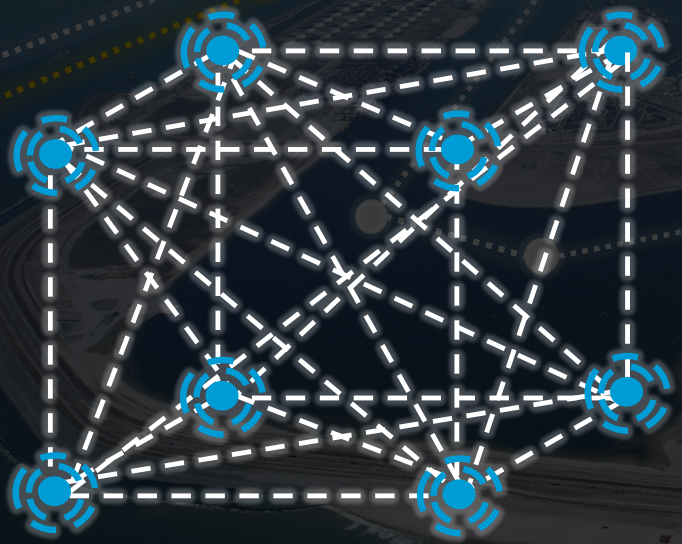
Parameter	Value
Object	Glass
Dimensions	10 cm x 5 cm x 5 cm 150 gr
Description	50% full 12 °C

Digital Twin

… as of Industrial Revolution 4.0

Parameter	Value
Object	Glass
Dimensions	10 cm x 5 cm x 5 cm 150 gr
Description	50% fill 12 °C
Location	On the table

Digital Twin
... and its four dimensions



Dimensions & Location

1. Length x
2. Width y
3. Hight / Depth z

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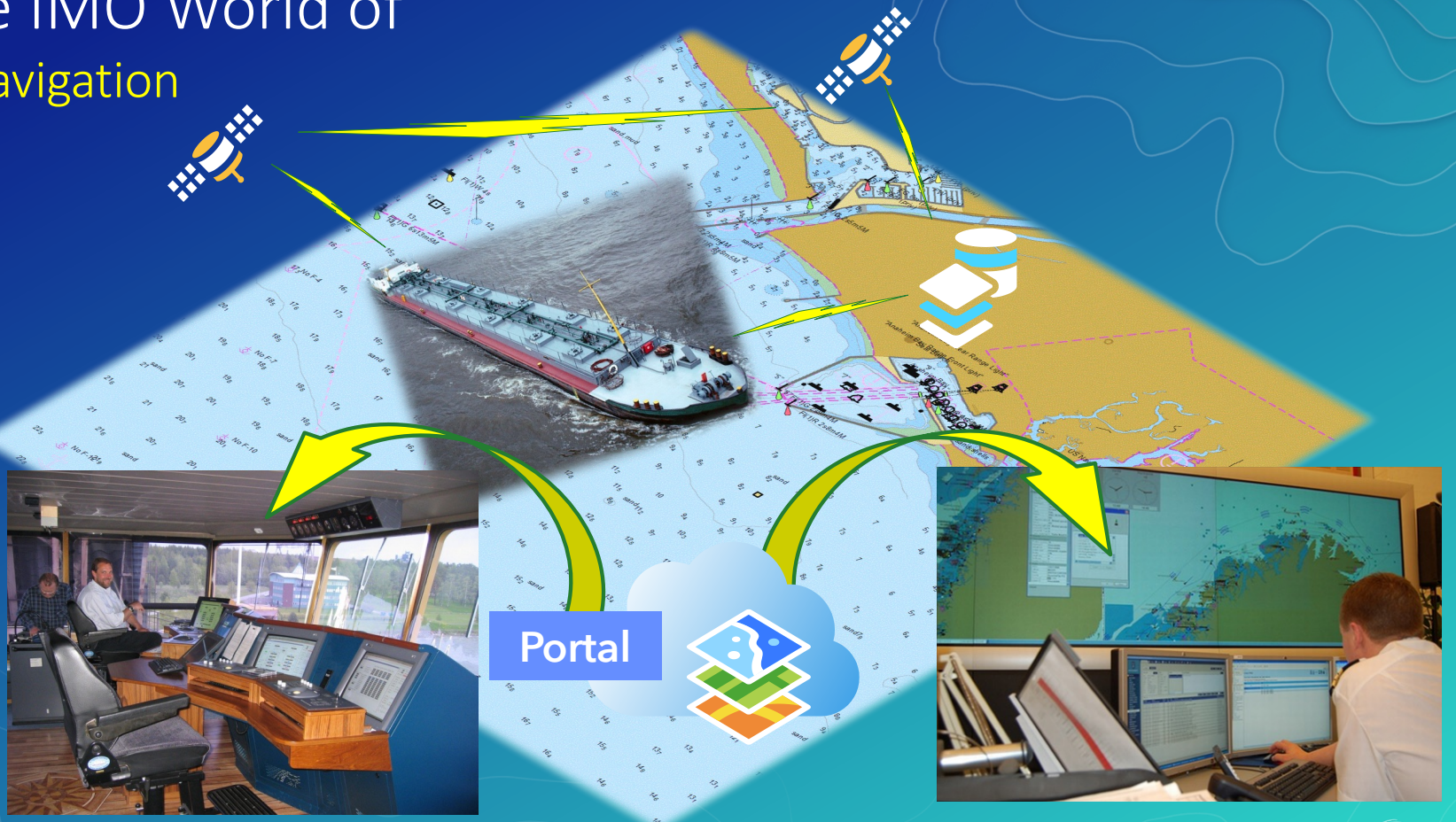
4. Time

- Real Time
- Historical
- Prediction

The IMO World of
e-Navigation



E-Nav 140: IMO has decided that **IHO standard S-100** should be the **baseline for** the IMO envisaged **Common Maritime Data Structure** (CMDS)

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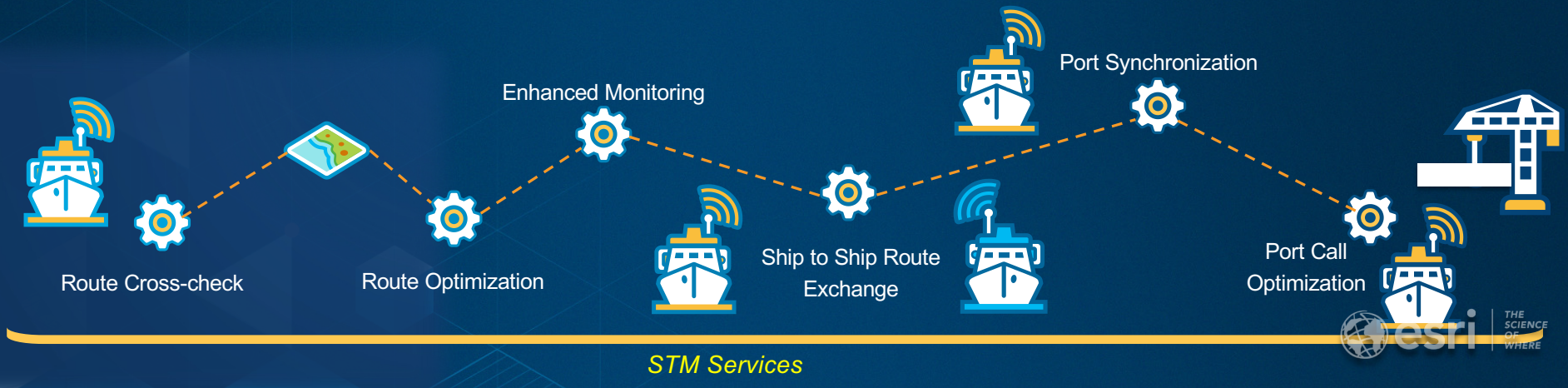
Sea Traffic Management (STM)

And e-Navigation

- STM Concept:
  - Standardization of real-time information exchange between ships, port and shipping companies
  - Improvements in quality and predictability of arrival information in port systems and navigation systems
  - Just in time operations based on better predictability and information sharing in and between ports and ships.
  - Improvements in situational awareness – safety of navigation (weather, collision avoidance and route deviation)



PortCDM – Collaborative Decision Making

And the International PortCDM Council

- Concept to implement processes, procedures and technical infrastructures at port calls for safe and secure communications in real-time
- Synchronize approaches
- Fast turn-around times
- Standards development – IALA S-2xx

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S-211 for Port Call messaging recently endorsed by IALA

- Adopted by PortCDM
- Fully registered in the IHO Registry
- Part of the IALA VTS domain within the CMDS GI Registry
- Enabling ships and ports of the world to exchange port call data in a standardize way.

Press Release,
9 October 2019

Adoption of S-211 standard for Port Call Message

IALA S-211
Product Specification
1.1.0 – July 2019
IALA Port Call Message Product Specification

After the adoption of the S-211 Standard by the International PortCDM Council (IPCDMC) and the endorsement by IALA, this standard for Port Call Messages has been fully registered in the IHO Registry, which is the foundation of the Common Maritime Data Structure (CMDS) of the IMO e-Navigation initiative.

During the last years, different projects have worked to develop and validate concepts, services and solutions to improve safety and efficiency of maritime transport. One result was the development of the "Sea Traffic Management" (STM) concept and its "Port Collaborative Decision Making" (PortCDM) enabler in the MONALISA and STM validation projects. Within STM, a Port Call Message Format has been developed to enable the coordination of stakeholder activities associated with port calls by providing a standard format to share the necessary information, particular time stamps, associated to movements and operations during port call operations.

In order to ensure sustainability and interoperability with the IMO initiative "e-Navigation", the International PortCDM Council (IPCDMC), initiated in the STM Validation project, has supported the idea to migrate the Port Call Message Format into a Common Maritime Data Structure (CMDS) format and as such integrate it in the CMDS GI Registry currently managed by the International Hydrographic Office (IHO). IALA has assigned S-211 within the IALA VTS domain as the identifier for this standard.

S-211 has been validated, been accepted and is now fully registered in the IHO GI Registry. It is part of the IALA VTS domain within the CMDS GI Registry. The standard can be accessed through the IHO GI Registry or through the IPCDMC homepage at www.ipcdmc.org.

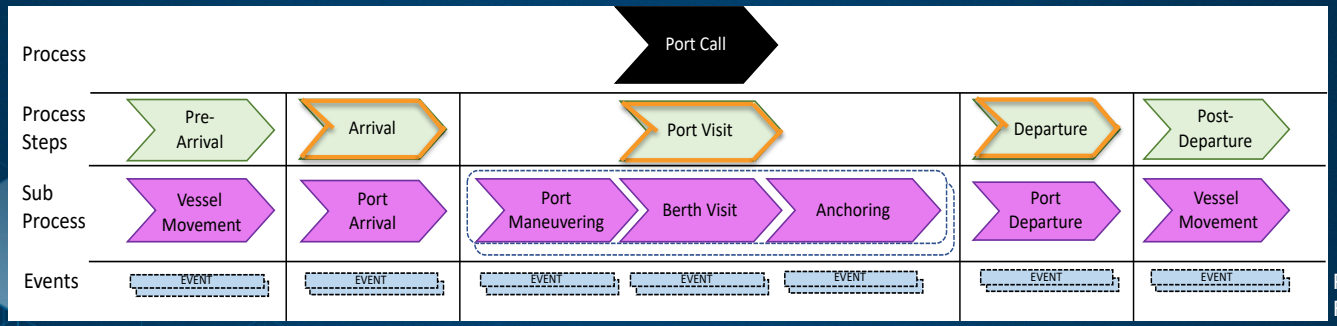
This standard enables both the merchandise fleet, as well as other types of ships, and the ports of the world to exchange port call data in a standardized manner to enable enhanced coordination and synchronization of port visits bringing a lot of value to involved parties and its clients.

For more information, contact:

Michael Bergmann, Secretary IPCDMC, +49 6186 912727, secretary@ipcdmc.org
Trond Andersen, Chair IPCDMC, +47 932 23 123, chair@ipcdmc.org

IALA S-211 Standard

- A feature-based (vector) product with information relating to a port call by a ship:
  - Ship – Port
  - Ship – Ship
  - VTS
  - Others
- Coordination through three process steps:



Port Call Process
From the S-211 standard

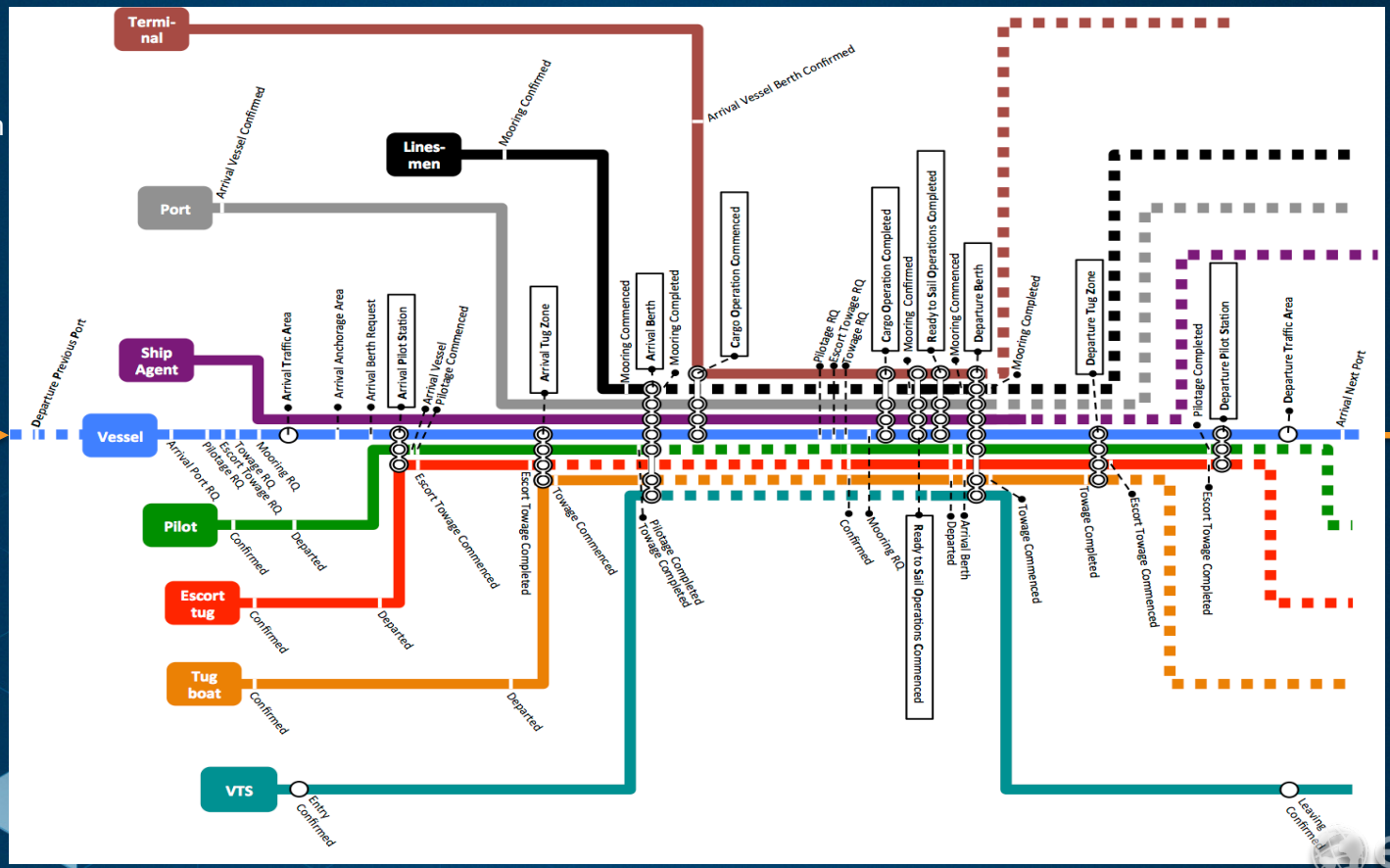
  - And contextual process steps: pre-arrival and post-departure

S-211 Generic state and coordination chart

IHO S-1xx Precise Navigation Information

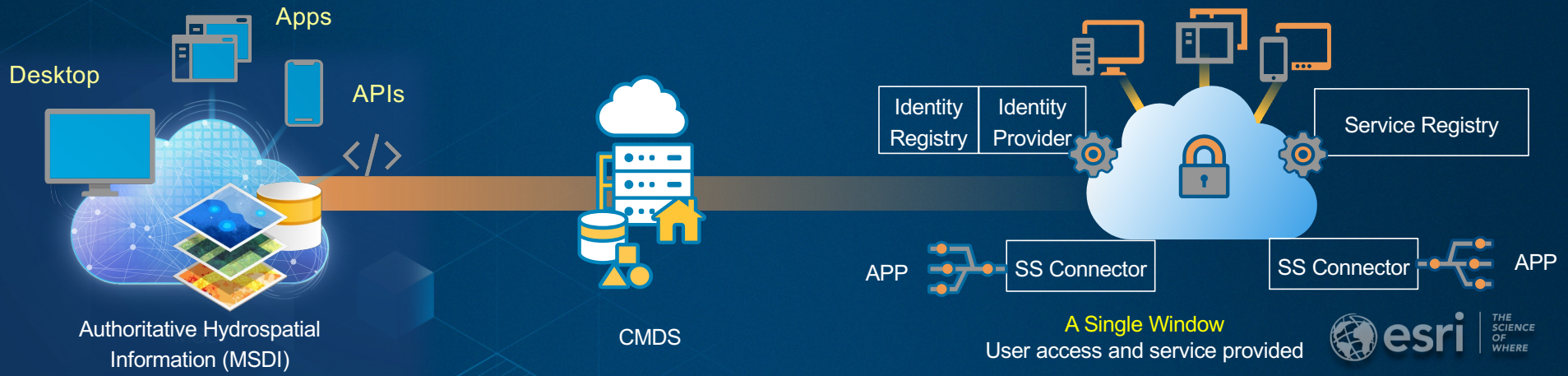
S-100 ECDIS

S-421 Voyage Information Standard (IEC 63173)



The “Single Window” concept

- It can be understood as the point of contact for communication in relation to ship-to-shore and shore-to-ship. IMO resolution A.950(23) "Maritime Assistance Service" (MAS) adopted on December 5th 2003.
- "Single Window" can also mean a service or institution on land that collects all information related to safety of navigation before sending them to ships, as defined in IMO documents on e-Navigation.
- The EU Directive 2010/65/EU on reporting formalities of ships arriving or departing the port of Member States, the vessel shall transmit reports mentioned in the IMO conventions and codes, the EU and national legislations, only once through the "national single window".



S-100 Specification series

IHO (S-101 to S-199)	IALA (S-201 to S-299)	IOC (S-301 to S-399)	Inland ENC HG (S-401 to S-402)	WMO/IOC JCOMM (S-411 to S-412)	IEC-TC80 (S-421 to S-430)	GMWG (S-501 to S-525)
S-101 ENC	S-201 Aids to Navigation Information		S-401 IEHG Inland ENC	S-411 JCOMM Ice Information	S-421 Route Plan	
S-102 Bathymetric Surface	S-210 Inter-VTS Exchange Format		S-402 IEHG Bathymetric Inland ENC	S-412 JCOMM Weather Overlay		
S-103 Sub-surface Navigation	S-211 Port Call Message Format			S-413 Weather and Wave Conditions		
S-104 Water Level Information for Surface Navigation	S-212 Port Call Message Format			S-414 Weather and Wave Observations		
S-111 Surface Currents	S-230 Application Specific Messages					
S-112 Open (Decision HSSC9/38)	S-240 DGNSS Station Almanac					
S-121 Maritime Limits and Boundaries	S-245 eLoran ASF Data					
S-122 Marine Protected Areas	S-246 eLoran Station Almanac					
S-123 Marine Radio Services	S-247 Differential eLoran Reference Station Almanac					
S-124 Navigational Warnings						
S-125 Marine Navigational Services						
S-126 Marine Physical Environment						
S-127 Marine Traffic Management						
S-128 Catalogue of Nautical Products						
S-129 Under Keel Clearance Management (UKCM)						

IHO – IALA Joint Workshop on S-100 & S-200

Coordination and close collaboration

https://events.iala-aism.org/s-100-200/

- Essential to achieve globally harmonized solutions for S-100/200 development and portrayal
- It was agreed upon that S-201 should be the update source for AtoN data for use by hydrographic authorities.
- It was agreed that S-125 would be a suitable replacement for the List of Lights and Fog Signals and act as a bridging mechanism.
  - It should be updated at a frequency necessary to support navigational safety.
- Integration of S-125 into ECDIS is a medium-term outcome but it will need immediate action in order to meet that goal.
- It was recognized that IMO approved communication requirements (GMDSS) cannot efficiently communicate S-100 based data to mariners.
- There is a need for a range of marketing communication, covering the necessity to adopt S-100 digital services, in a way that reaches a wider audience, especially policy makers, to emphasize the benefits.

IHO – IALA Joint Workshop on S-100 & S-200

Coordination and close collaboration

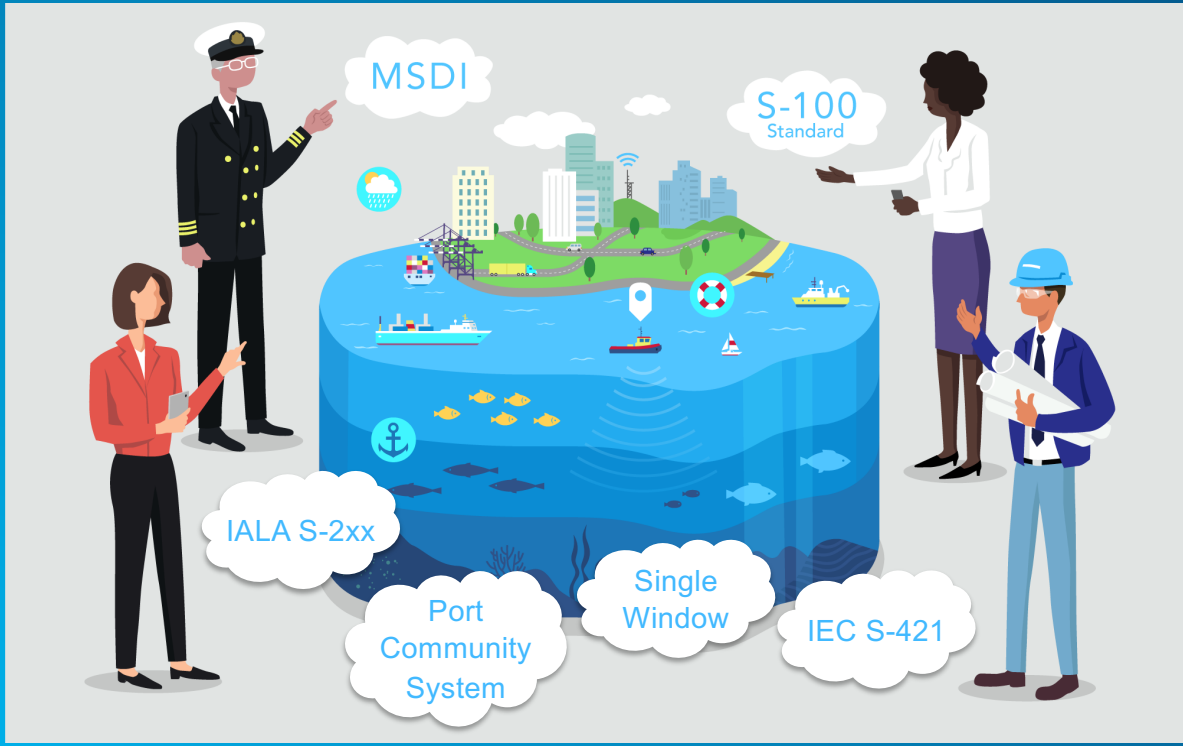
https://events.iala-aism.org/s-100-200/

Actions:

- The IALA Secretariat should consider submitting an input paper to the S-100 working group before the December 2022 meeting recommending that an impact assessment should be made, on whether the S-100 Version 5.0.0 release requires an update of S-97.
- IALA should consider updating Guideline G1106 on S-2xx management to include version control and update procedures etc.
- IALA should consider requesting the S100P include S-2xx suite of data product specifications as part of their test-bed.
- IALA considers developing a roadmap covering S-2xx suite and also considers the possibilities of non-ECDIS related S-100 products.

A Geospatial Infrastructure

Integrating distributed services



- Connecting e-Nav initiatives with Hydrospatial data
- Enabling this data to many users (MSPs)
- Spatial and temporal pillars in a PCS
- S-100/S-200 products series

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NOAA PORTS: Physical Oceanographic Real-Time System

NOAA CO-OPS PORTS

Physical Oceanographic Real-Time System®

Have you ever wondered how that new pair of tennis shoes arrived at your door? Or how those bananas got to your grocery store? Maybe you just bought a brand new car. How did it get here?

The U.S. marine transportation system consists of more than 25,000 miles of navigable waters and is the backbone for the movement of goods, services, and people throughout the nation and abroad. Huge cargo ships transport goods through different ports across the country, but how do ship operators know if they can fit under bridges or through narrow channels safely? These ships use real time information provided by NOAA's Physical Oceanographic Real-Time System® (PORTS®) to make it happen! Find out more about how water level and other oceanographic data are critical for maritime commerce, economic efficiency, and coastal resource protection below.

PORTS® is an Information System

To assist mariners, NOAA's Center for Operational Oceanographic Products and Services (CO-OPS), part of the National Ocean Service, developed the Physical Oceanographic Real-Time System (PORTS®), a robust integrated real time information system that provides them with a comprehensive situational awareness of the operating environment, enabling the best safety and operational decisions. Through a partnership with CO-OPS and it's users, PORTS® delivers accurate and reliable environmental observations to users in over 25 of the nation's major ports and is a critical decision support tool for maritime commerce and coastal resource management.

About PORTS®

PORTS® sensors measure oceanographic and meteorological conditions, such as water levels, currents, salinity, wind, and bridge clearance. Each integrated system of sensors, concentrated in seaports, is tailored to the specific needs of the local community. PORTS® systems come in a variety of sizes and configurations, each specifically designed to meet local user requirements. The largest of the existing PORTS® installations is comprised of over 50 separate sensors; the smallest consists of a single water-level gauge and meteorological instruments to measure winds, air temperature, barometric pressure, etc.

Navigation

PORTS® offers local communities and pilots multiple ways to successfully guide ships into and out of the nation's ports to ensure safe navigation. PORTS® measures water

https://arcg.is/1v14Dn

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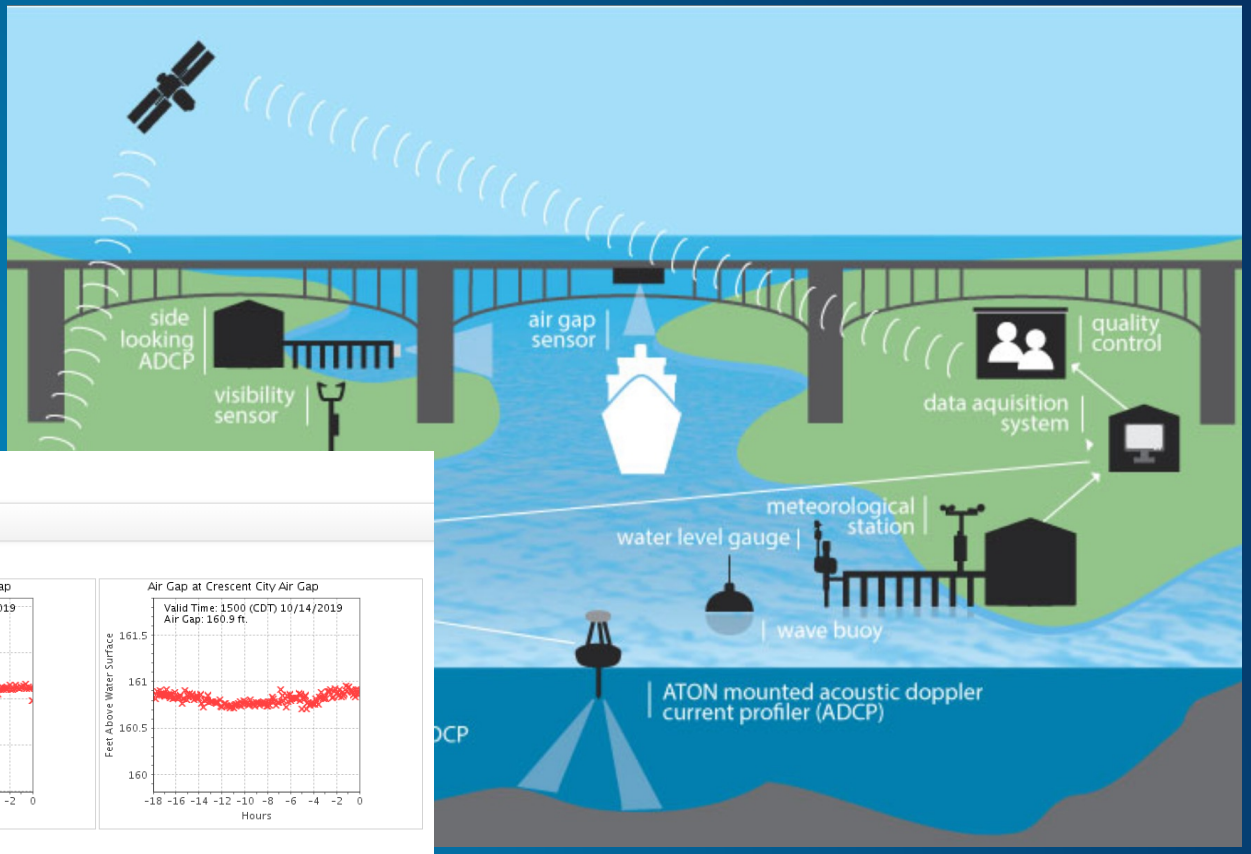
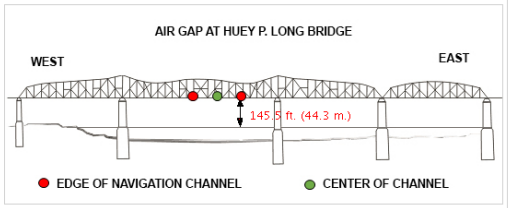
NOAA CO-OPS PORTS

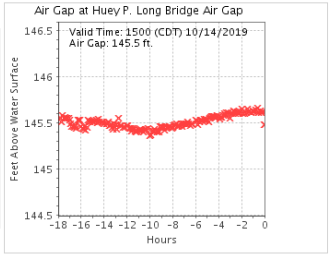
Air gap under a bridge (same principle applied to UKC)

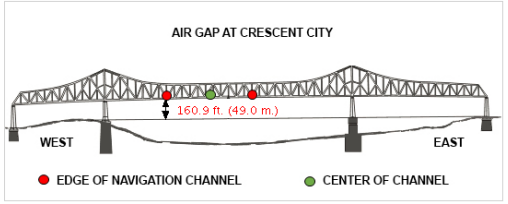


PORTS®: 8762002 Huey Long Bridge Air Gap

Summary | Air Gap | 3 Days Air Gap







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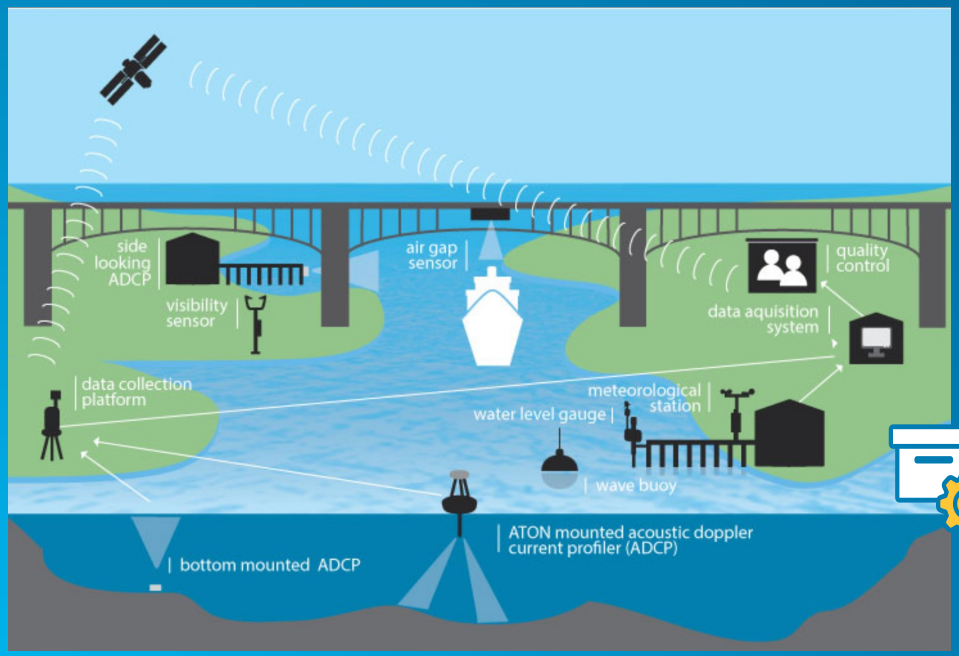
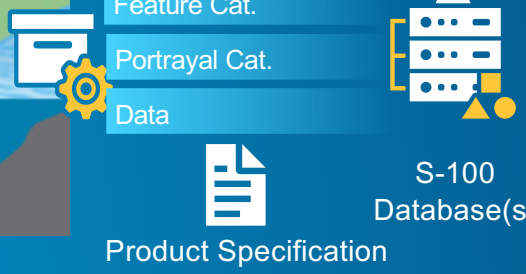
What is missing here?



The S-100 Process



Product Specification

S-100

S-100 Database(s)

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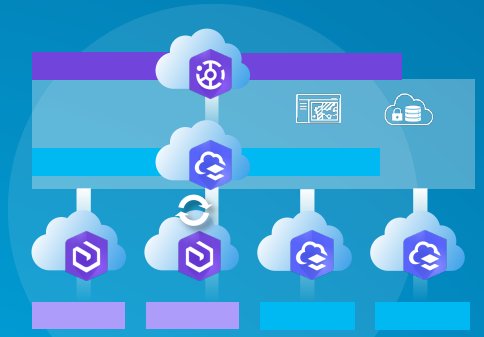
How Esri is supporting S-100

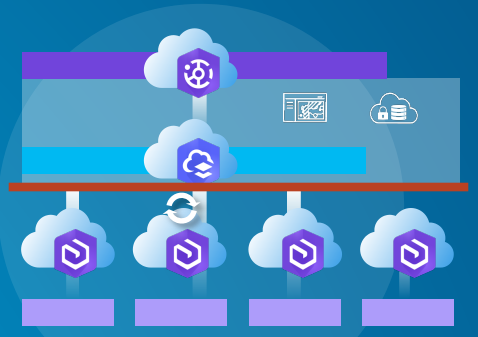
Once produced, how to make these services available to the user?

MSDI Implementation Patterns: *Thinking outside the box*

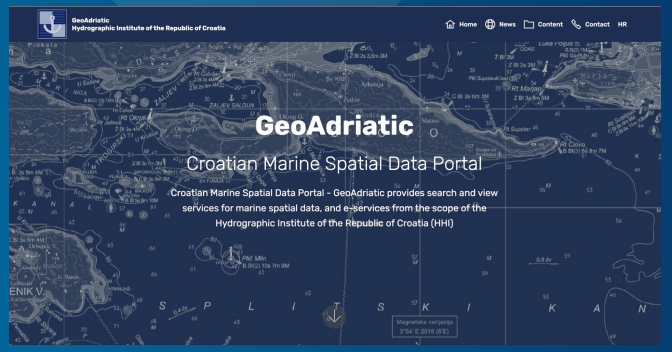
Hybrid



Registered/Referenced



Hosted



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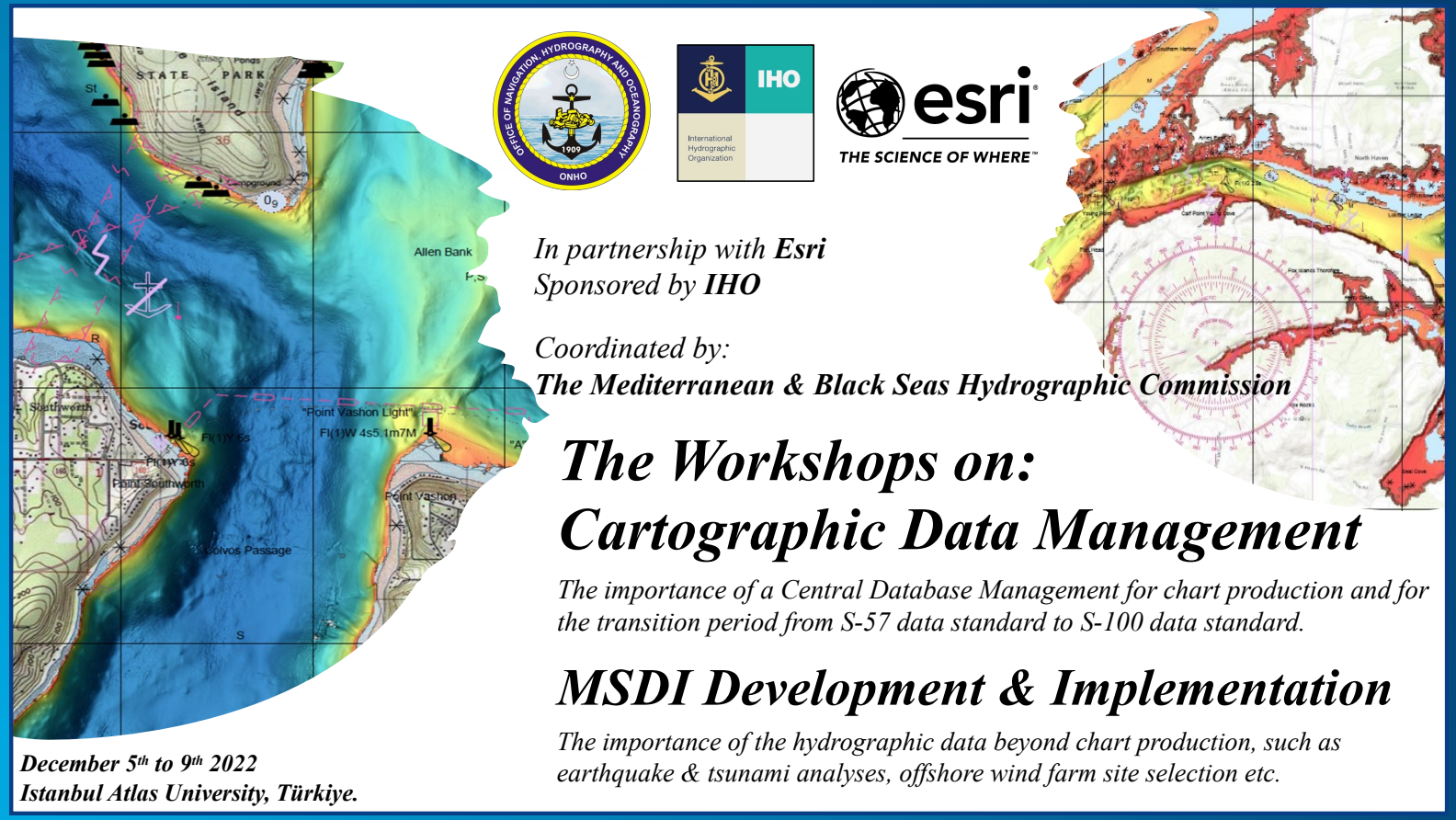
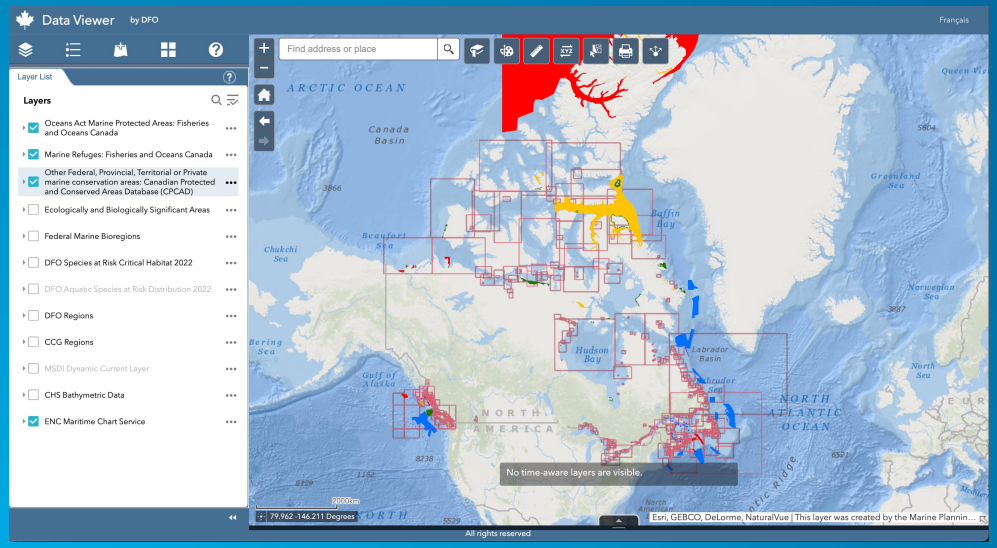
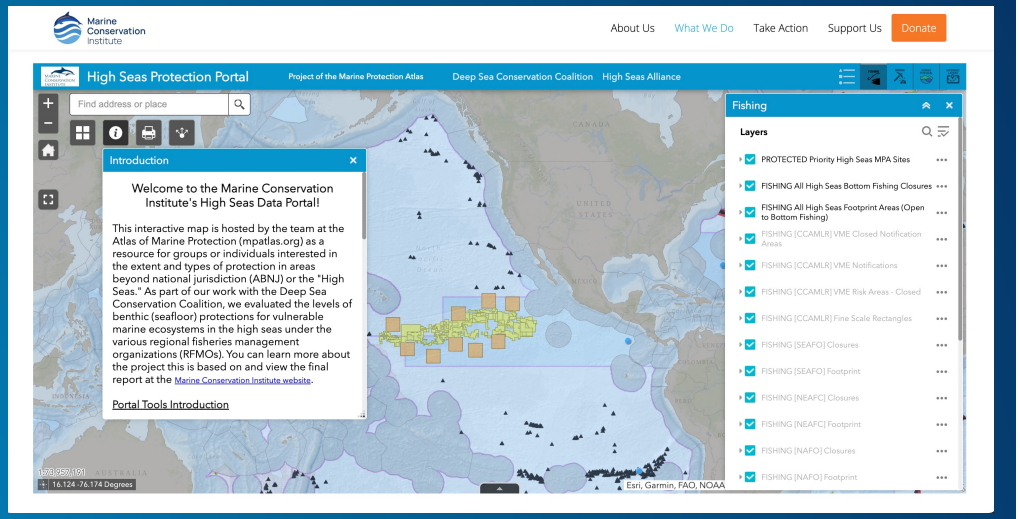
And please consider this type of CB option!



Check out these MSDI services



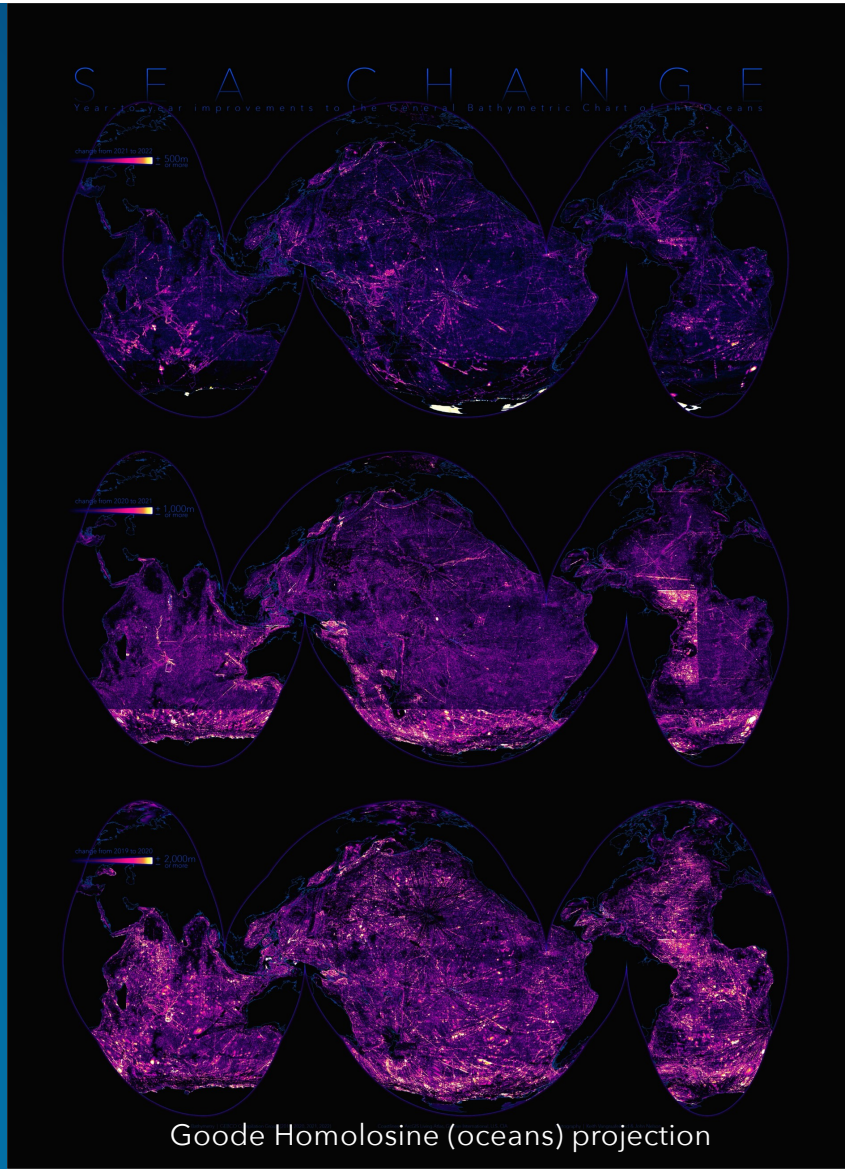
Fisheries and Oceans Canada – DFO Data Viewer:
https://gisp.dfo-mpo.gc.ca/apps/DataViewer/



Marine Conservation Institute:
https://marine-conservation.org/high-seas-protection-portal/

ArcGIS Living Atlas: Sea Change

- From Radar based measurements from space (Gravity effect by undersea features)
- To GEBCO data
- Improvements showing a color map with the amount of change year over year.
- Cut in half with each update.
  - 2020's improvements had to be mapped to a range of +/- 2,000 meters.
  - 2021 was mapped to 1,000 meters,
  - and 2022 was mapped to a change of just 500 meters.
- This poster was made by running a minus raster function in ArcGIS Pro, between successive years of GEBCO's annual bathymetry products, to generate a change map (difference) of each year.
- Find more details about this here.



They all come together for the future of Maritime…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Thank you!
rponce@esri.com