



Esri Maritime:

Building & Understanding the Hydrospatial Environment for safety of navigation and efficient operations

18th Conference of the EAthC.
1 to 3 of May 2024
Casablanca, Kingdom of Morocco.

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Principal Consultant and Maritime Practice Lead - Esri



ArcGIS

A System for managing, sharing & applying the geographic approach



*Delivering Value Across Organizations
Improving Efficiency, Communications, Decision Making and Collaboration*

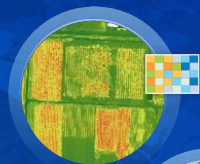
Integrating All Types of Data

Geospatial
Infrastructure

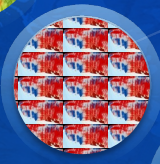
Creating a Common Language

Shared Services

Maps
Scenes
Layers



Imagery



Multidimensional



Tabular



Unstructured



Vector



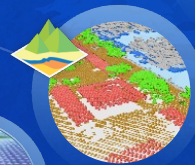
3D



Real-Time
(IoT)



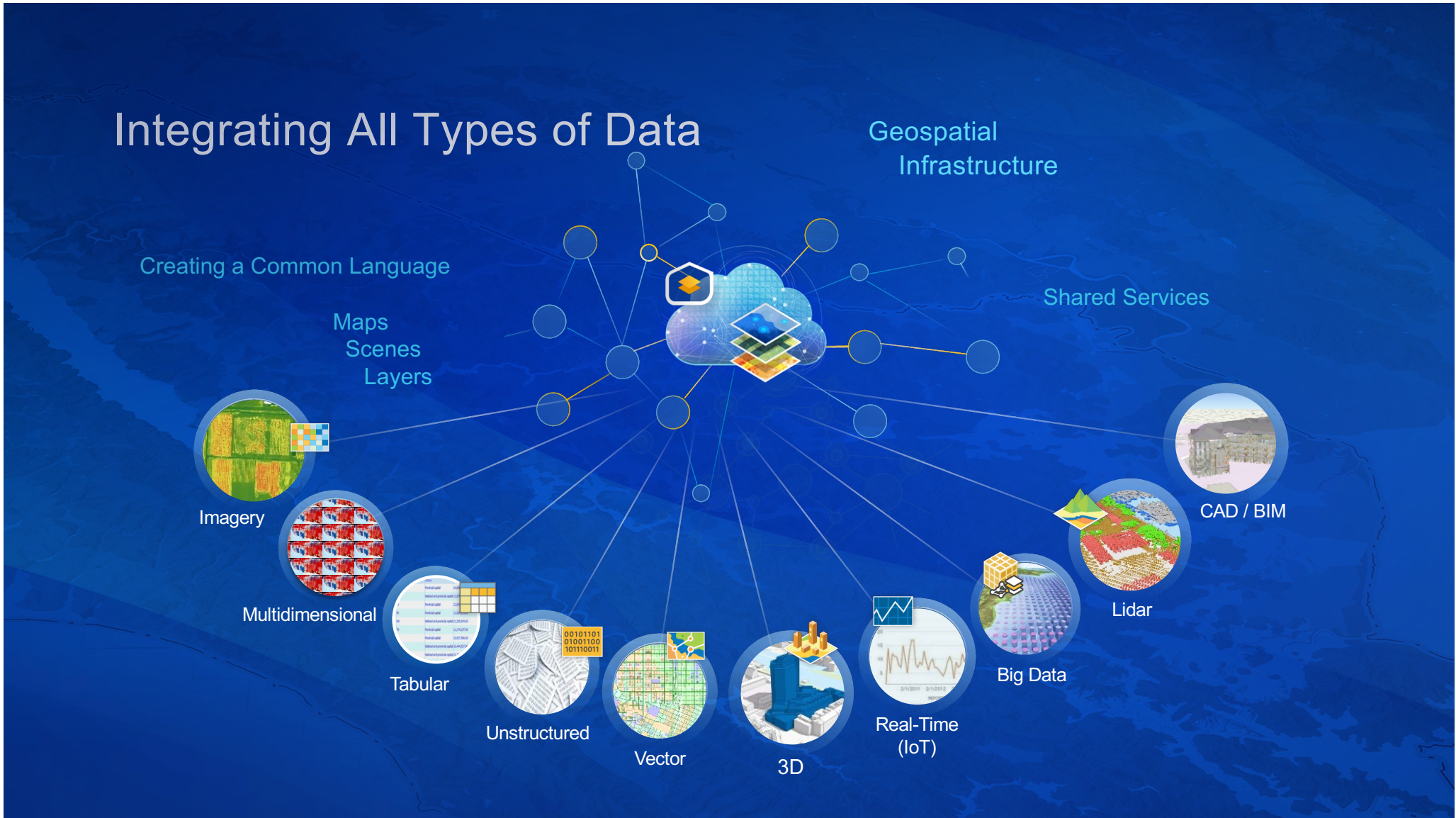
Big Data



Lidar

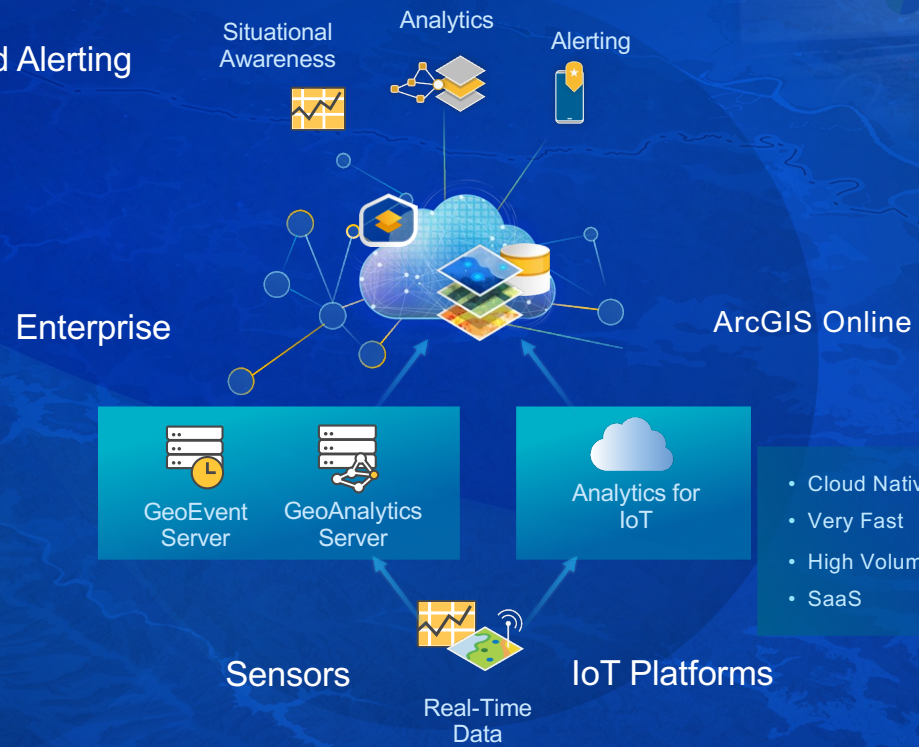


CAD / BIM



Real-Time Analytics Integrating Sensor Networks and IoT

Supporting High-Velocity Data Streams
Tracking, Monitoring and Alerting



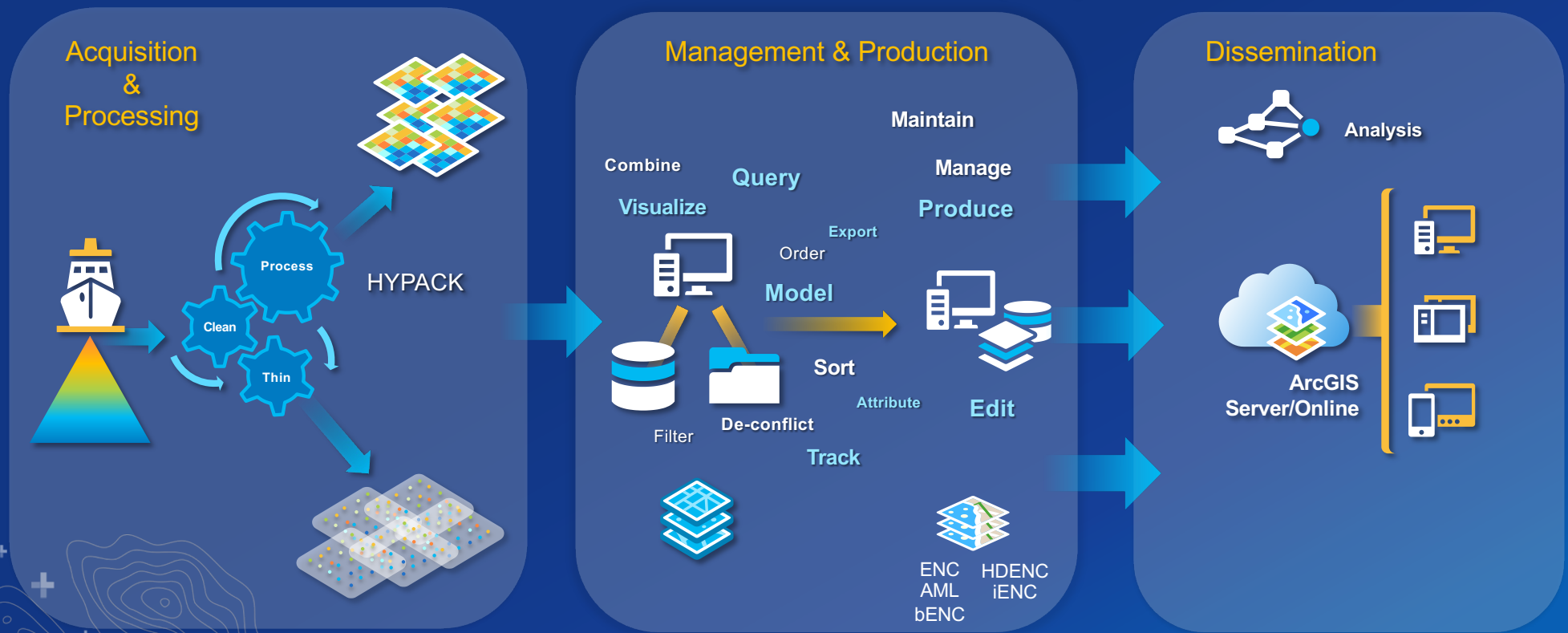
- Cloud Native Service
- Very Fast
- High Volume
- SaaS

Collapsing the Time from Measurement to Decision Making

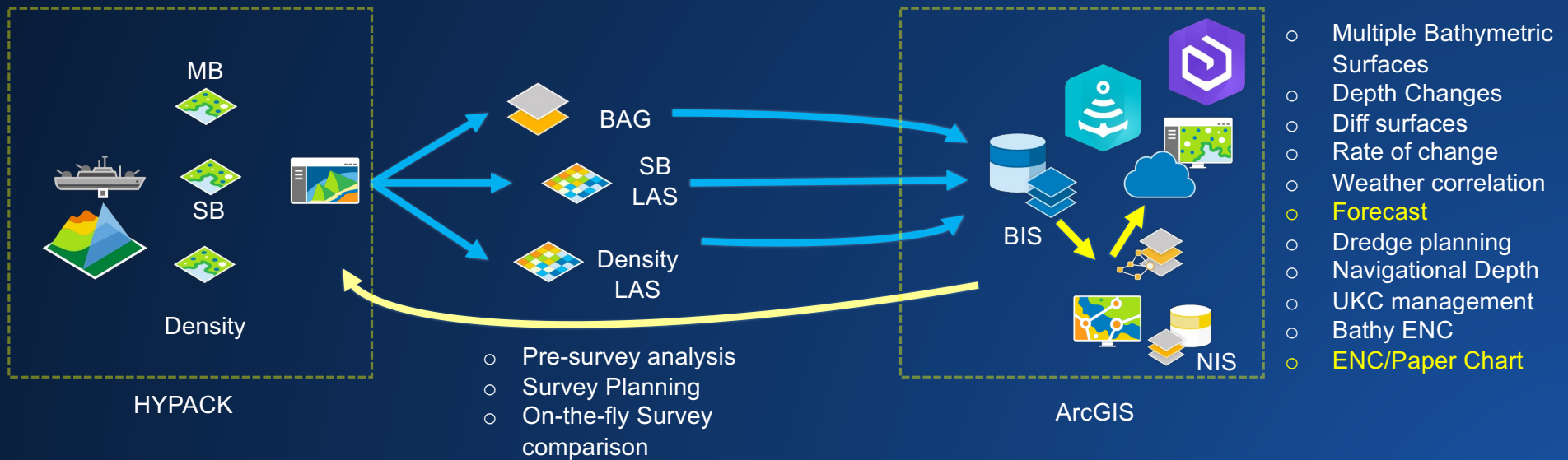
The Workflow

Collect, Manage, Produce, Share

ArcGIS Bathymetry – ArcGIS Maritime

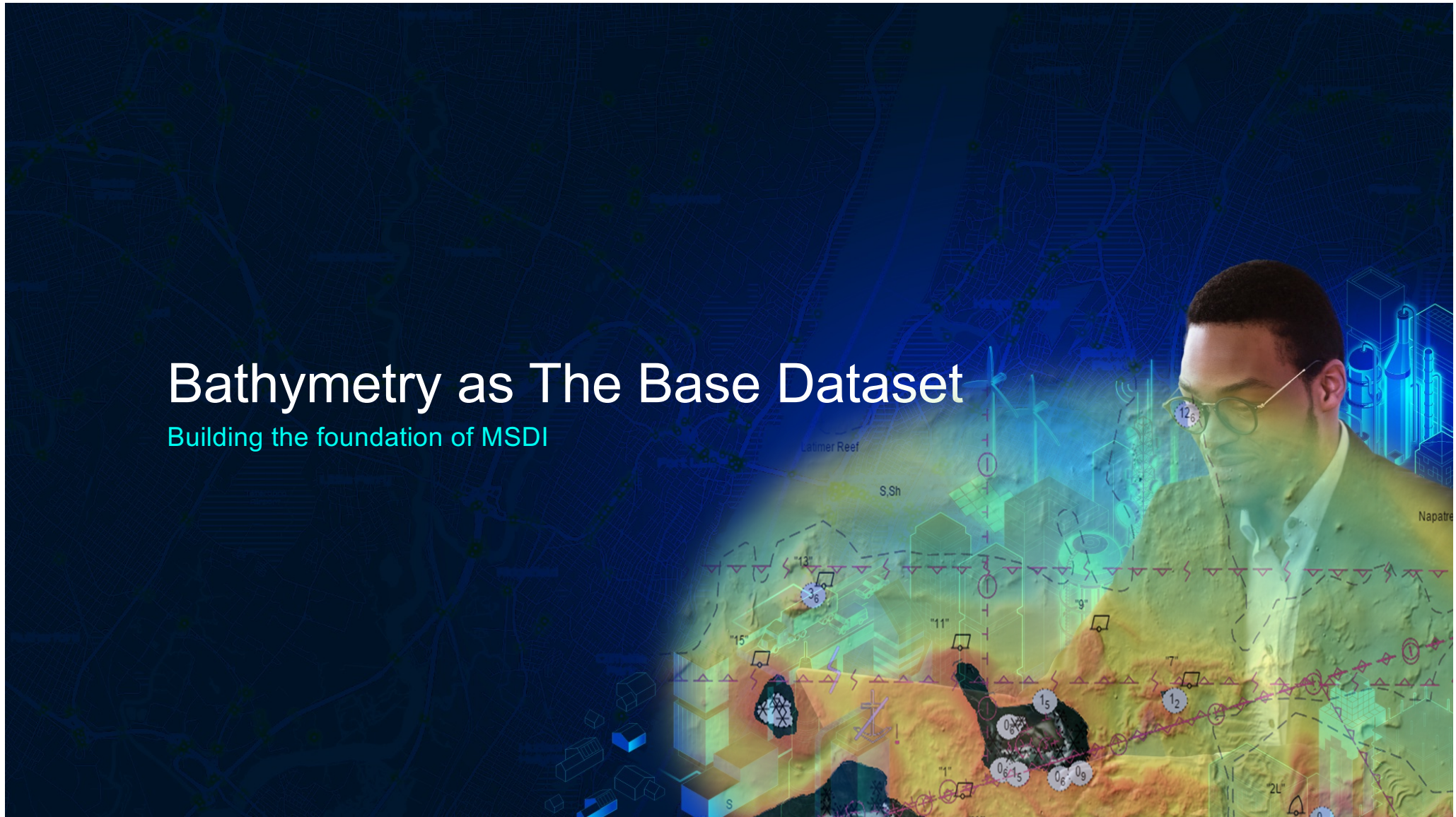


HYPACK – ArcGIS Bathymetry – ArcGIS Maritime workflow overview



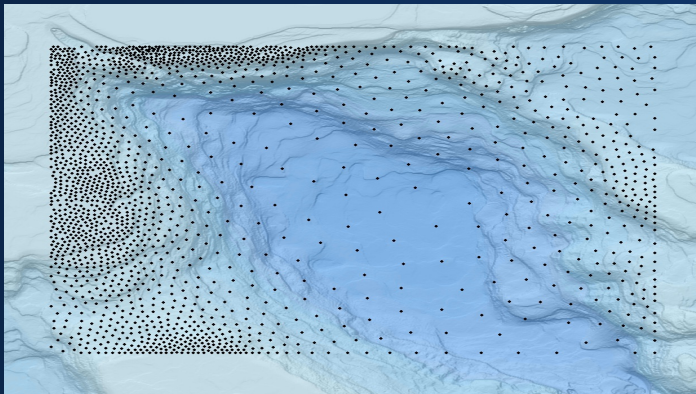
Bathymetry as The Base Dataset

Building the foundation of MSDI



What is ArcGIS Bathymetry?

- Is an extension for ArcGIS with tools and workflows for:
 - Managing bathymetric data and metadata
 - Performing data exploration
 - Performing data modeling
 - Creating bathymetric surfaces for multiple uses without duplication
 - Supporting Hydrosatial analysis and production



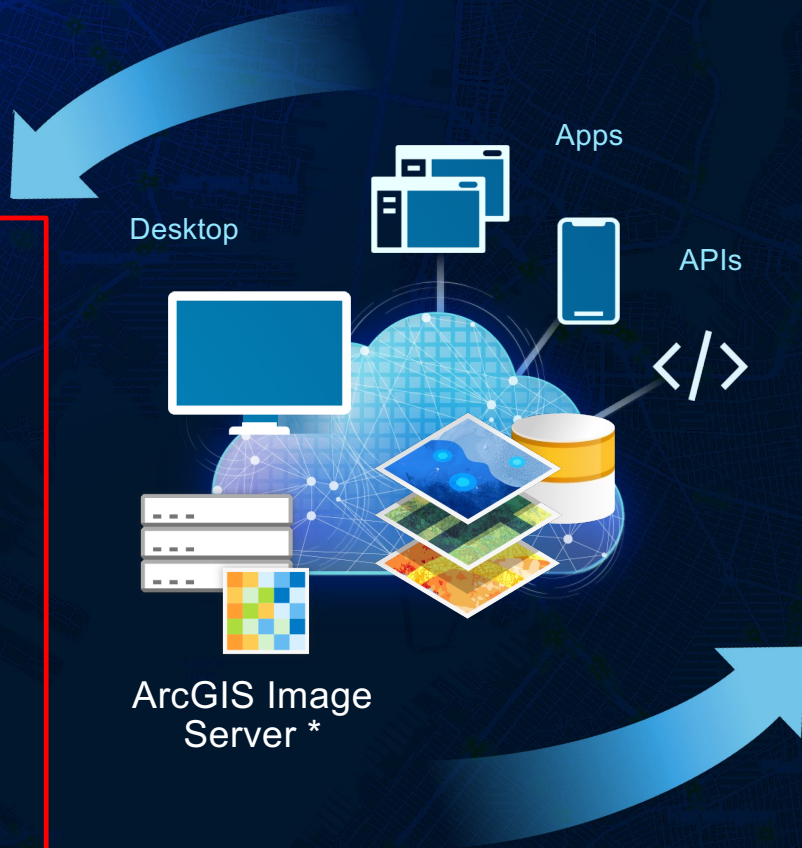
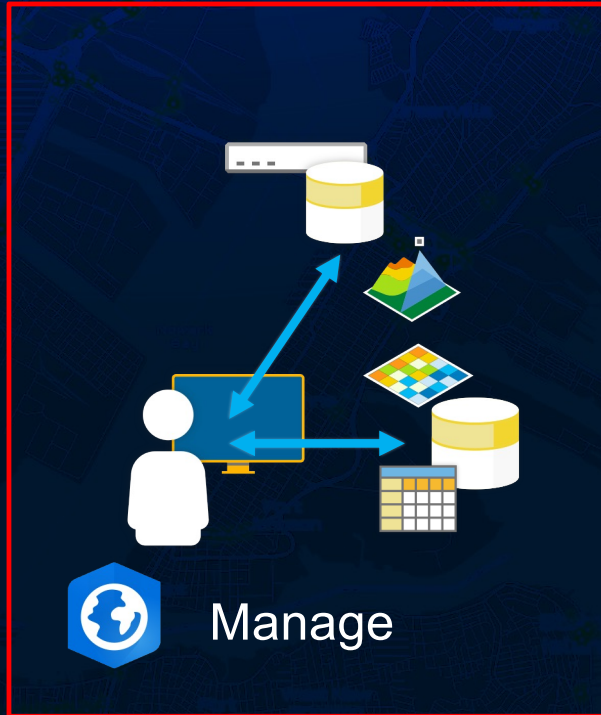
What is NOT:

- A data acquisition software
- A patch testing / latency testing / sonar artifact correction
- A Tides and SVP corrections application
- A raw sonar data processing app
- A “dot killing” app

Learn more at: www.esri.com/bathymetry



ArcGIS Bathymetry



Explore and Extract





ArcGIS Bathymetry

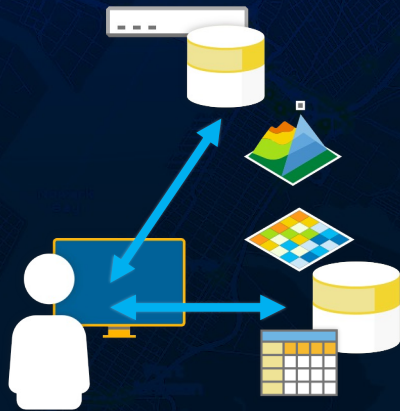
Explore and Extract



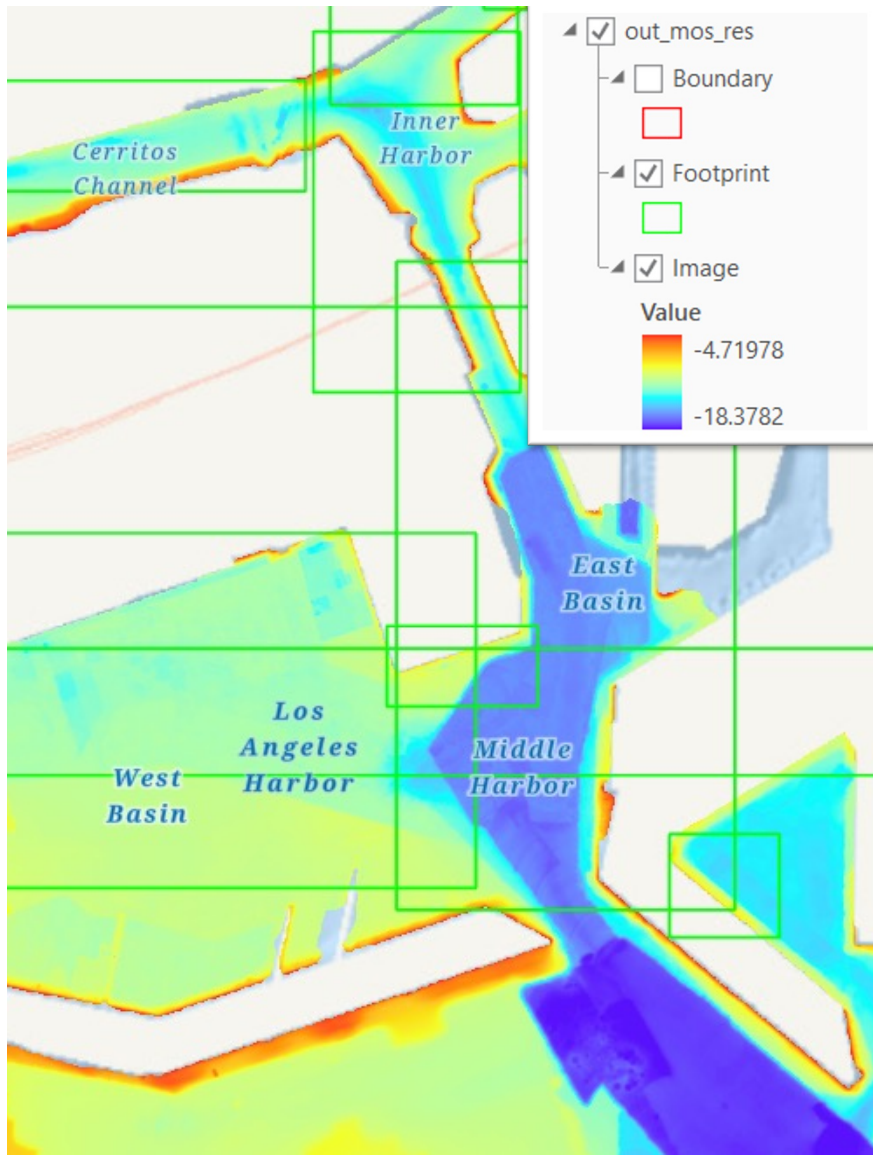
Desktop Apps APIs



ArcGIS Image Server *



Manage



Mosaic Datasets

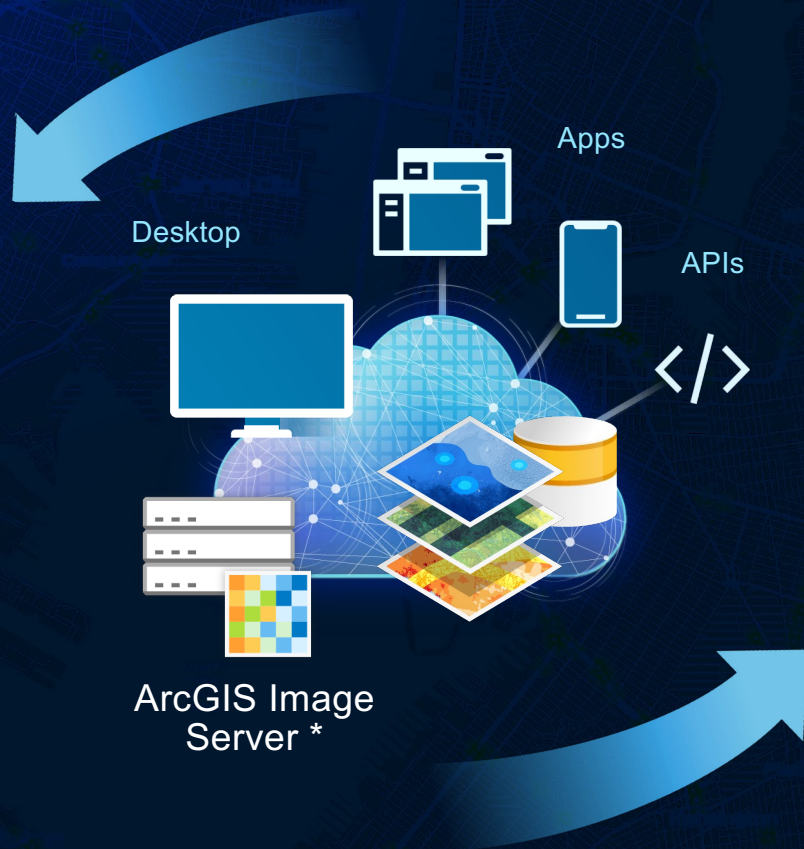
- Dataset referencing versus duplication
- Customizable tables
- Seamless, multiresolution data visualization
- Advanced modeling and raster analytics
- Source for web service



ArcGIS Bathymetry



Manage



Explore and Extract



Web App - Explore & Extract

ArcGIS Bathymetry
Geo-enable your bathymetric data

Explore Bathymetry

Imagery Filter to Map Extent

Name

Category

PercentCoverage and

CellSize and

DatasetType

VerticalUnits

Meters

Directionality

POSITIVE_UP

Vertical Datum

MLLW

Scale and

Agency

- NOAA
- USACE
- USGS
- USCG
- Ports of LA/LB
- CSUMB
- other

Compose Surface

Imagery

Save Model

Rule

Survey Date Descending

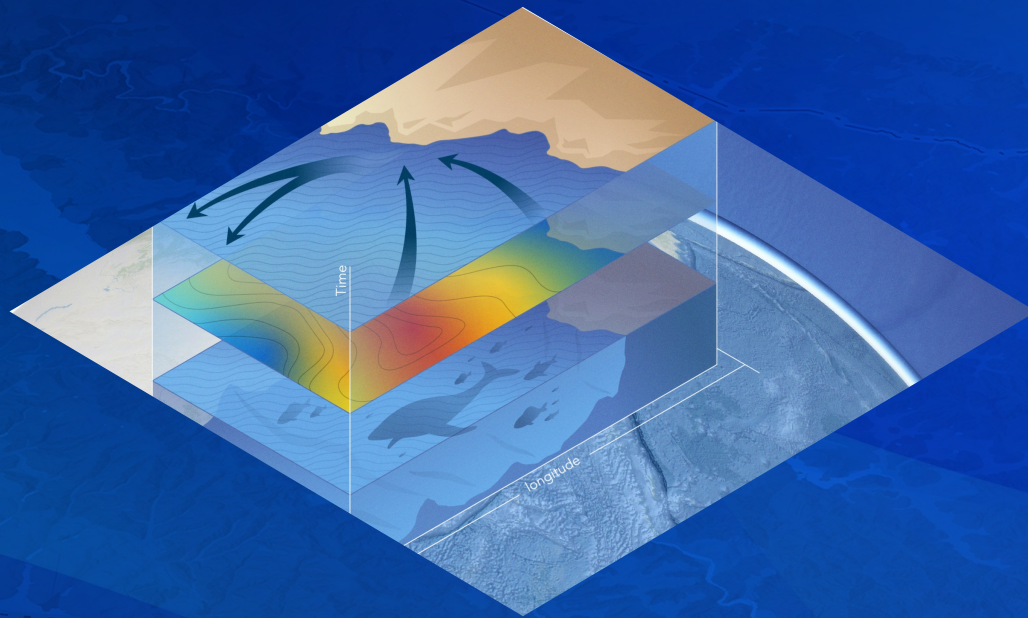
CellSize Ascending

Add Rule

Load Rules Save Rules

Clear Rules Apply Rules

| VerticalUnits | Directionality | BisDatasetId | DatasetPath | Vertical Datum | Scale | Agency | Size |
|---------------|----------------|---------------------------|---------------------------|----------------|--------|----------------|------|
| Meters | POSITIVE_UP | {43077148-7564-4612-90... | \\esri.com\psdata\GNav... | MLLW | 2,500 | Ports of LA/LB | 1/2 |
| Meters | POSITIVE_UP | {C110EB32-0F2D-49BD-8... | \\esri.com\psdata\GNav... | MLLW | 2,500 | Ports of LA/LB | 8/1 |
| Meters | POSITIVE_UP | {2D216E9D-E9CC-4E4D-9... | \\esri.com\psdata\GNav... | MLLW | 5,000 | USACE | 1/2 |
| Meters | POSITIVE_UP | {AE64BDE6-47A0-4453-9... | \\esri.com\psdata\GNav... | MLLW | 5,000 | USACE | 5/2 |
| Meters | POSITIVE_UP | {1AB70620-BD95-4327-B... | \\esri.com\psdata\GNav... | MLLW | 5,000 | USACE | 8/2 |
| Meters | POSITIVE_UP | {5879CF94-C13A-47FA-A... | \\esri.com\psdata\GNav... | MLLW | 6,000 | NOAA | 10 |
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| Meters | POSITIVE_UP | {A697D004-D06D-4FD5-... | \\esri.com\psdata\GNav... | MLLW | 2,500 | Ports of LA/LB | 1/1 |



Creating a Nautical Chart Production Foundation for an MSDI

A Hydrospatial Infrastructure



ArcGIS Maritime

A complete Production and Dissemination System



And developing support for S-100

ArcGIS Maritime Production tools



Nautical Data
Model

A screenshot of the ArcGIS Pro software interface. The main window displays a nautical chart with various navigational features like depth contours, lights, and buoys. On the left, the 'Contents' pane shows a 'Drawing Order' list with numerous checked items such as 'SeabedL', 'TidesAndVariationsL', and 'S57'. On the right, the 'Geoprocessing' toolbox is open, showing a list of tools under 'Maritime Tools' and 'S-57', including 'Convert S-57 to S-101 Cell', 'Export S-101 Cell', and 'Smooth Bathymetric TIN'. The top menu bar includes 'Project', 'Map', 'Insert', 'Analysis', 'View', 'Edit', 'Maritime', 'Imagery', and 'Share'. The status bar at the bottom shows coordinates: 122.5192514°W 47.5769246°N.

Automated S-100 tools in ArcGIS Pro

The image displays the ArcGIS Pro interface with several Geoprocessing tool windows overlaid on a map. The main map shows a geospatial dataset with various colored overlays and labels like 'US4WA17M', 'US4WA10M', 'US5WA21M', and 'US5WA20M'. The tool windows are:

- Convert S-57 to S-101 Cell:** Parameters include S-100 Feature Catalogue, Input S-57 [File or Folder] (File), and Output Location.
- Import S-100 Cell:** Parameters include S-100 Feature Catalogue, S-100 Cell, and Target Workspace.
- Export S-101 Cell:** Parameters include S-100 Feature Catalogue, S-101 Workspace, S-101 Product, Export Type (New edition), and Output Location.

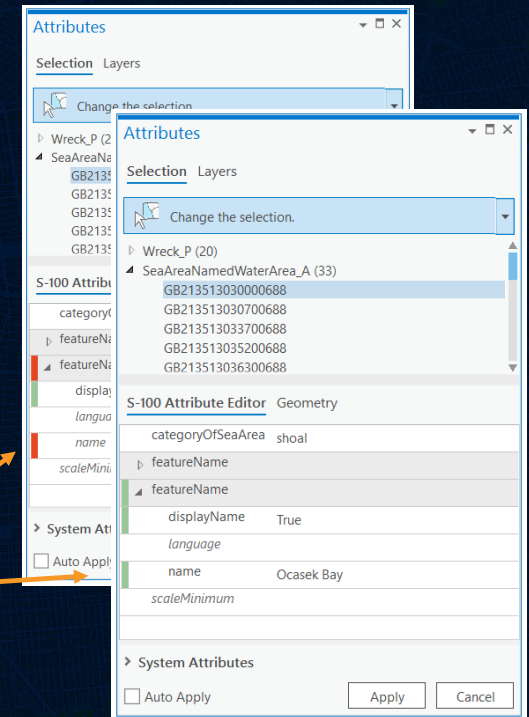
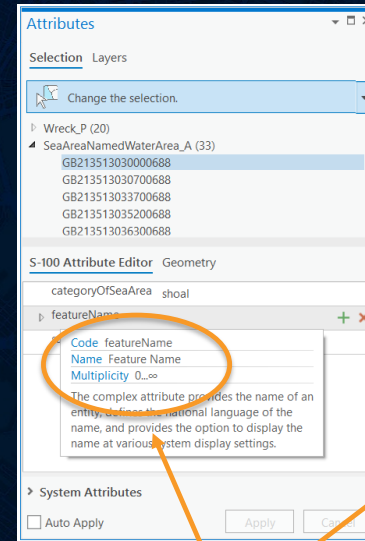
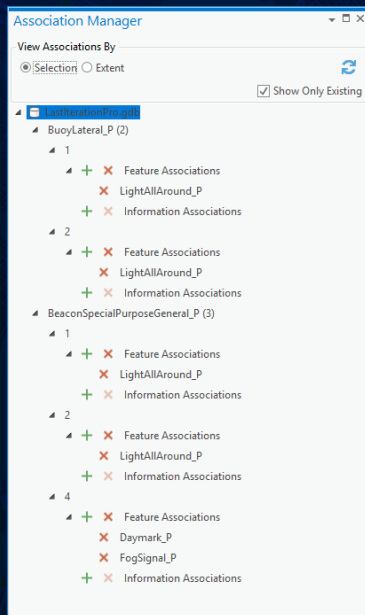
A workflow diagram at the bottom left shows a sequence of steps: 'S-100 Code' -> 'Select Layer by ATTRIBUTE' -> 'Selected Census Blocks' -> 'Copy Features to Selected Blocks' -> 'State Census Blocks' -> 'Derivate Year Table' -> 'State Year Table' -> 'Add Join' -> 'State Blocks Layer' -> 'Copy Features' -> 'State Census Blocks with Distance'. A toolbar at the bottom right highlights the 'ModelBuilder' icon.

Enhanced S-100 editing tools



S-100 Attribute Editor

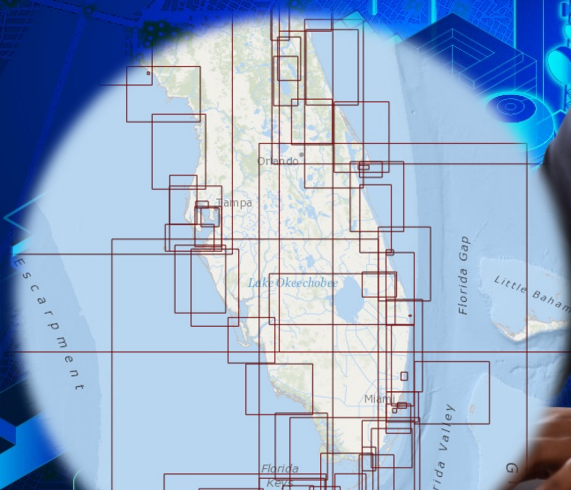
Association Manager



Feature Catalogue in runtime for tooltips and validation

ENC data as a reference framework

A Maritime Chart Service



Maritime Chart Server Architecture

- Authoritative
- Up to Date Information
- Simple
- Integrated

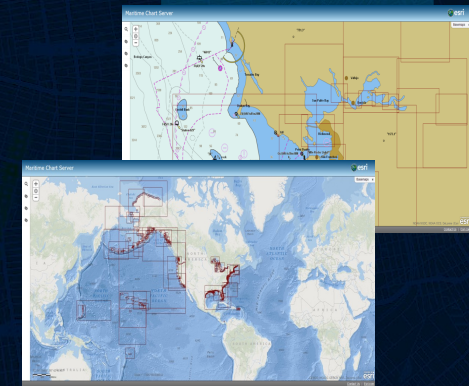


REST
OGC WMS



Highlights

- ArcGIS Server Object Extension
- S-52 Display
- Search
- Identify
- S-63 Decryption



...Rapid display of authoritative data

ArcGIS Maritime server extension

Technical Highlights



Dissemination of S-57/63 datasets



Web Map Services



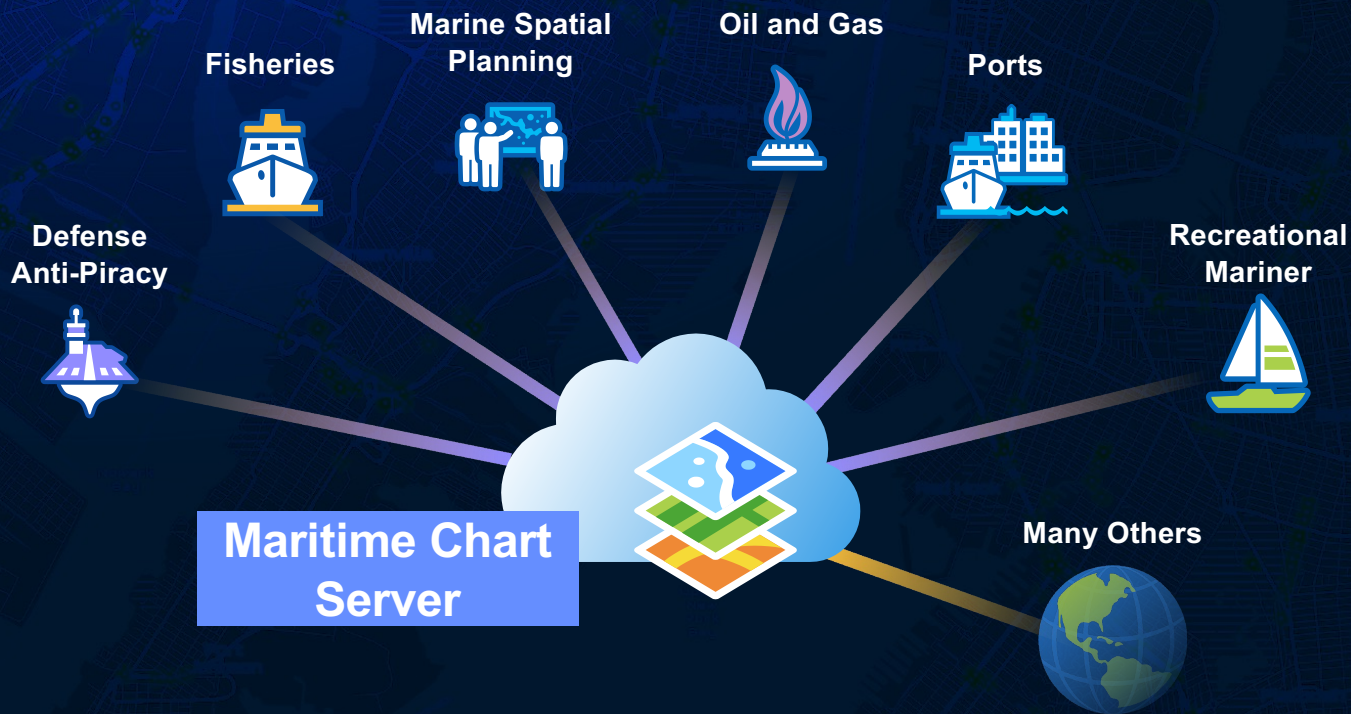
ECDIS controls



Custom Chart Products



Industries



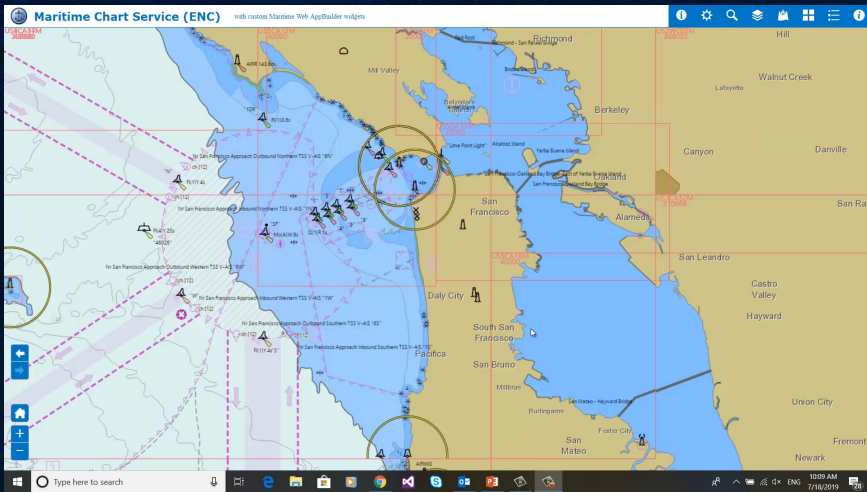
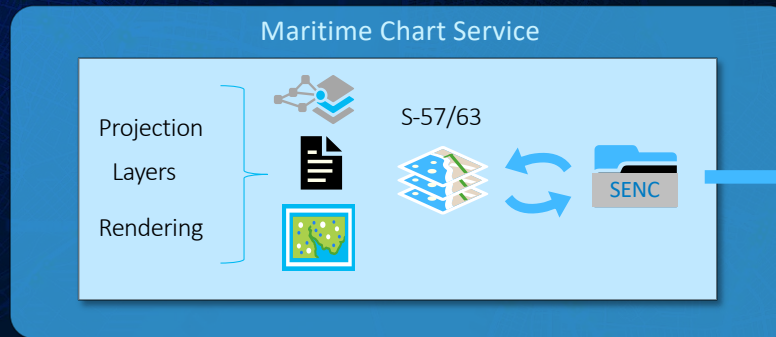
Highlights

- Asset Management
- Common Operational Picture
- Operational Basemap
- Voyage Planning

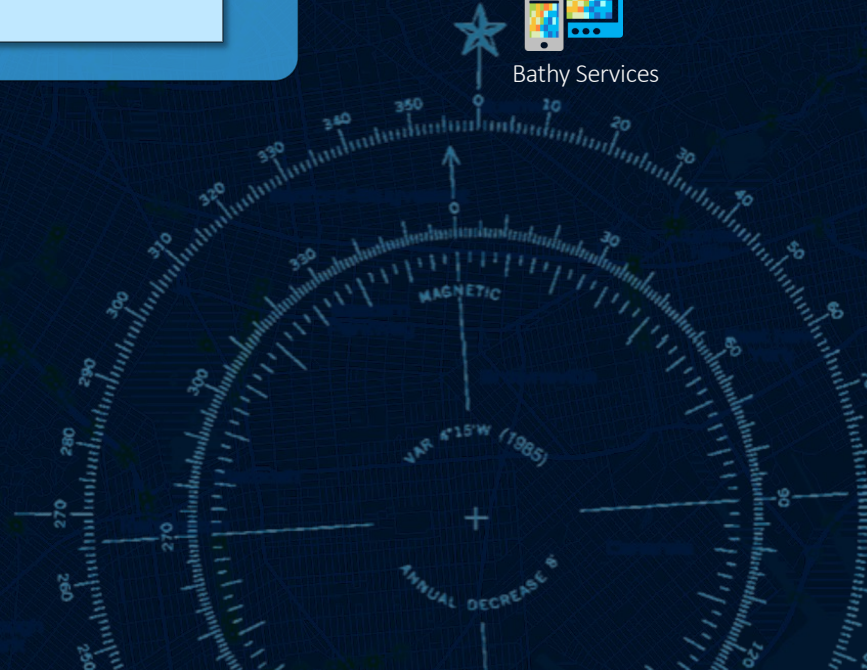
... One authoritative dataset with many uses

Maritime Chart Service (MCS)

ArcGIS Server



<http://nsdemo.esri.com/demo/wab4mcsenc/>



Custom Chart Builder (CCB)

S-57/S-63 datasets



Python/JScript



Configuration



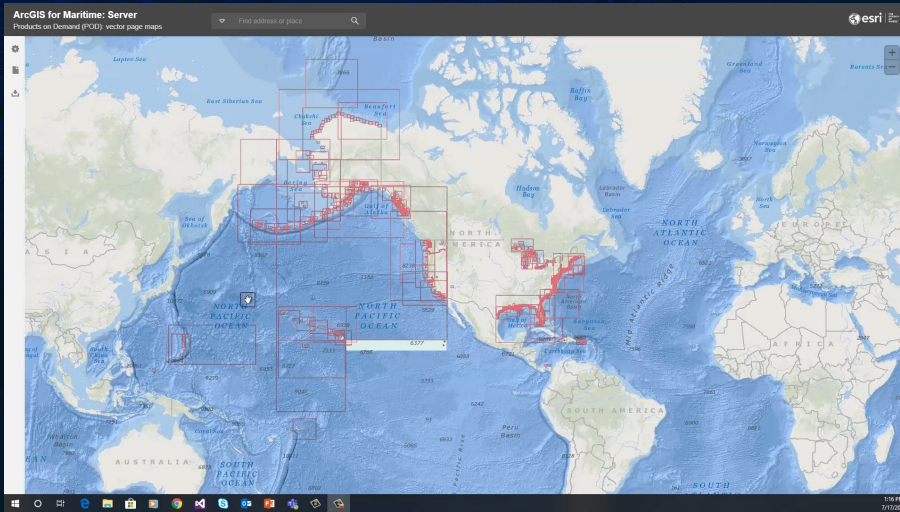
Templates



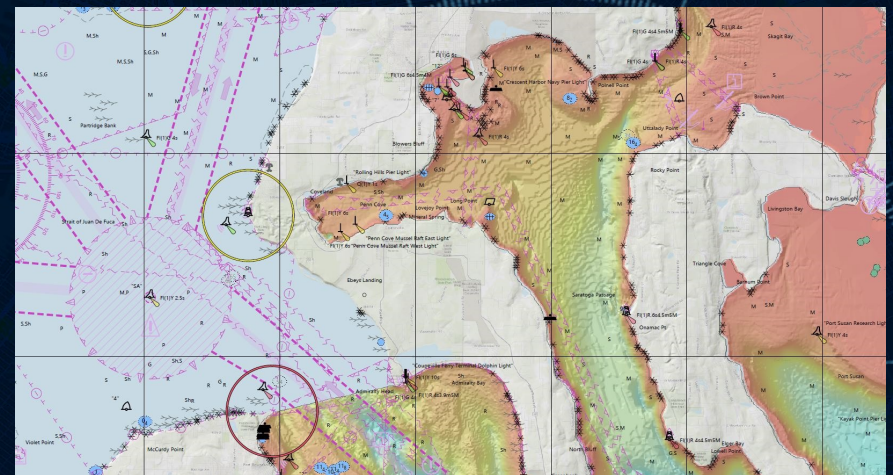
Runtime



Bathy Services

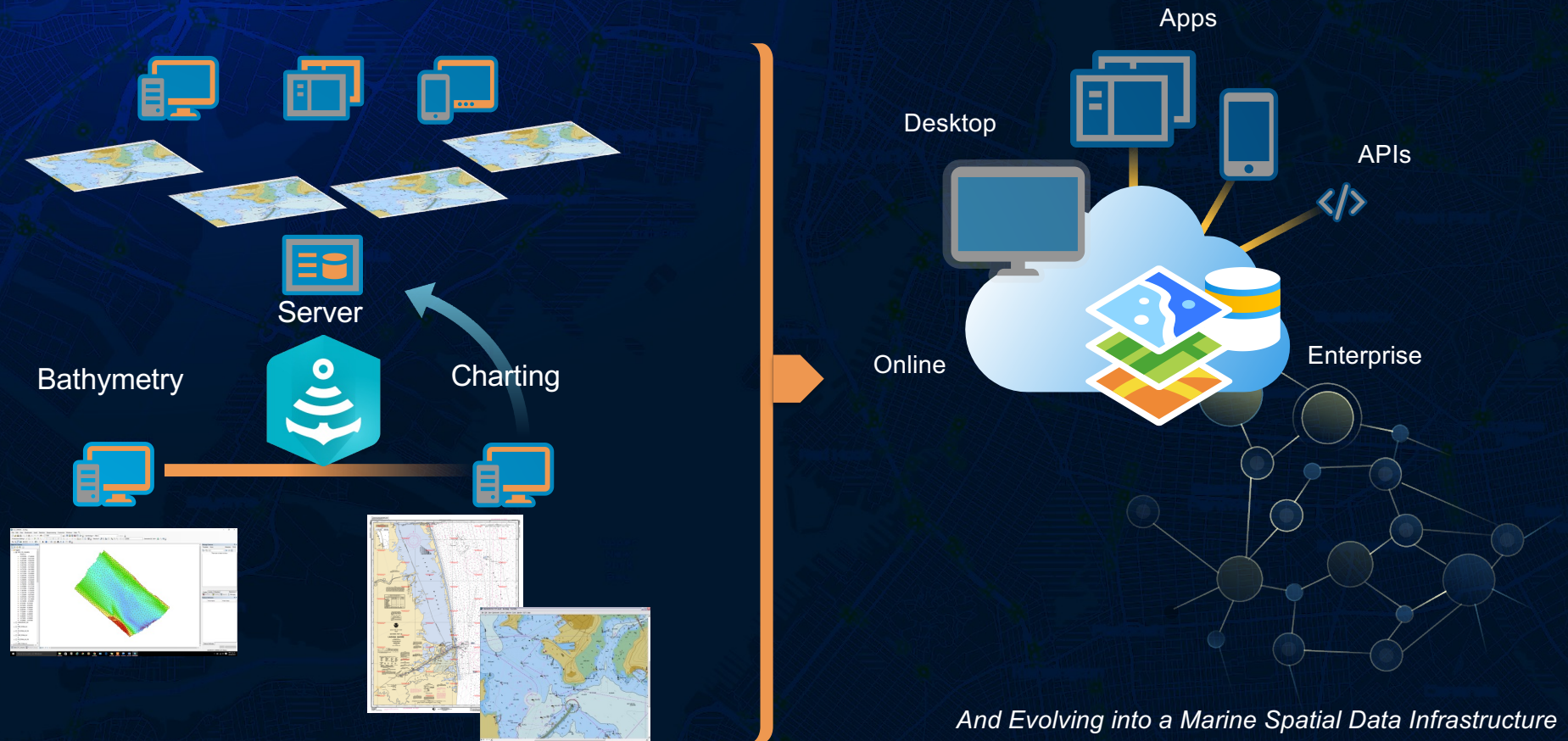


<https://chartondemand.esri.com/ccb/>





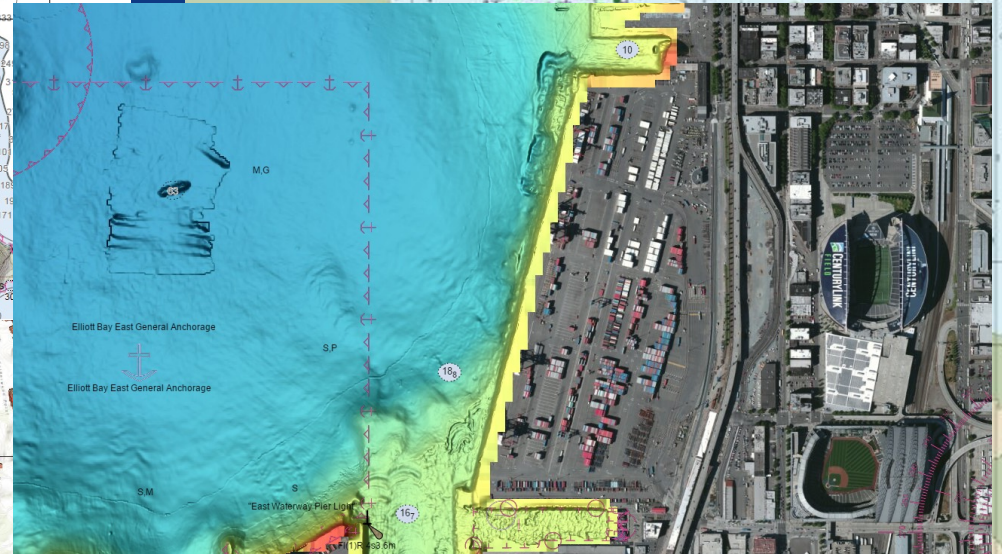
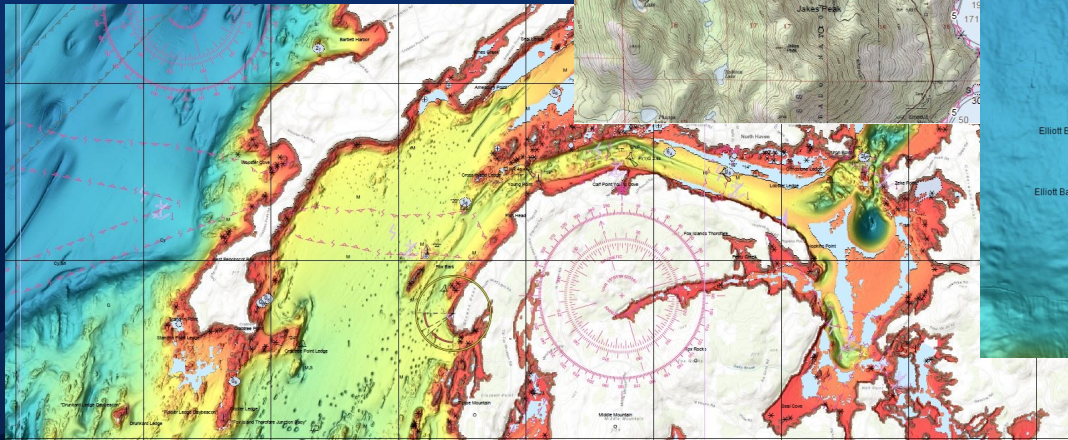
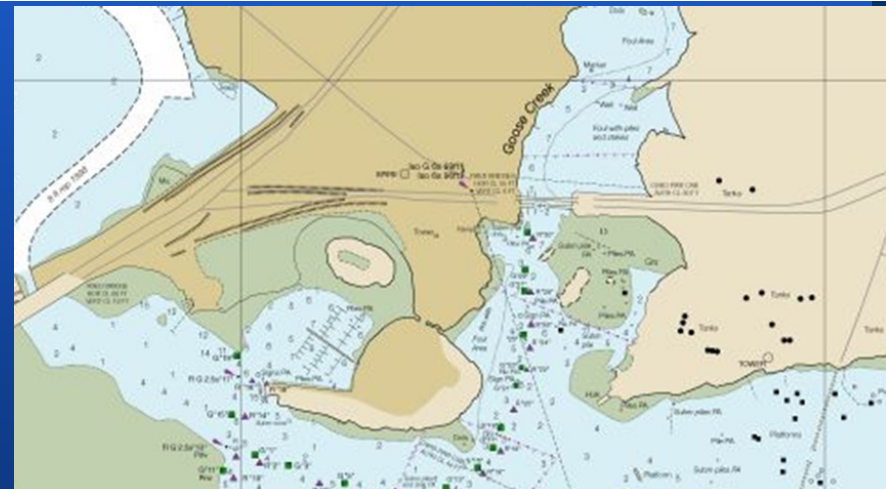
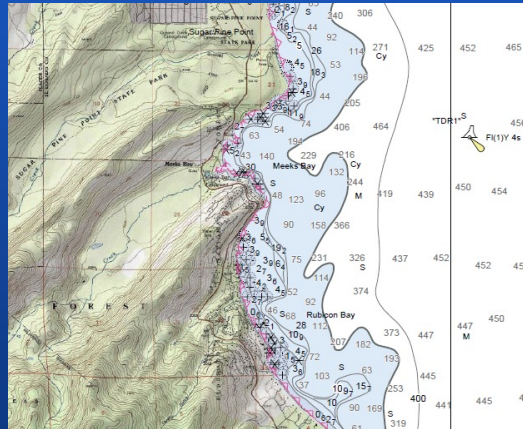
Building Foundation Hydrographic Data



And Evolving into a Marine Spatial Data Infrastructure

ArcGIS Maritime server

Charts as a service



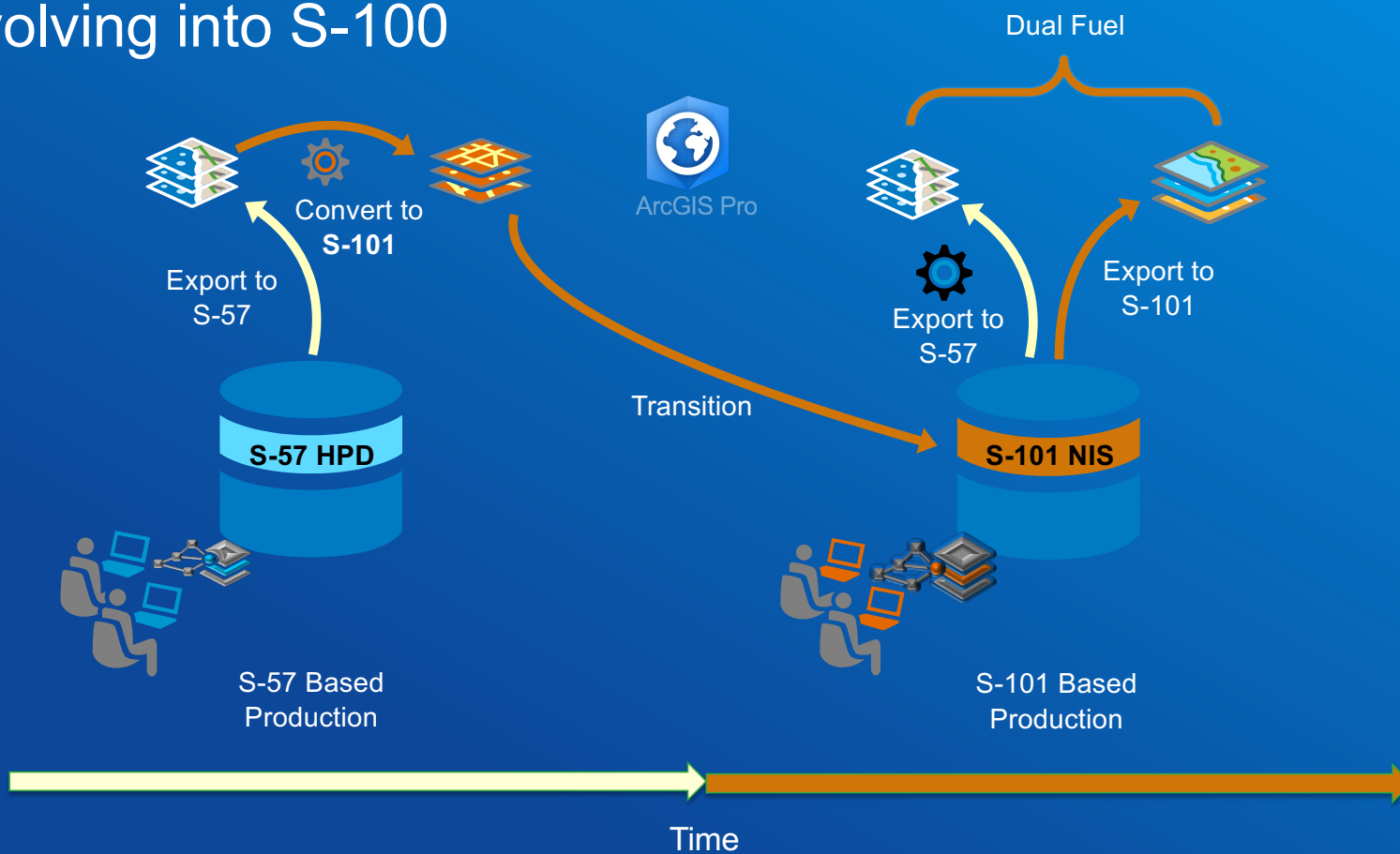


S-100 – Not just for Navigators



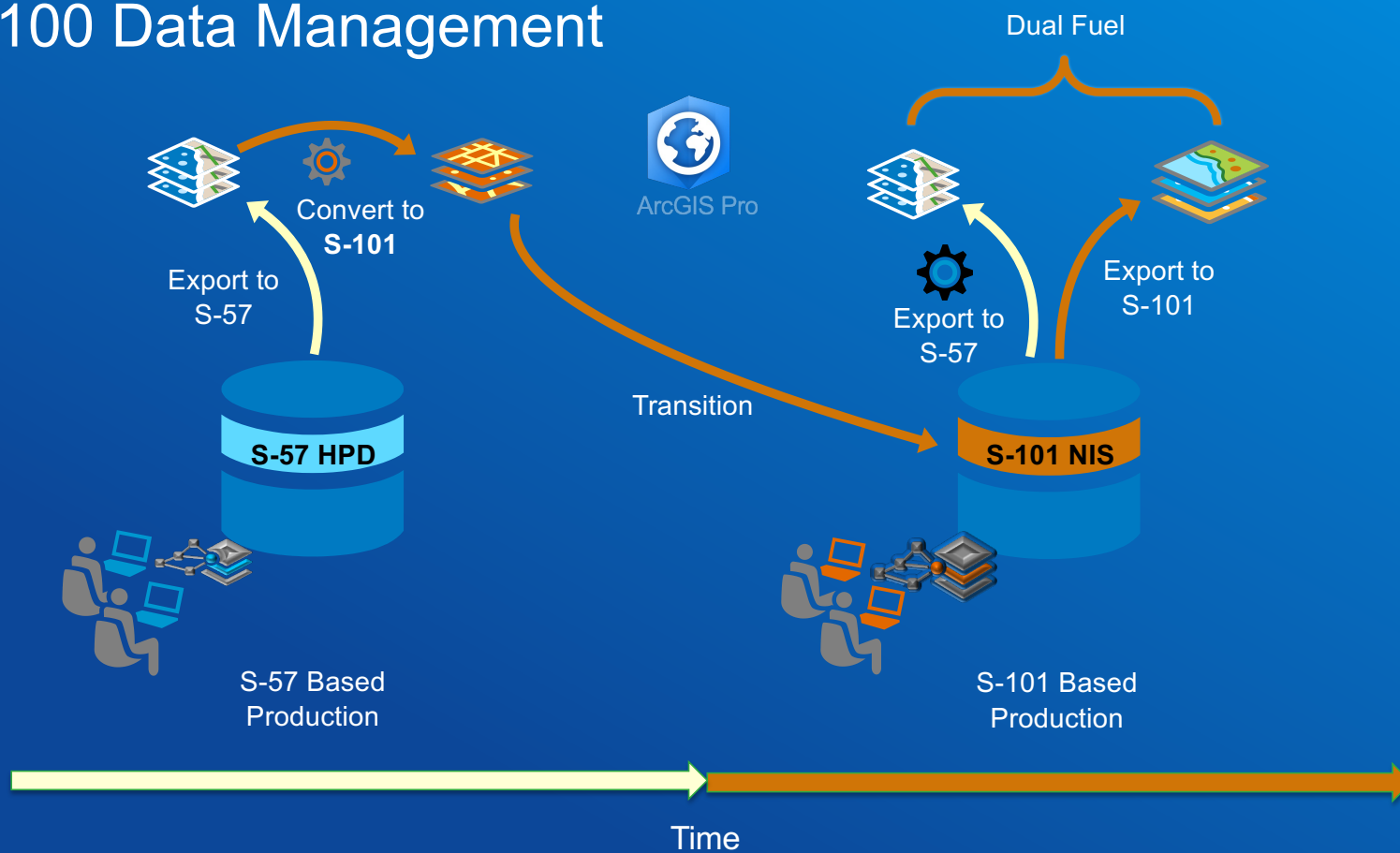


Evolving into S-100



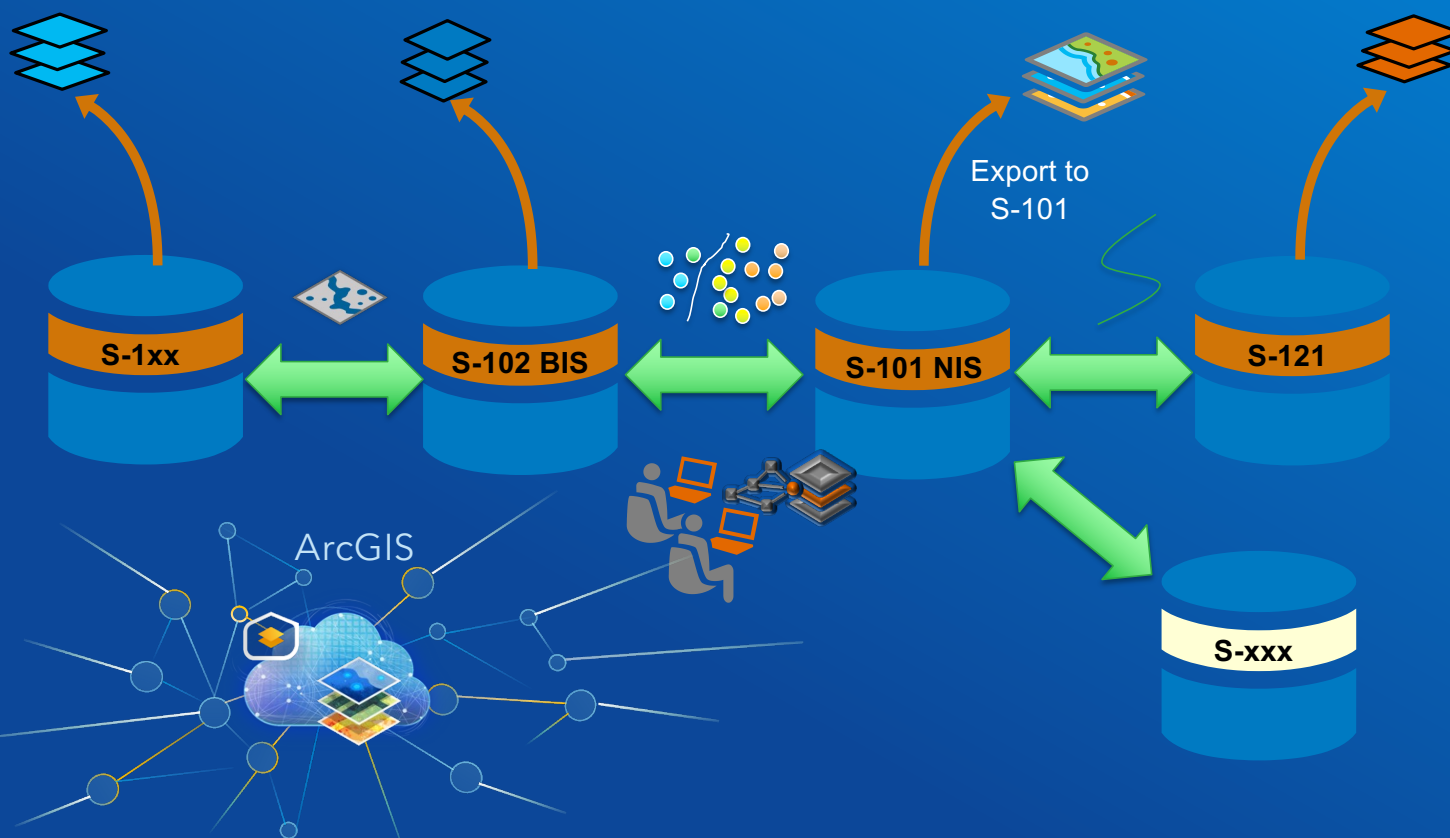


S-100 Data Management





S-100 Data Sharing & Collaboration



Enabling Agency Collaboration

Hydrographic office

- S-101 (ENC)
- S-102 (Bathymetric Surface)

Maritime Safety Authority

- S-125 (Aids to Navigation)
- S-127 (Marine Traffic Management)

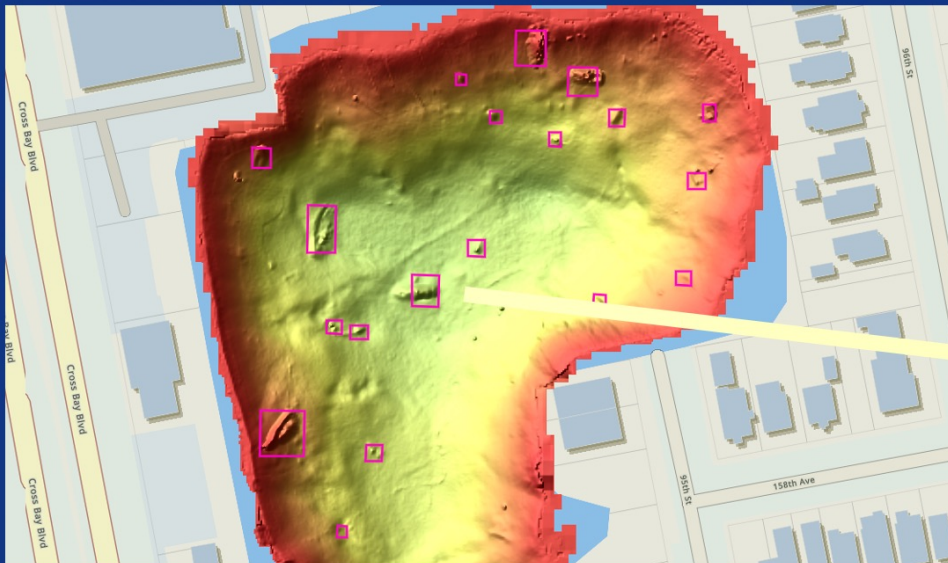
AGO / GEOINT

- S-103 (Sub Surface Navigation)
- S-126 (Marine Physical Environment)

Dept of Infrastructure, Transport...

- S-131 (Marine Harbor Infrastructure)

AI & Machine Learning: Wreck detection



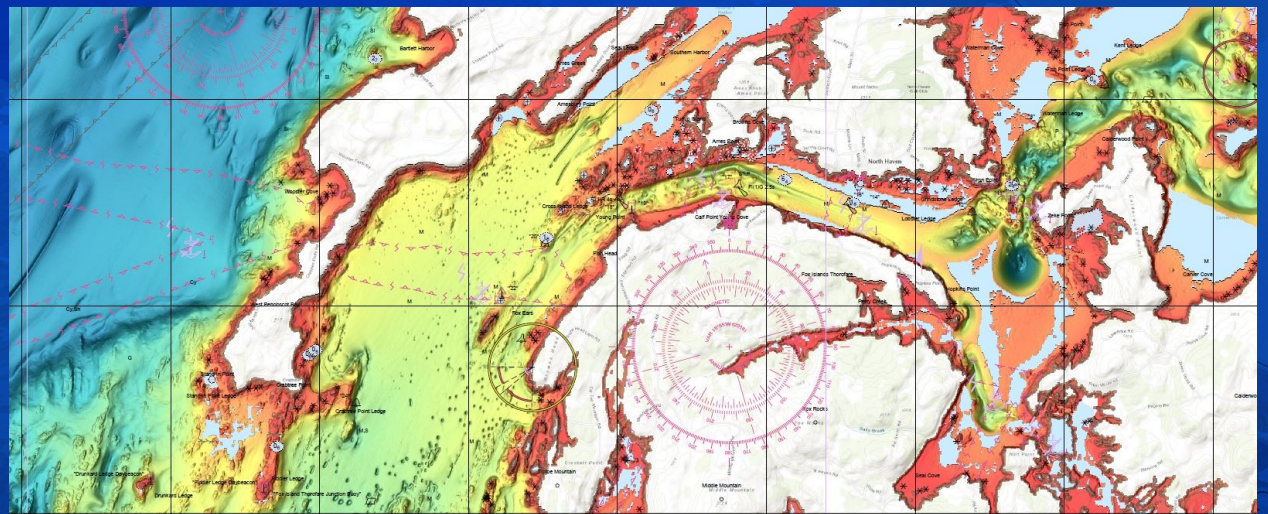
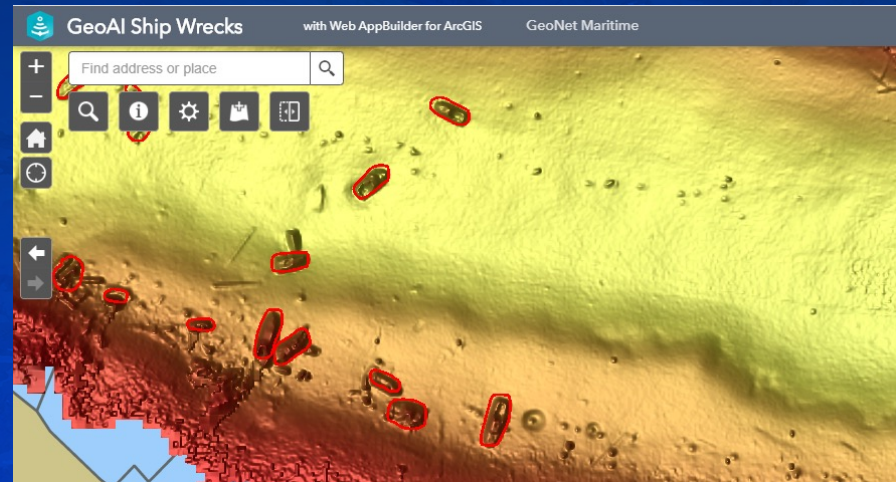
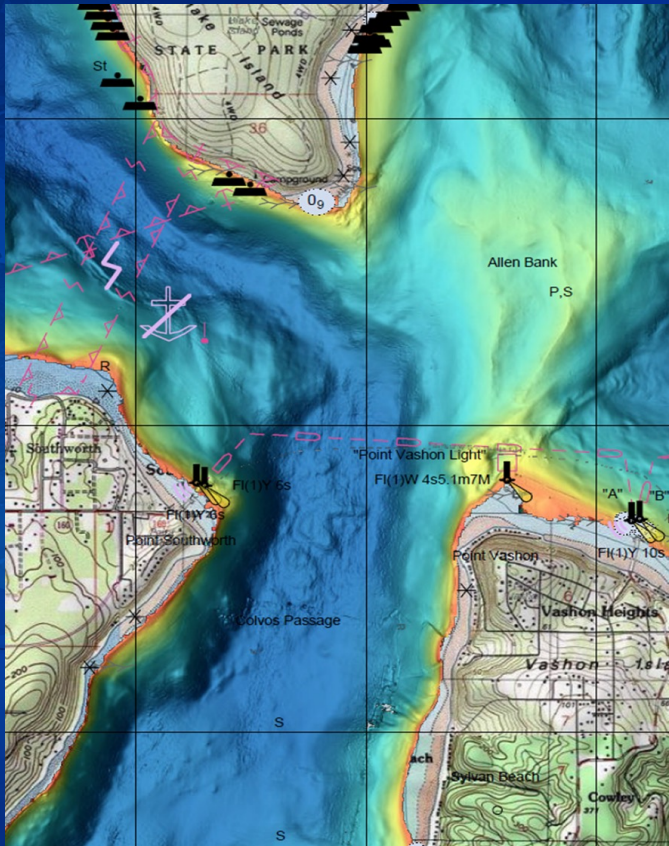
- Detects wrecks from BAG
- Feature to Point
- Point to WRECKS in the NIS
- Export Geodatabase to S-57
- Publish as Rest/WMS ENC service



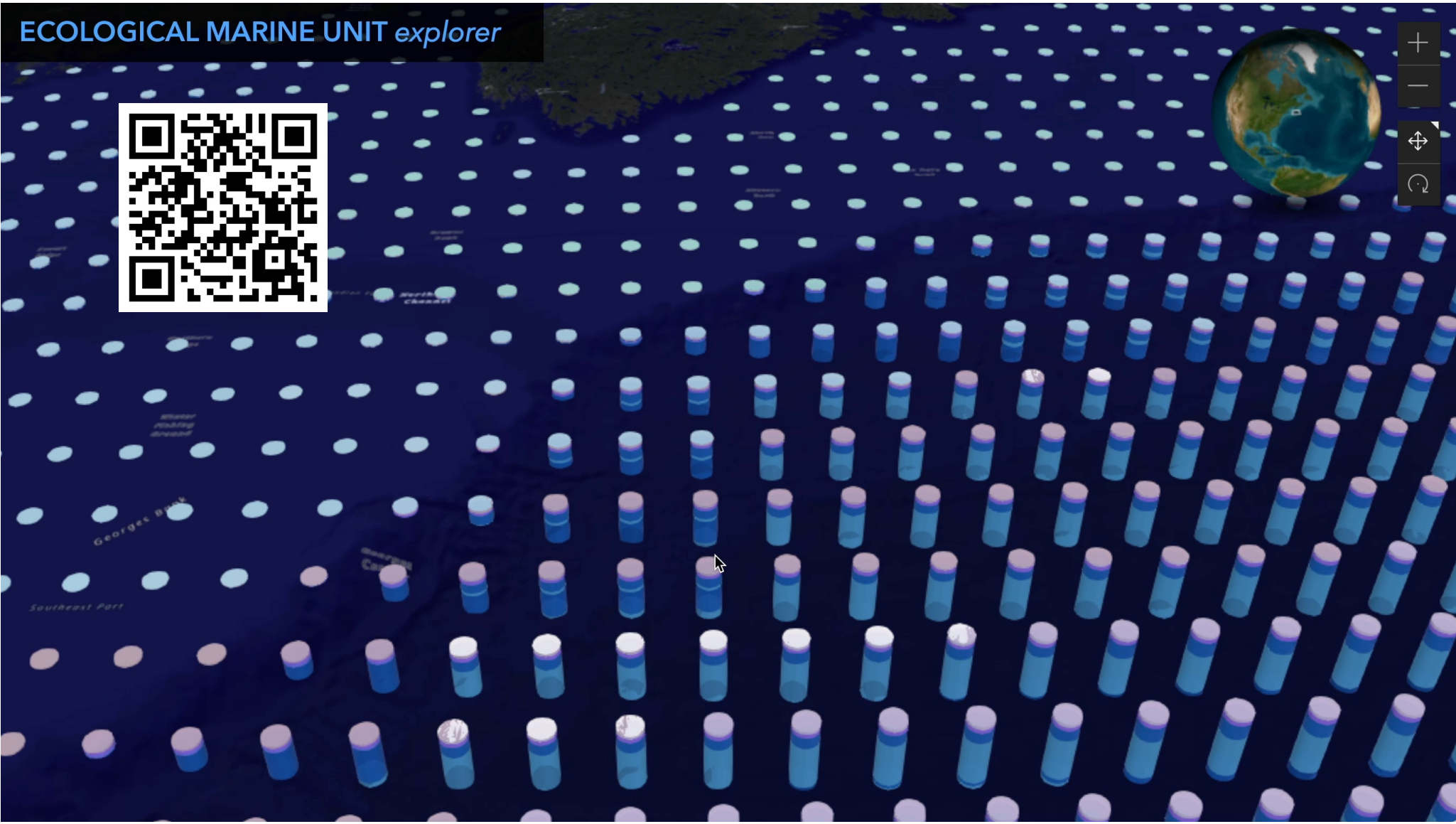
Sample web map

<https://chartondemand.esri.com/GeoAIshipWrecks/>

From GeoAI to Tactical Information products



ECOLOGICAL MARINE UNIT *explorer*



Ecological Coastal Units

- Developed by the U.S. Geological Survey (USGS) in partnership with Esri and the Marine Biodiversity Observation Network (MBON).
- Data were developed as part of a Group on Earth Observations (GEO) initiative called GEO Ecosystems (GEO ECO), and is associated with a GEO ECO task to develop global coastal ecosystems data.
- The underlying data are 4 million 1 km or shorter coastal segments.
- Attributed with values from ten ecological settings variables representing the adjacent ocean, the adjacent land, and the coastline itself.

ECOLOGICAL COASTAL UNITS

GLOBAL COASTLINE CLASSIFICATION

Data allows for the visualization and query of any stretch of coastline on Earth, except for Antarctica.



ECUs Feature Layer



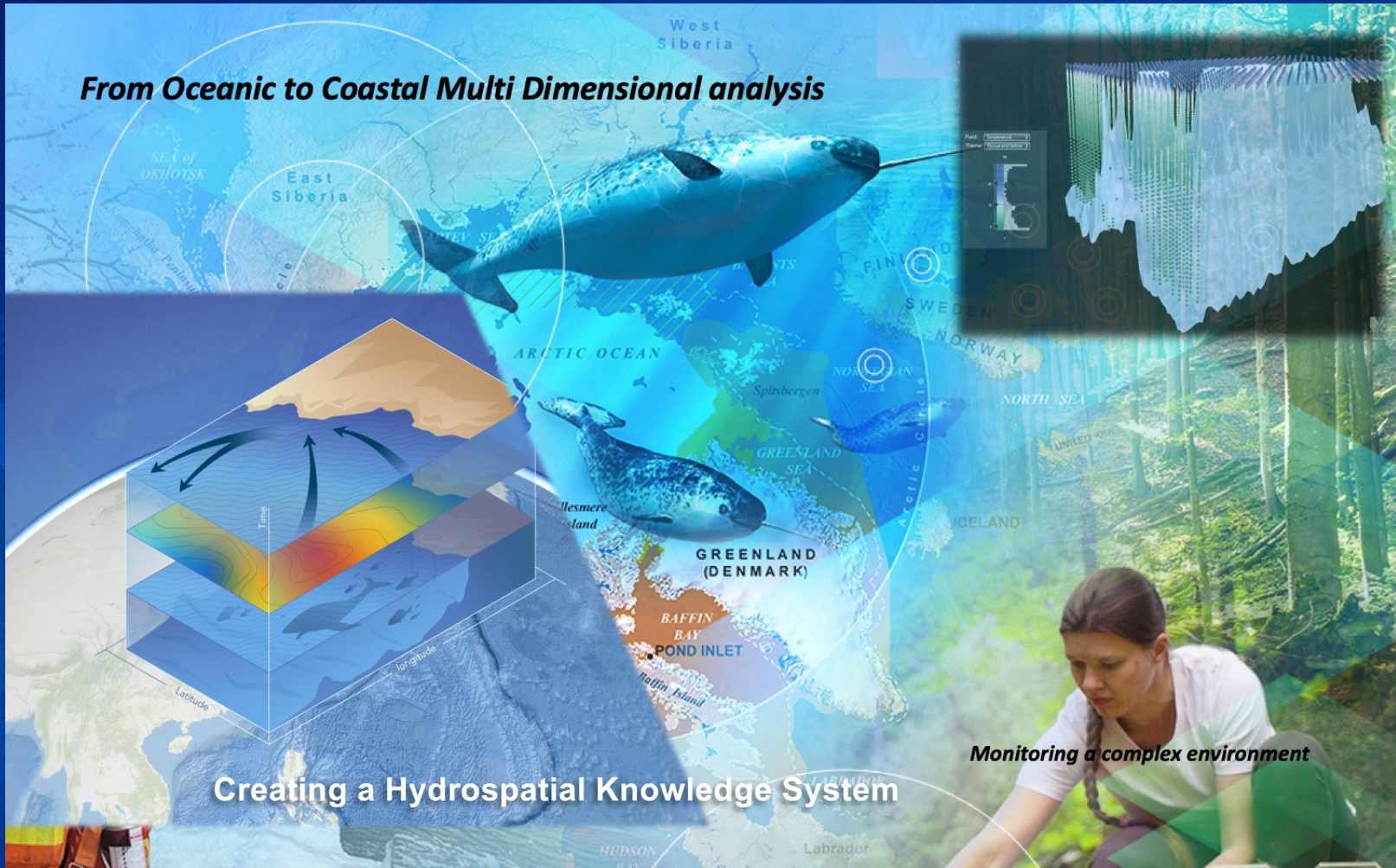
ArcGIS Pro Package

Take home message

Use the ArcGIS System to:

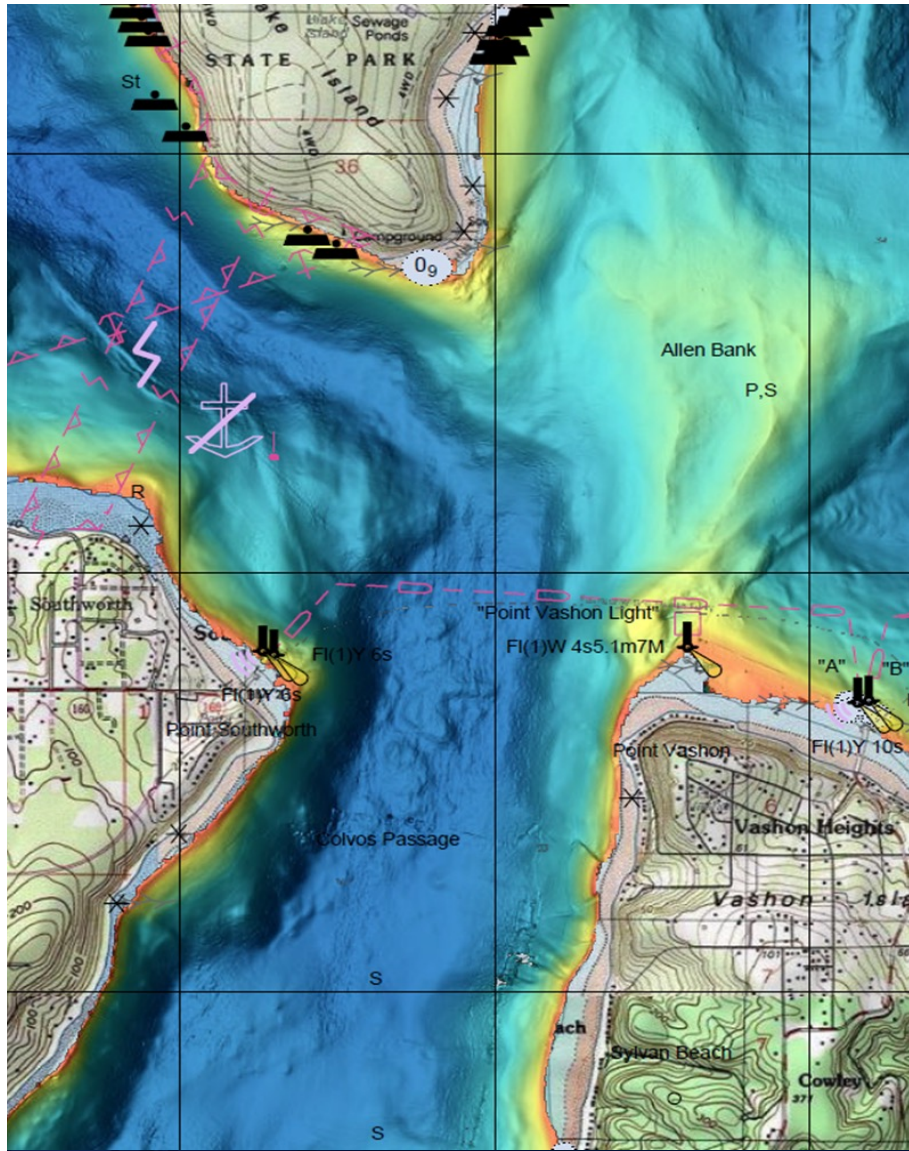
- Produce, maintain nautical charts and manage bathymetry in one single platform;
- Automate processes – increase efficiency;
- Build the foundation and your complete MSDI;
- Prepare for today's needs and the future;
- Build a flexible, open and interoperable system for civilian and military applications:
 - Closed, Open and Hybrid systems.
- Interconnect and collaborate with other organizations;
- Do more with your same resources.
- Create a true Hydrospatial System for the 21st Century Hydrographic Office.

From Oceanic to Coastal Multi Dimensional analysis



Creating a Hydrospatial Knowledge System

Monitoring a complex environment



Thank you

Maritime ArcGIS Online Organization

<http://esriho.maps.arcgis.com/home/index.html>

Maritime Esri Community

<https://community.esri.com/t5/arcgis-maritime/ct-p/arcgis-maritime>

Contact

rponce@esri.com

