Marine Data Sharing and Collaboration:
The Keys for a Successful Hydrospatial Strategy Implementation

Session 8
“Coordinated and coherent integrated marine geospatial information management”
Singapore, May 12th, 2022

International Seminar on United Nations Global Geospatial Information Management
Open Vision & Geospatial Infrastructure Resources

https://www.esri.com/en-us/arcgis/open-vision

Collaboration is key
What is Geospatial Infrastructure?

Geospatial infrastructure is a technology enabler of digital ecosystems.

It provides:
- Security, privacy and accessibility
- Identity management
- Data sharing & Collaboration

Through:
- Open standards
- APIs
- Licenses
- Marketplaces
On-demand streaming web services & APIs
Evolving SDI: Integrated Geospatial Infrastructure
Expanding beyond data to knowledge and understanding

Metadata catalogs
Federated portals
Digital ecosystems

Search & Discovery → Integration & Use
Modern SDI: Integrated Geospatial Infrastructure
Connects organizations across borders, sectors, and jurisdictions
Modern SDI: Integrated Geospatial Infrastructure
Indonesian Hydrographic Data Center

https://tinyurl.com/4fmyub2m
Modern MSDI: Integrated Geospatial Infrastructure
Whether we call it SDI, Open Data, Digital Twin, or otherwise...

- Key characteristics:
  - Multi-organizational
  - Integrated Fundamental & Operational Data
  - Interoperable (standards)
  - Collaborative
  - Digital Ecosystem
  - Focus on End Users / Putting Data to Use
Digital Ecosystem: SDI Community of Practice
Today: Global Geospatial Ecosystem

- SSDI
- NSDI
- Regional SDI
- MSDI
- Digital Twin
- SDI
Technology & Policy: Influencers

NSDI

SDI

Geospatial Policy Centers

Open Source Community

Digital Twin

SSDI

Policy Directives

SSDI

NGO & PPP Initiatives

MSDI

Standard Development Organizations (SDOs)

NSDI

Regional SDI
An open platform is essential
evolving, expanding, energizing the community

Integrated Geospatial Infrastructure & SDI
- Green Deal
- Horizon 2020
- Open Data Directive
- High value datasets
- GEO / GEOSS
- GAIA-X
- Data Spaces
- Digital Twins
- SDGs

UNGGIM
Integrated Geospatial Information Framework (IGIF)

Geospatial Knowledge Infrastructure (GKI)

Regional Strategy for Data

Open Data

INSPIRE

IHO MSDI

National Spatial Data Infrastructure

Standards Support
- OGC
- IHO
- ISO
- OGC APIs
- Web Services
- INSPIRE
- DCAT-AP
- Domain/Industry Standards
- Federated services
- Federated catalogs

FAIR data principles
- Open Data
- Open Science
- Metadata & Search
Standards & Interoperability
Working in heterogeneous environments
Standards Development Organizations

The Home of Location Tech Collaboration
Your Global Resource for Geospatial
Welcome to OGC, a worldwide community of location information. We connect people, solve challenges and address everyday needs. The government agencies, research organizations, location information firms - everyone works together to advance location technology.

OGC Standards and Resources
Made by our Member Community for use by the Global Community

- Standards
- Reports
- Best Practices
- Community Practices
- Engineering Reports
- Discussion Papers
- White Papers
- OGC Reference Model

OGC Standards and Resources:
- International standards that detail conceptual models, interfaces, or exchange to enable interoperability
- View all OGC standards
- NIST standards
- Open-source implementation agreements
- Crosswalks
- Implementation reports
- CEOP and C-View
- ISO standards
- OpenGIS Standards

ISO/TC 211
Geographic information/Geomatics

88 : published ISO standards
24 : ISO standards under development

https://committee.iso.org/home/tc211

https://www.ogc.org/standards
Standards Listing : https://www.ogc.org/docs/is

https://www.ogc.org/
https://iho.int/
The New S-100 series
The IHO S-100 “Universal Hydrographic Data Model

How can these new series of standards help?
S-100 Derived Product Specifications

Types and domains

Electronic Navigational Charts
Nautical Publications
Surface Currents
Bathymetry
Tides

AIS
VTS
Aids to Navigation
Port Calls

E-Navigation
CMDS
MSP

Domain Responsible

IHO Hydro
WMO ICE
WMO Weather
Inland ENC
Port ENC
IALA AIS
IALA AtoNs
IALA VTS
AML
IEC

IHO
WMO ETSI
WMO ETMSS
IEHG
IALA
IALA
IALA
NATO GMWG
IEC
Best Practices: Spatial data on the Web

**REUSE**
- All Best Practices

**ACCESS**
- Use spatial data encodings that match your target audience
- Provide geometries on the Web in a usable way
- Provide geometries at the right level of accuracy, precision, and size
- Choose coordinate reference systems to suit your user's applications
- Provide information on the changing nature of spatial things
- Expose spatial data through "convenience APIs"

**DISCOVERABILITY**
- Use globally unique persistent HTTP URLs for Spatial Things
- Make your spatial data indexable by search engines
- Include spatial metadata in dataset metadata
- Describe the positional accuracy of spatial data

**PROCESSABILITY**
- Link resources together to create the Web of data
- Use spatial data encodings that match your target audience
- Provide geometries on the Web in a usable way
- Provide geometries at the right level of accuracy, precision, and size
- Choose coordinate reference systems to suit your user's applications
- State how coordinate values are encoded
- Describe relative positioning
- Use appropriate relation types to link Spatial Things

**INTEROPERABILITY**
- Link resources together to create the Web of data
- Use spatial data encodings that match your target audience
- Provide geometries on the Web in a usable way
- Choose coordinate reference systems to suit your user's applications
- State how coordinate values are encoded
- Use appropriate relation types to link Spatial Things
- Expose spatial data through "convenience APIs"
- Describe the positional accuracy of spatial data

**COMPREHENSION**
- Link resources together to create the Web of data
- Use spatial data encodings that match your target audience
- Choose coordinate reference systems to suit your user's applications
- State how coordinate values are encoded
- Use appropriate relation types to link Spatial Things
- Expose information on the changing nature of spatial things
- Include spatial metadata in dataset metadata
- Describe the positional accuracy of spatial data

**TRUST**
- Use globally unique persistent HTTP URLs for Spatial Things
- Include spatial metadata in dataset metadata
- Describe the positional accuracy of spatial data

**LINKABILITY**
- Use globally unique persistent HTTP URLs for Spatial Things
- Include spatial metadata in dataset metadata
- Describe the positional accuracy of spatial data

OGC and W3C joint initiative

Spatial Data on the Web Best Practices
W3C Working Group Note 28 September 2017

https://www.w3.org/TR/sdw-bp/#toc
Where to start?

- Identify key stakeholders and their requirements
- Identify National and/or regional initiatives/legislation that support MSDI
- Identify appropriate IHO Committees and WGs to be involved with and participation at the RHC
- Consider participation at the IHO MSDI WG

- Identify data providers
  - Who they are and what is their data
  - How does that data complement that of the HO
  - Who are the key people in each organization to engage with
  - What do they expect from the MSDI
  - How will they interact with other organizations in the MSDI
  - What are their data sharing and exchange protocols
What datasets the National HO and related agencies could provide?

- **Bathymetry** (e.g. Digital Elevation Model, Triangulated Irregular Network, Grid, points);
- **Coastline**;
- **Tidal data** (heights and streams);
- **Oceanographic data** (e.g. sound velocity, salinity, temperature, currents);
- **Aids to Navigation** (e.g. lights, landmarks, buoys);
- **Maritime information and regulations** (e.g. administrative limits, traffic separation schemes);
- **Obstructions and wrecks**;
- **Geographical names** (e.g. sea names, undersea feature names, charted coastal names);
- **Seafloor type** (e.g. sand, rocks, mud);
- **Constructions/infrastructure at sea** (e.g. wind farms, oil platforms, submarine cables, pipelines);
- **Shoreline constructions/infrastructures** (e.g. tide gauges, jetties) and
- **Practice and Exercise and/or Restricted areas**.
Modern SDI Patterns
Produce, Publish, Collaborate, Share, Use
Geospatial Infrastructure is emerging rapidly
Connecting organizations across borders, jurisdictions, and sectors

Supporting FAIR principles
Findable Accessible Interoperable & Reusable

Dynamically integrating content...
...enabling decision-ready information products
Hydrospatial Infrastructure Integrates Distributed Services
Making Available All Types of Data

Maps, Layers & Scenes

Big Data
Unstructured
Lidar / Point Cloud
Real-Time (IoT)
3D
Multidimensional Data
Imagery
Vector
Terrain
Tabular
Voxels
Textured Meshes

APPs & MAPS

HYDROSPATIAL SERVICES

Maps, Layers & Scenes

CAD / BIM
Produce, **Publish**, Collaborate, Share & Use

**Hybrid**

**Registered/Referenced**

**Hosted**

https://www.caribbeangeoportal.com/

https://data.admiralty.co.uk/portal/apps/sites/#/marine-data-portal

https://geo Adriatic.hhi.hr/en/
The Big Picture
So what? What does this enable?
Ease of Sharing and Integration: US Marine Cadastre

An Ocean of Information
A joint BOEM and NOAA initiative providing authoritative data to meet the needs of the offshore energy and marine planning communities.

Features

https://marinecadastre.gov/
Regional and Multi-state Collaboration

The Caribbean GeoPortal
Inspiring communities through geography

What inspires you?
Your neighborhood, your school, your community? Perhaps a people or place whose story needs to be told? Maybe it's an app to help collect some type of data for your community?
The #YourCaribbeanStory competition allows students like you to tell your story while encouraging spatial thinking and promoting research across the region. And for winners of the competition... a chance to secure an intern/externship.

YOUR CARIBBEAN STORY
We are pleased to announce the inaugural 2022 CARIGEO Student Competition
Let’s Recap

• The **main take-aways** we want you to leave with:
  - Geospatial (Hydrospatial) Infrastructure powering modern MSDI
  - The future is bright: Technology enables the creation of a system-of-systems supporting modern MSDI
  - Supported by an open platform
    - Interoperability through open standards and specifications
  - Enabling new things!
    - These patterns support organizations and their local-to-global key initiatives
Thank you for your kind attention!

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Connect with us and additional resources
https://www.esri.com/en-us/arcgis/open-vision/resources