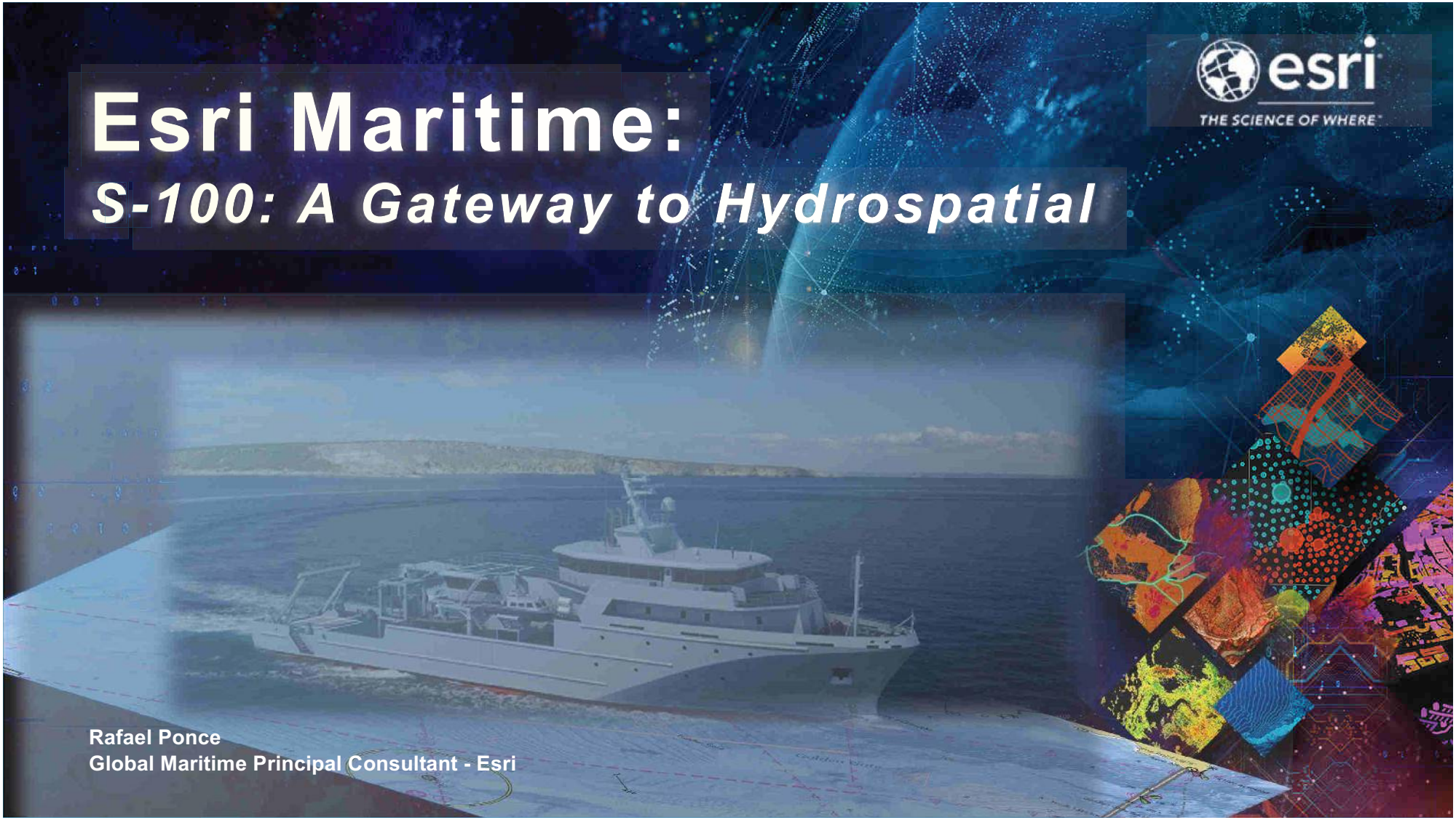
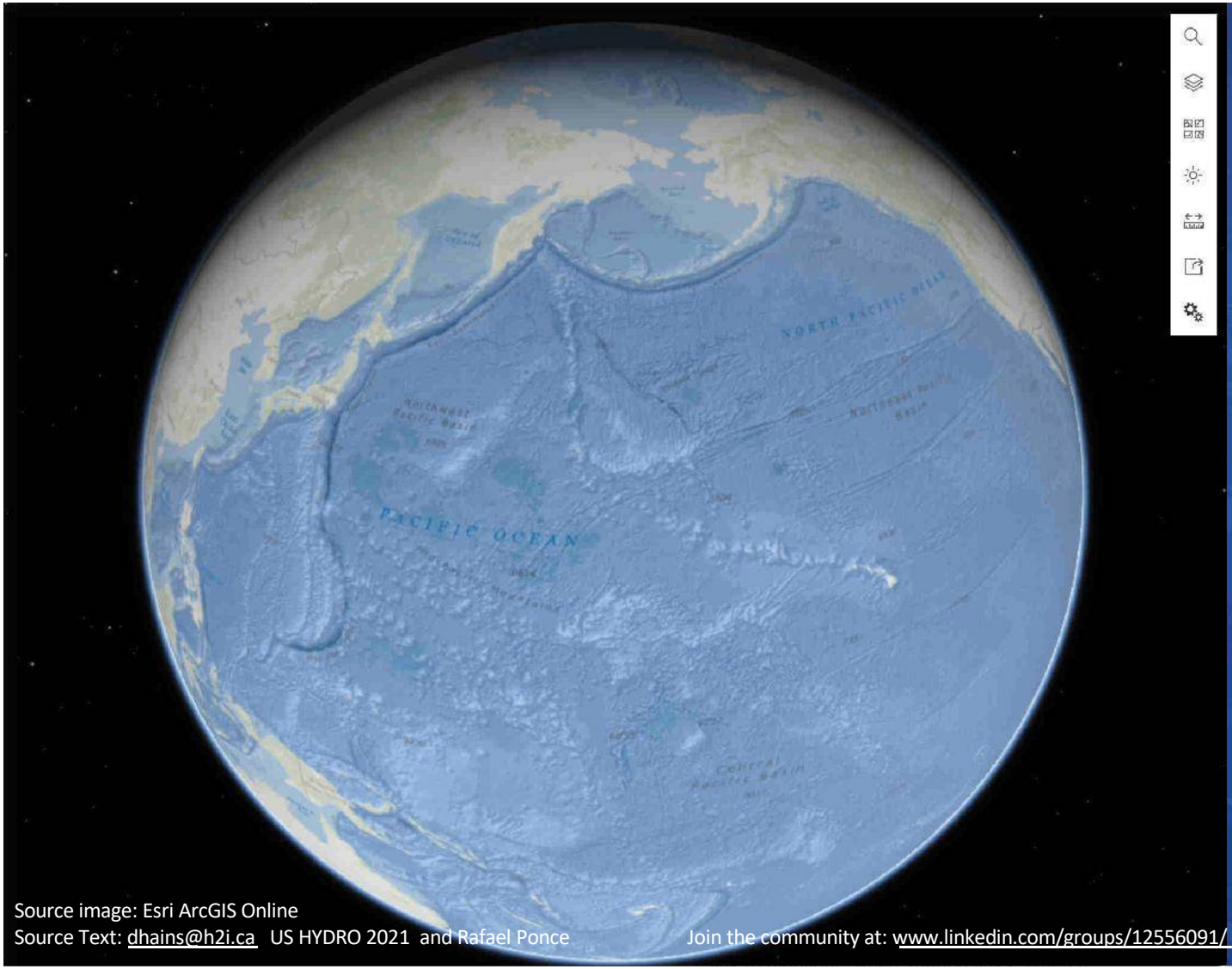

esri
THE SCIENCE OF WHERE
Esri Maritime:
S-100: A Gateway to Hydrospatial
Rafael Ponce
Global Maritime Principal Consultant - Esri



Source image: Esri ArcGIS Online
Source Text: dhains@h2i.ca US HYDRO 2021 and Rafael Ponce

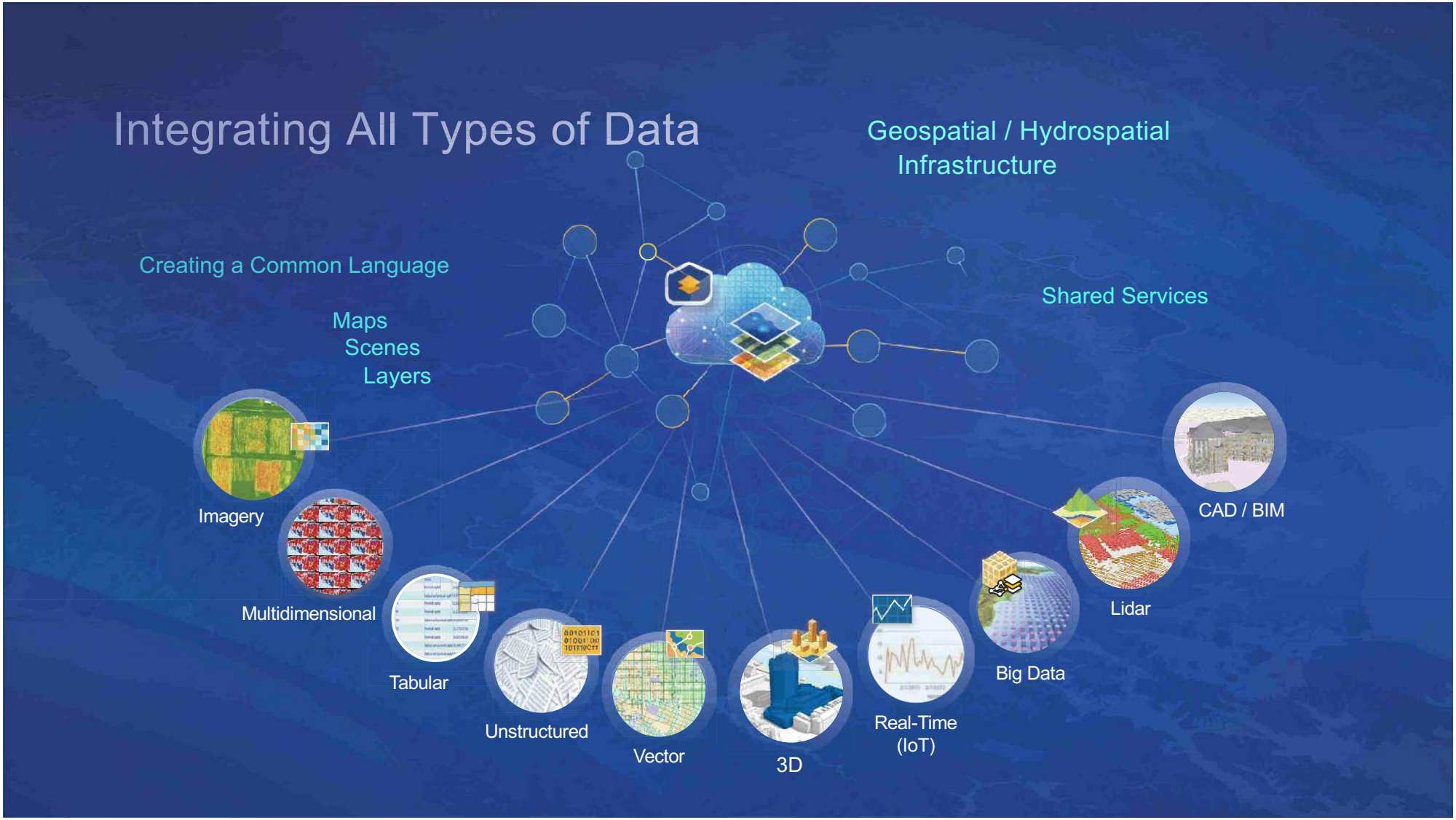
Join the community at: www.linkedin.com/groups/12556091/

HYDROSPATIAL …

" is all about the Blue of our Blue Planet… & its contiguous zones (Coastal, Bottom, Sub Bottom, Surface & Atmosphere)"…

… It's the "Blue" Geospatial environment, its resilience and contribution to the Blue Economy…

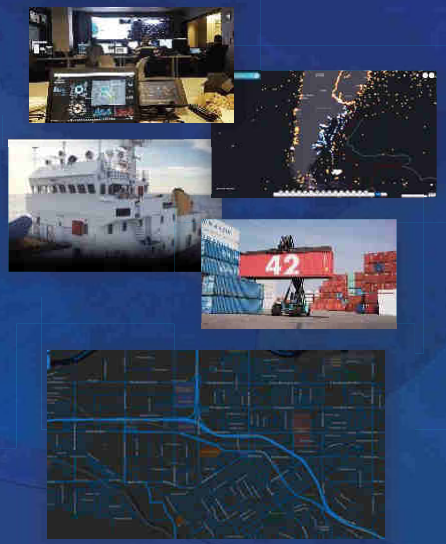
Integrating All Types of Data

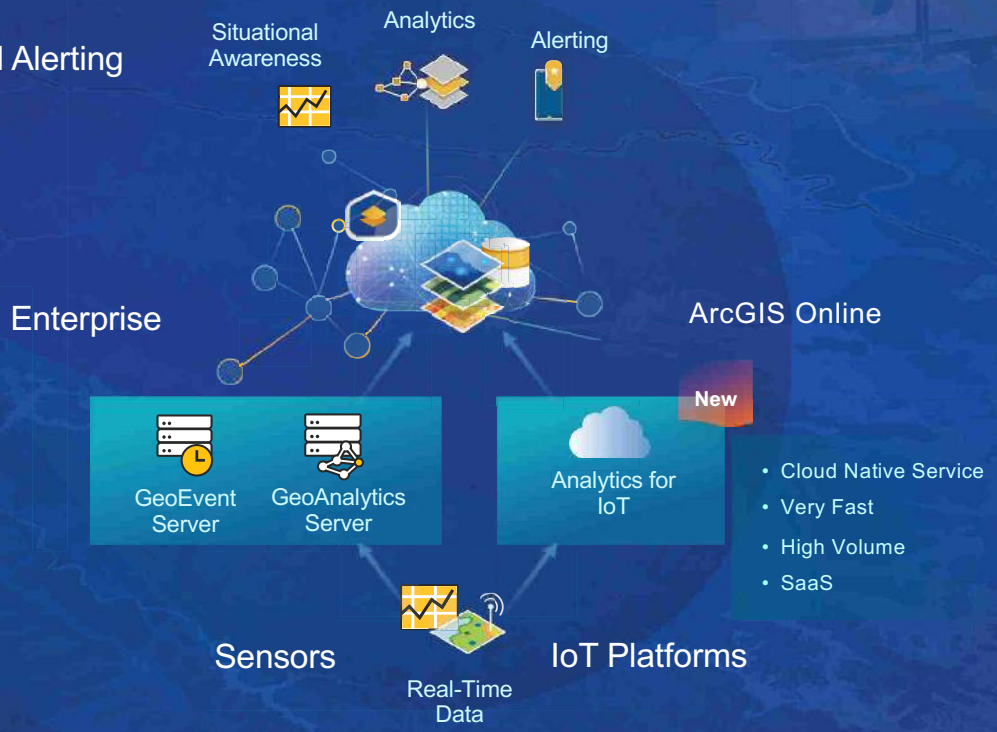


Real-Time Analytics Integrating Sensor Networks and IoT

Supporting High-Velocity Data Streams

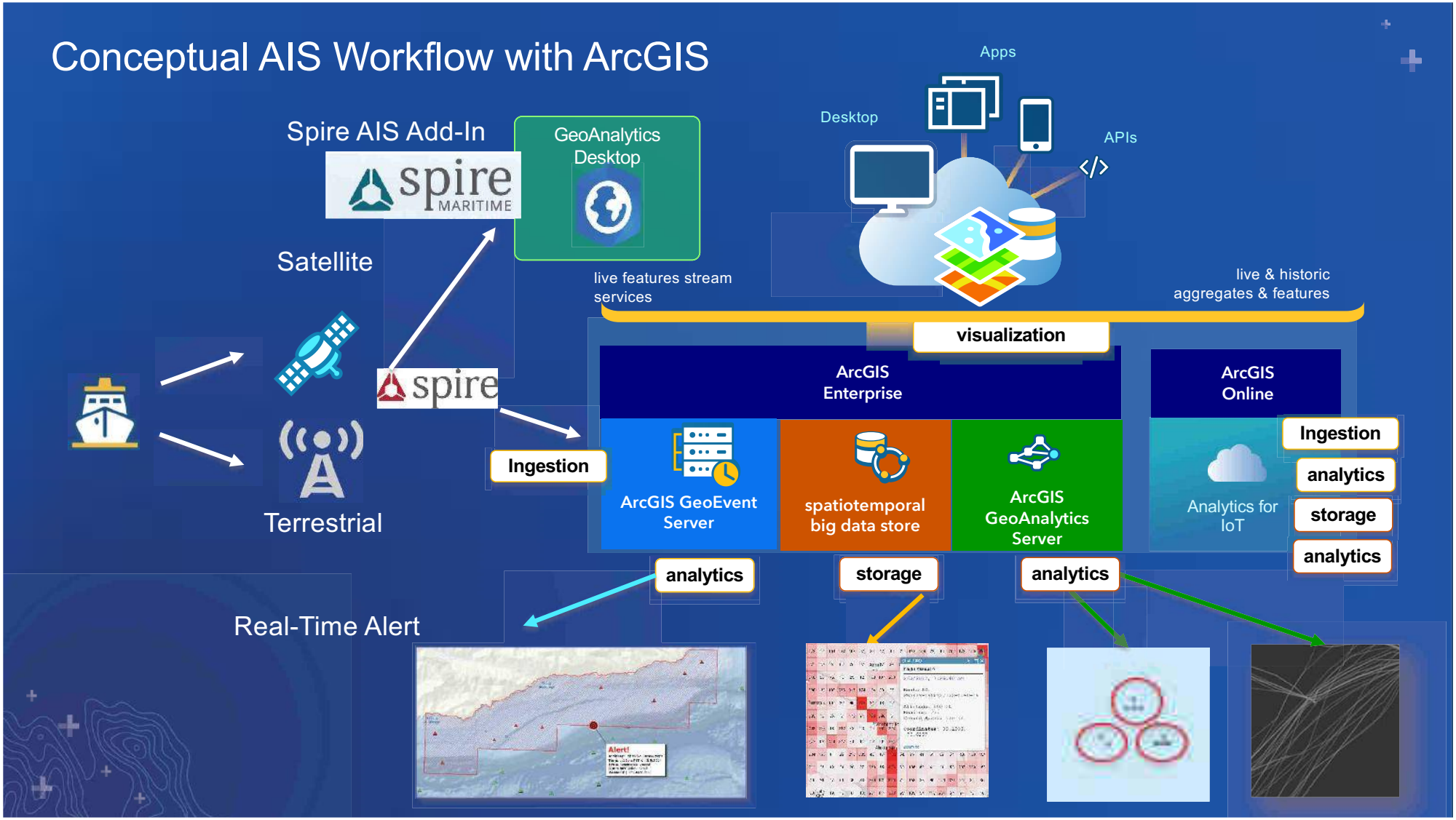
Tracking, Monitoring and Alerting





Collapsing the Time from Measurement to Decision Making

Conceptual AIS Workflow with ArcGIS



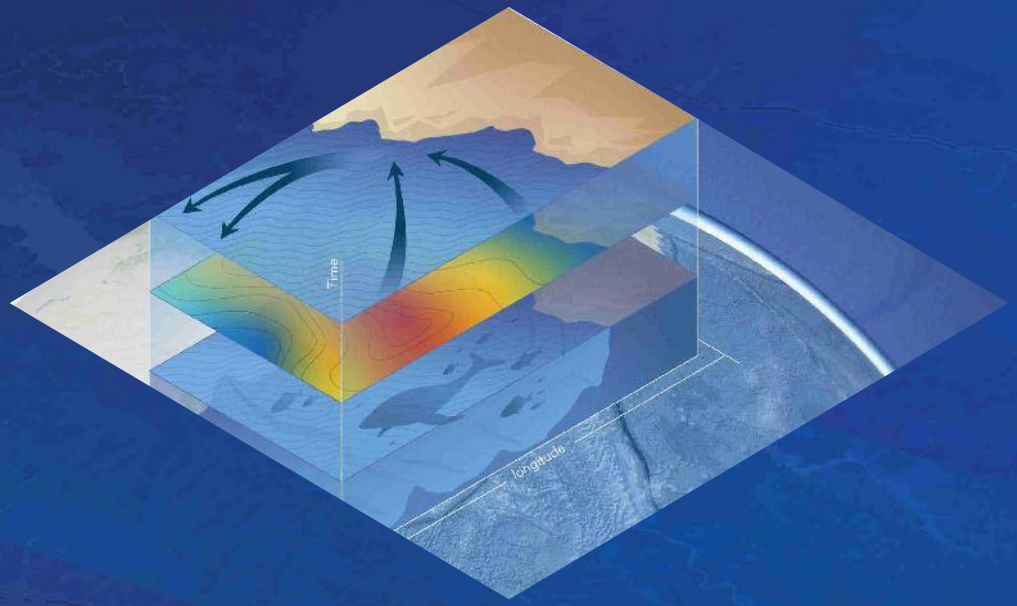
Maritime Domain Awareness – Ship SIGINT

What if ship is NOT broadcasting AIS?

- Satellite provider focusing on RF detection
- Understand where ships are based off of RF

HawkEye 360

VHF Comms



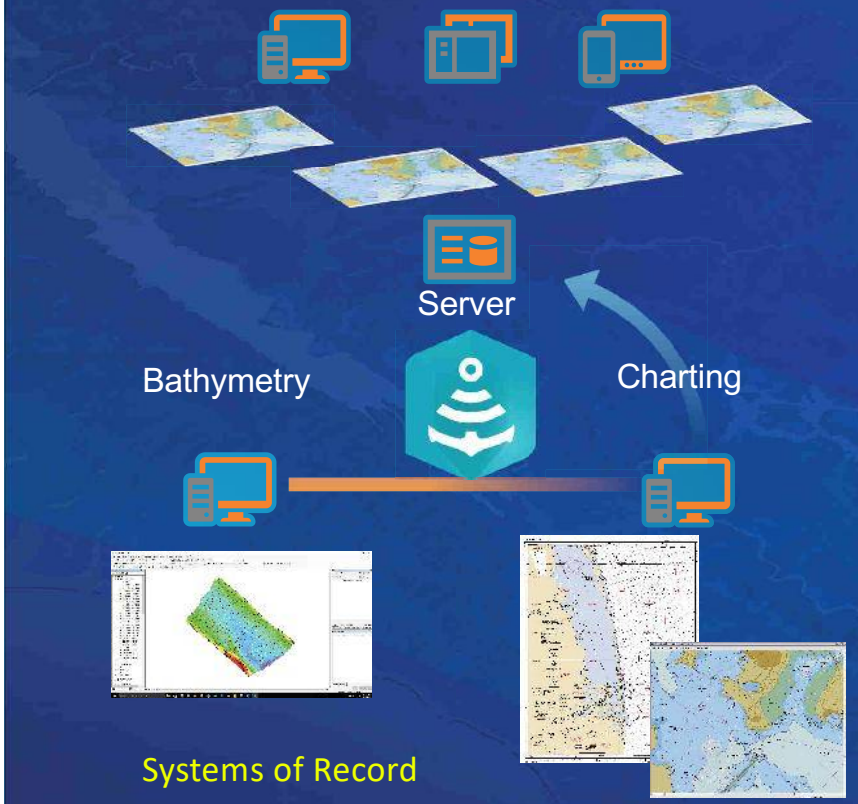
The creation of foundational data

A Hydrospatial Infrastructure

Data

ArcGIS Has the Right Tools and Frameworks for Your Enterprise Data Workflows

Building Foundation Hydrographic Data



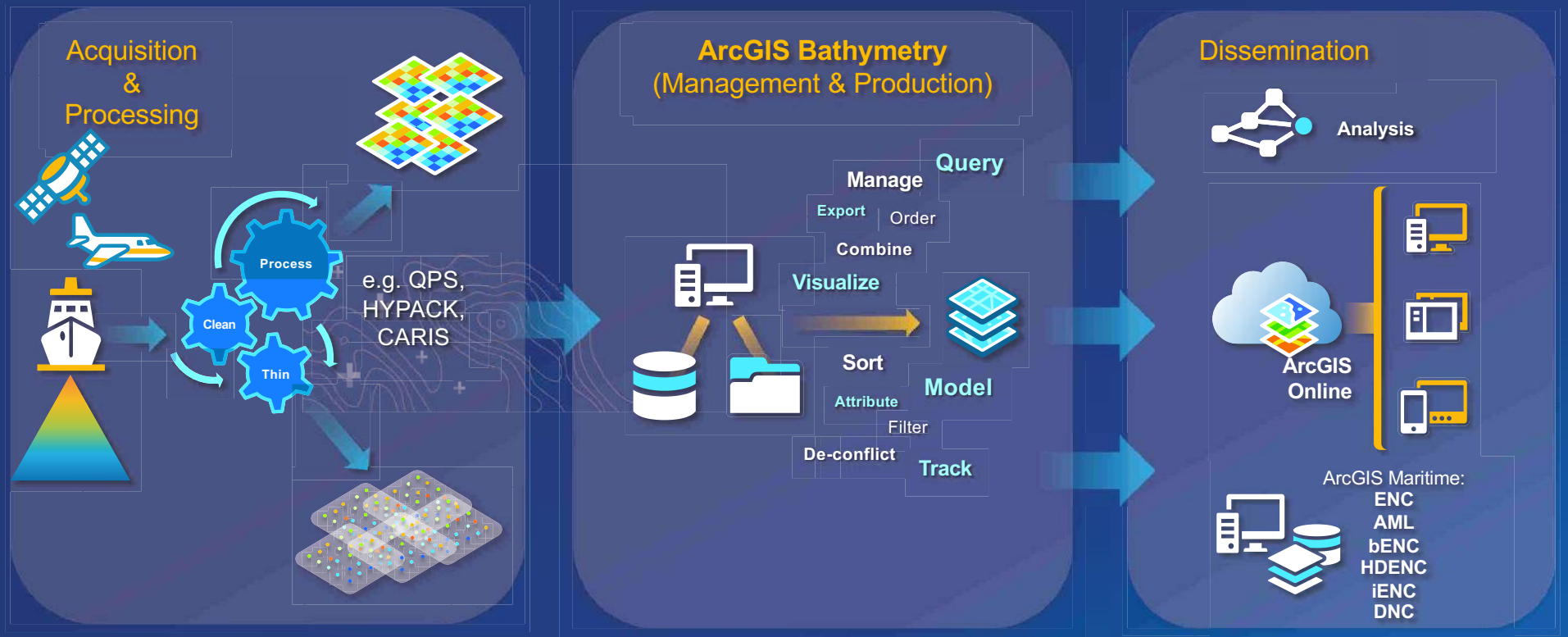
Systems of Record

System of Engagement

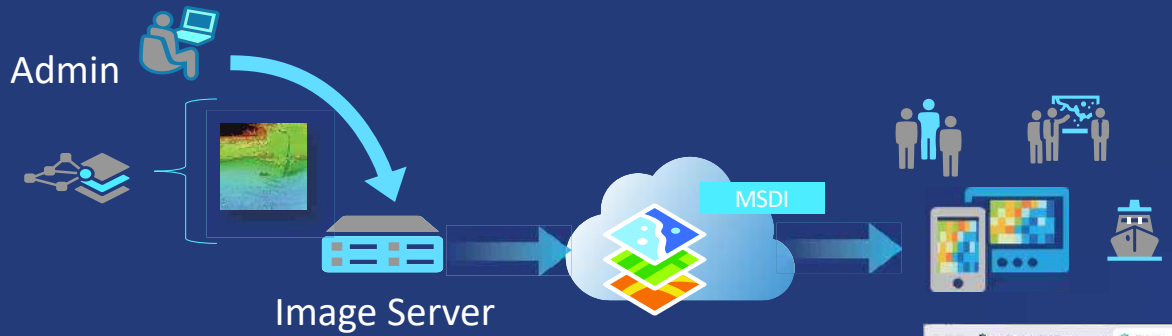
And Evolving into a Marine Spatial Data Infrastructure

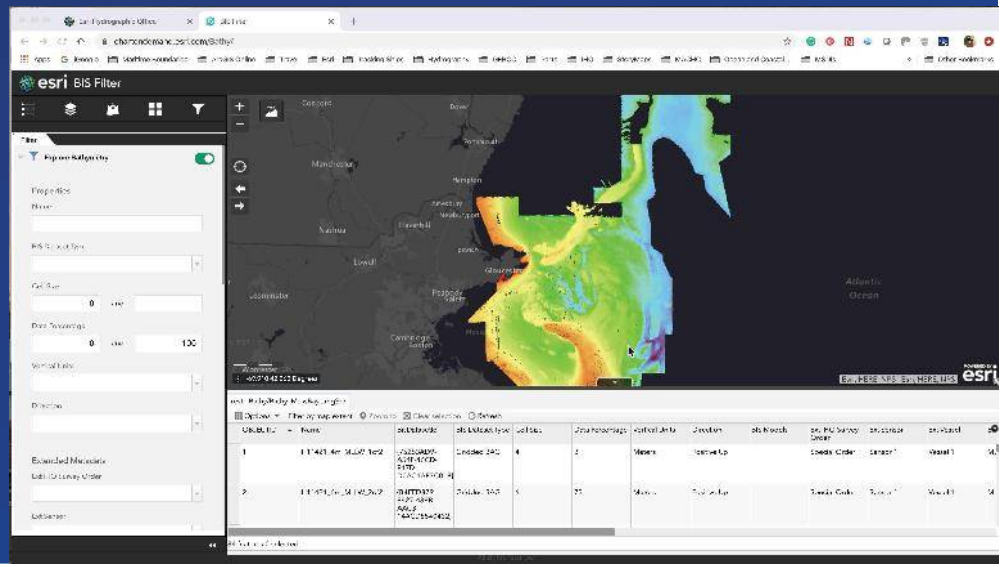
The Workflow

Collect, Manage, Produce, Share



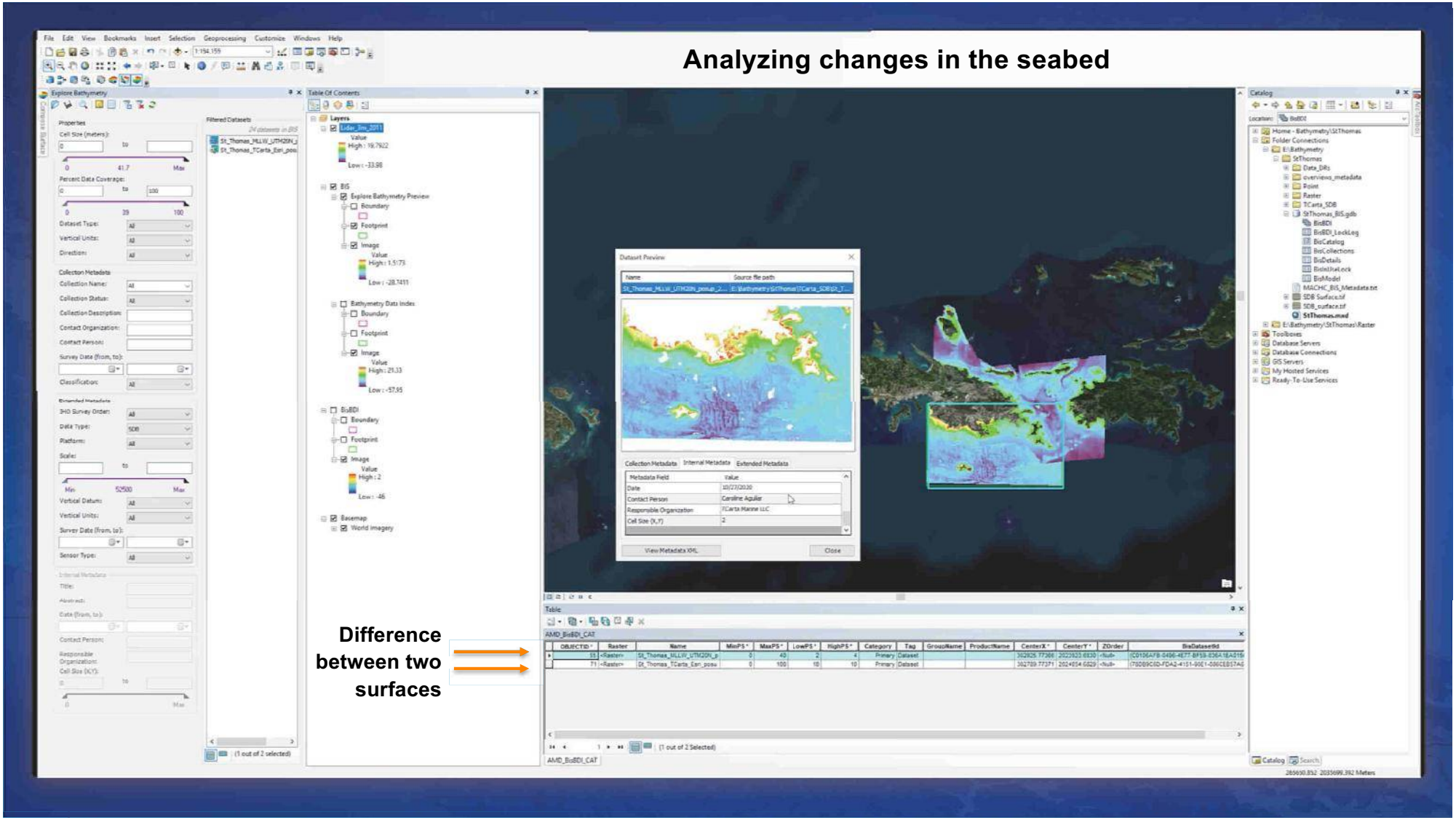
Establishing a Bathymetric Elevation Service

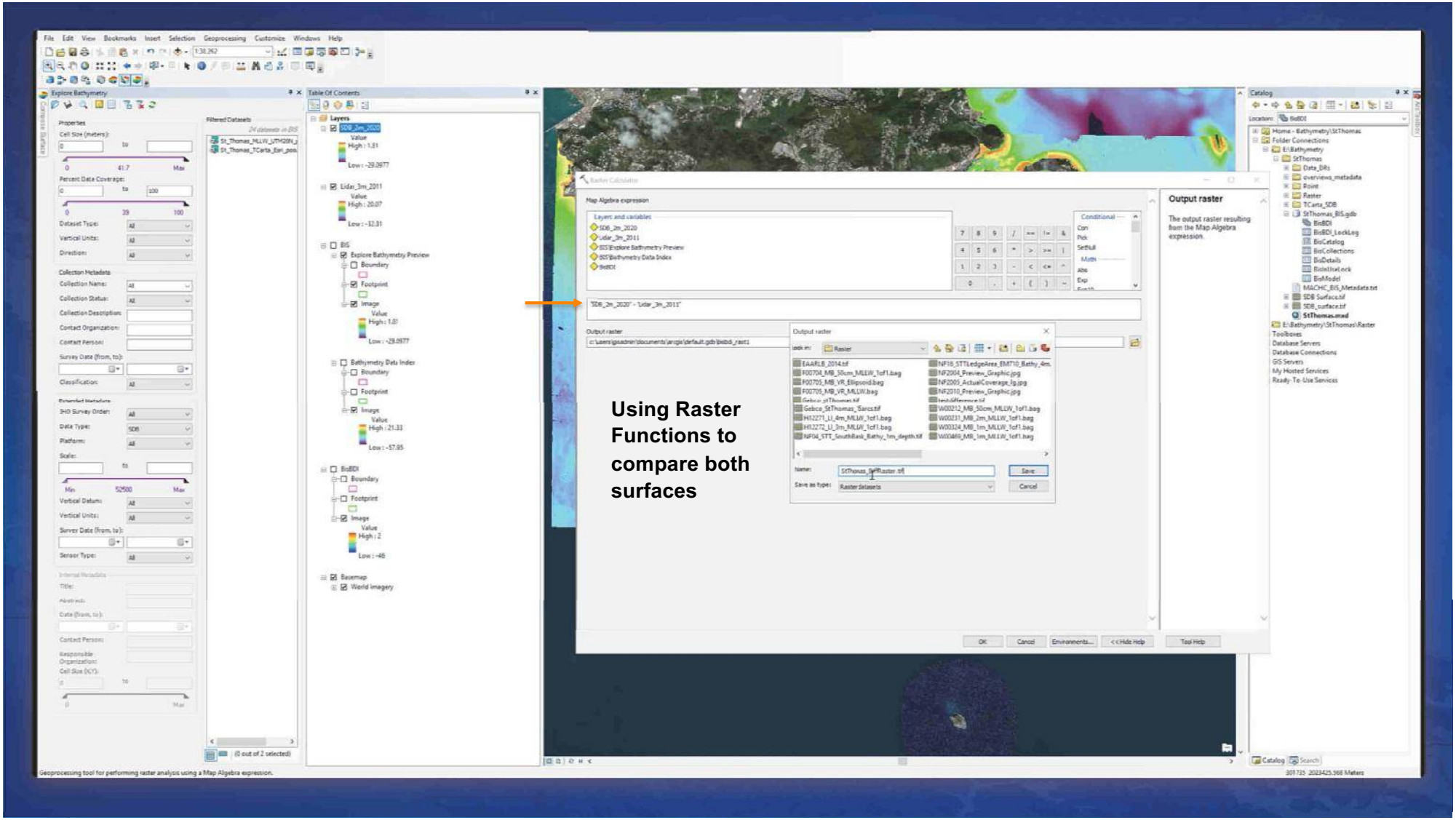


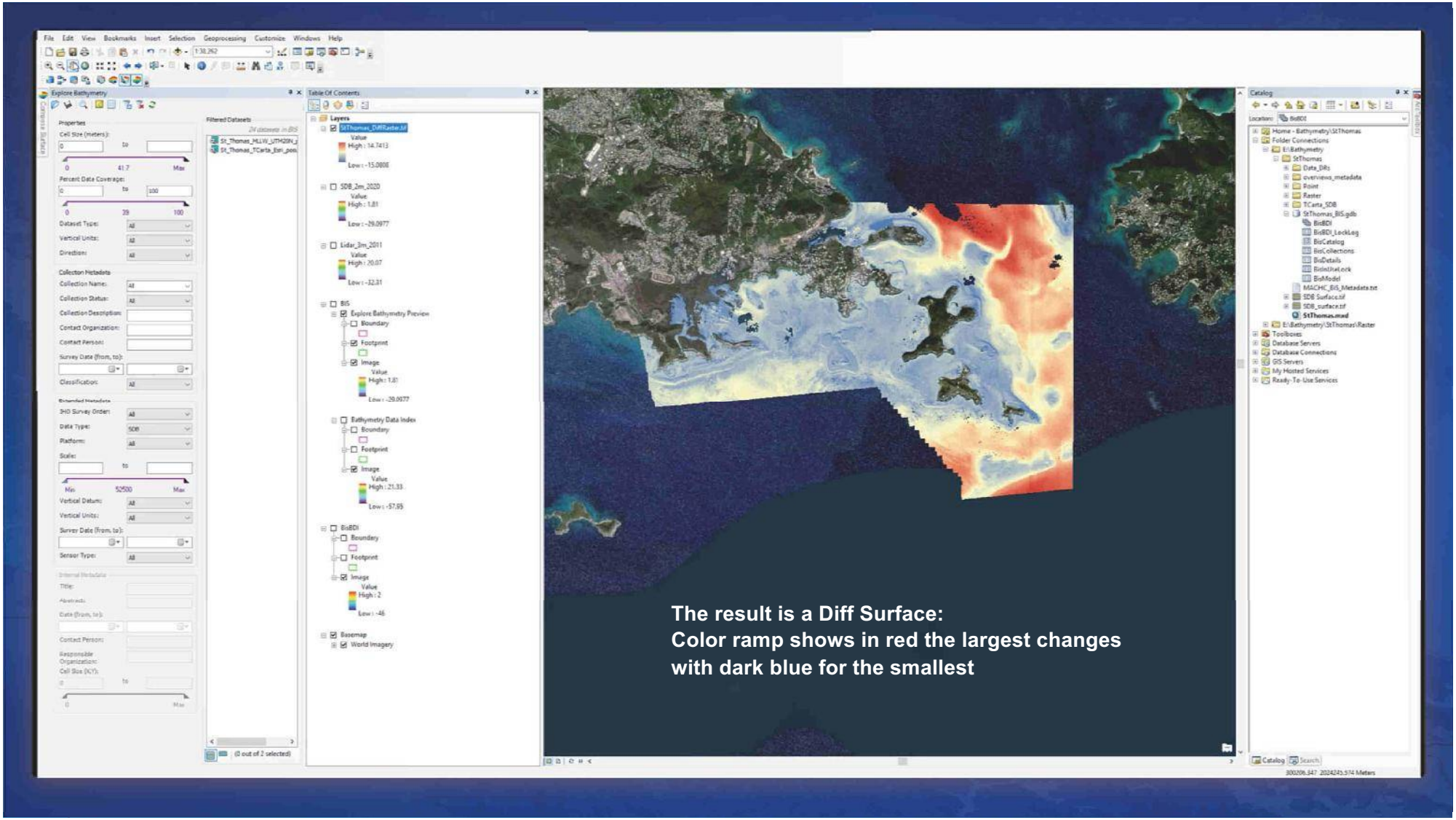


https://maritimedemo.esri.com/bisfilter/

Analyzing changes in the seabed

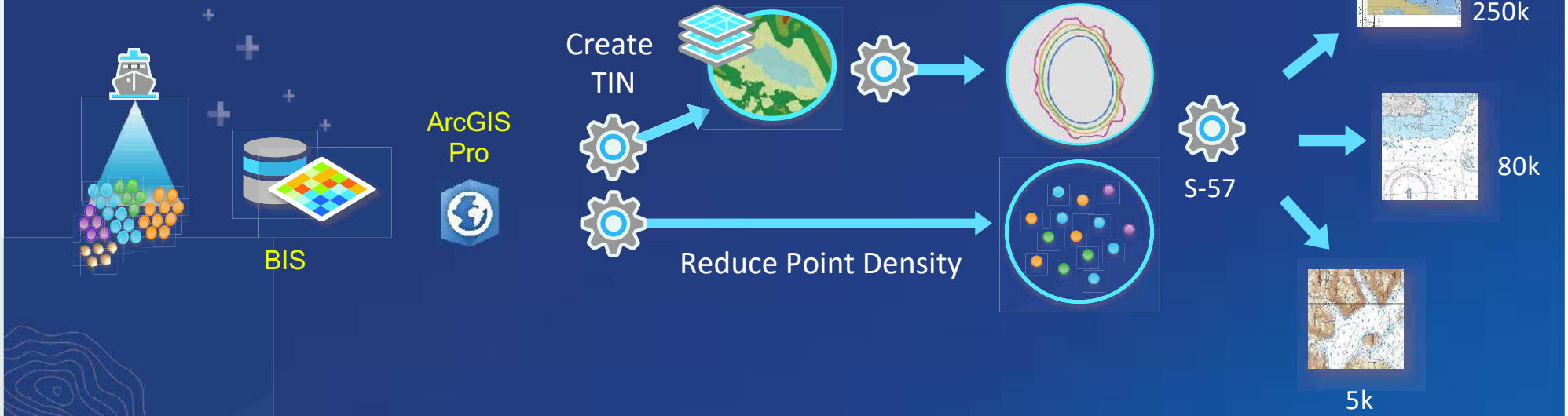



Using Raster Functions to compare both surfaces


The result is a Diff Surface:
Color ramp shows in red the largest changes
with dark blue for the smallest

Automated sounding selection and contours

- Workflow available in ArcGIS Pro
- Workflow available in ArcMap
  - (with the exception of Smooth Bathymetric TIN)

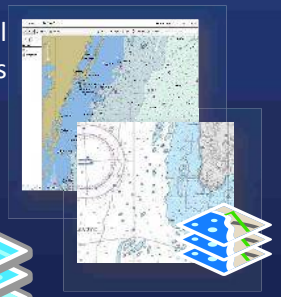


ArcGIS Maritime

Desktop

System of Record

Paper Nautical Charts



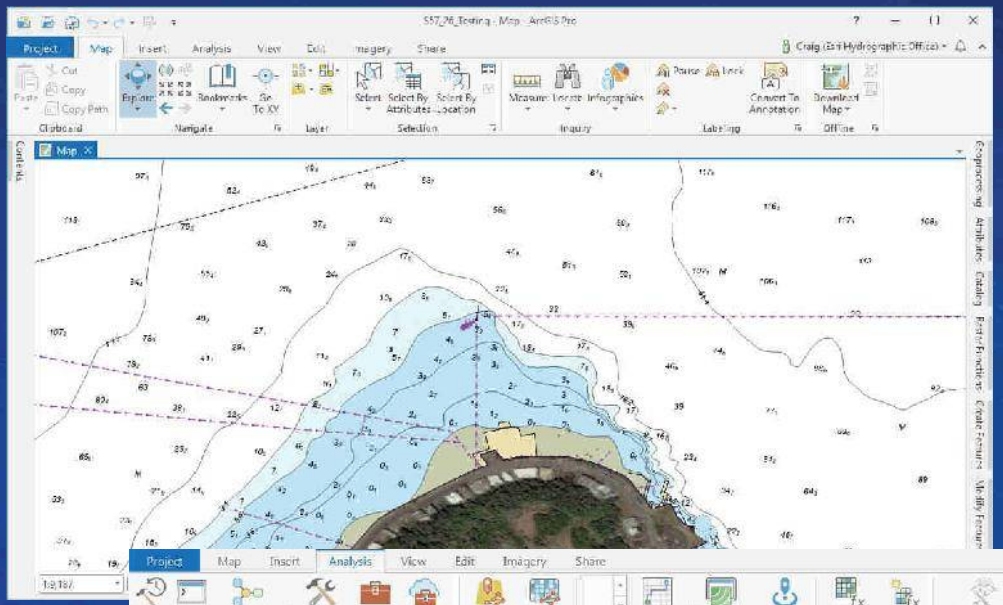
Electronic Navigational Charts

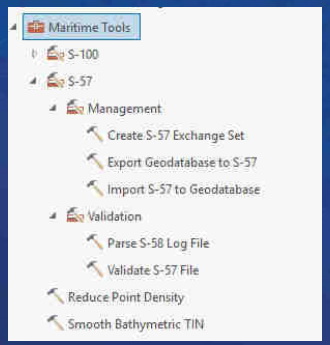
Server

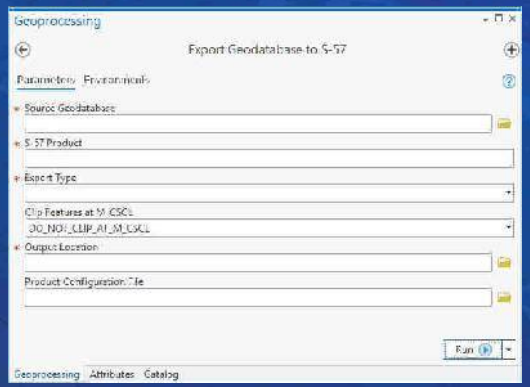
System of Engagement

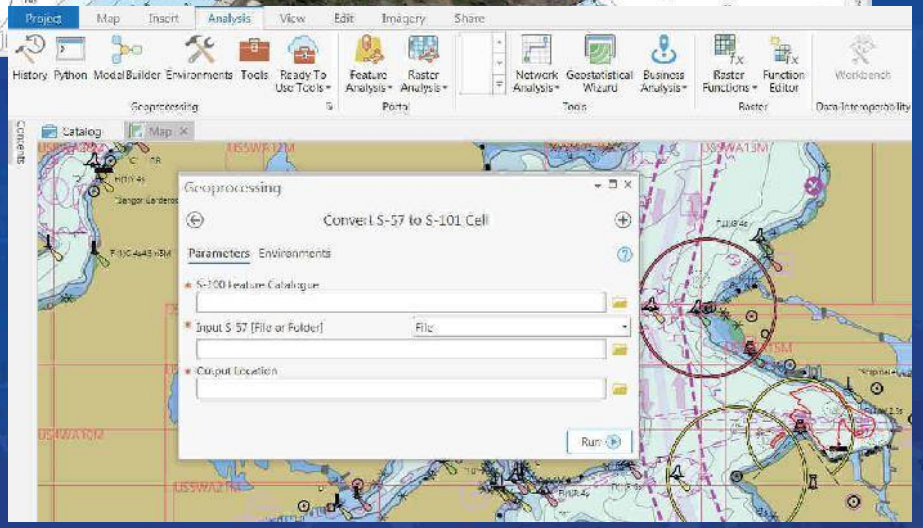
Chart Production made easy: ArcGIS Pro Maritime

- **Simplification + Low Disruption**
  - Most tools remain unchanged
  - Tools and Workflows simplified.
  - Ease of adoption.
- **Product Library not required**
- **New “Product Configuration File” parameter**
  - Choose any product configuration file when you export.
  - Optional parameter
  - Simplifies support for multiple product mappings from the same data
  - S-57 and S-100

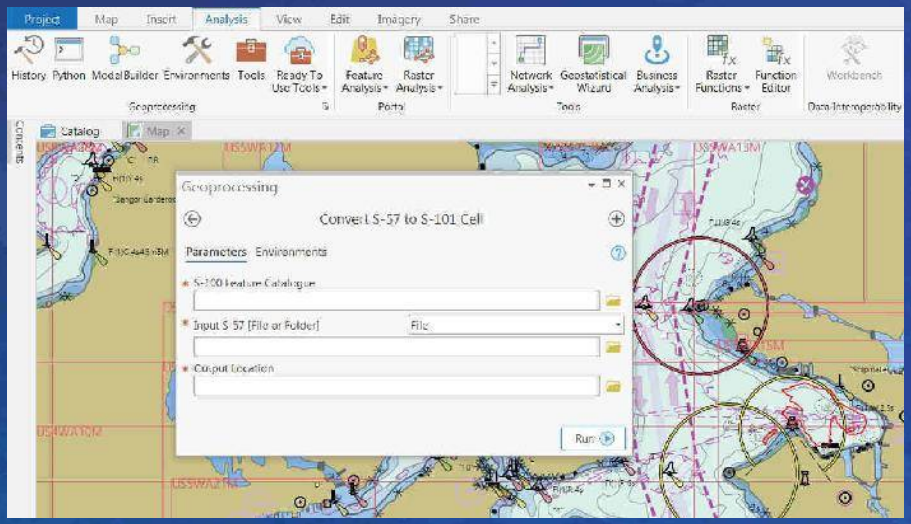


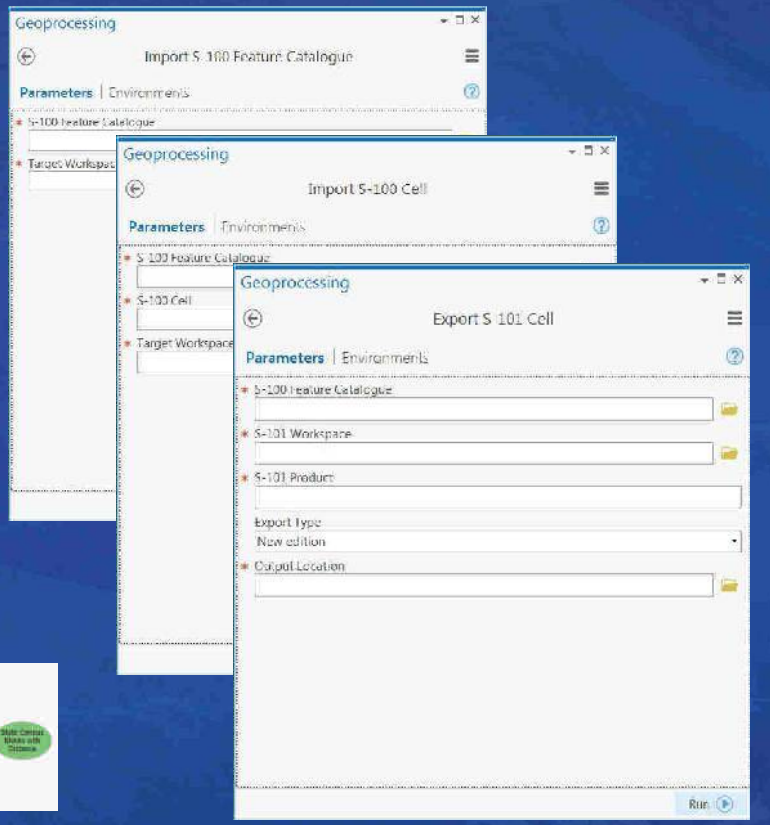


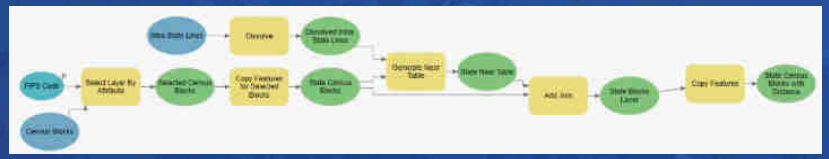




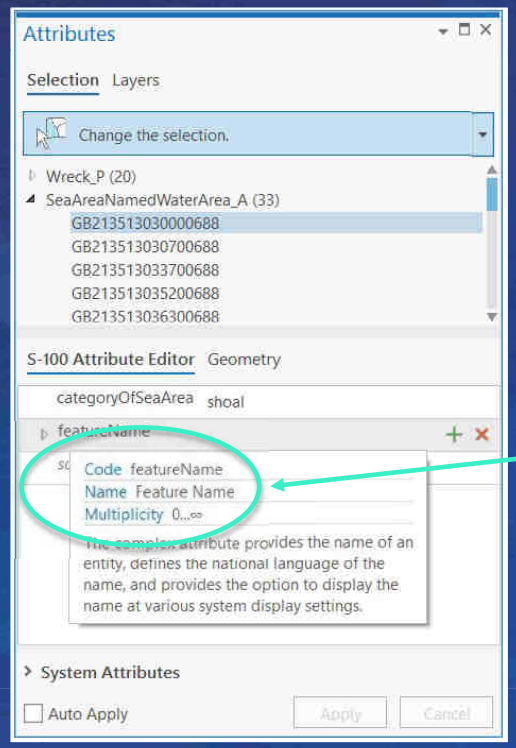
Automation across the platform



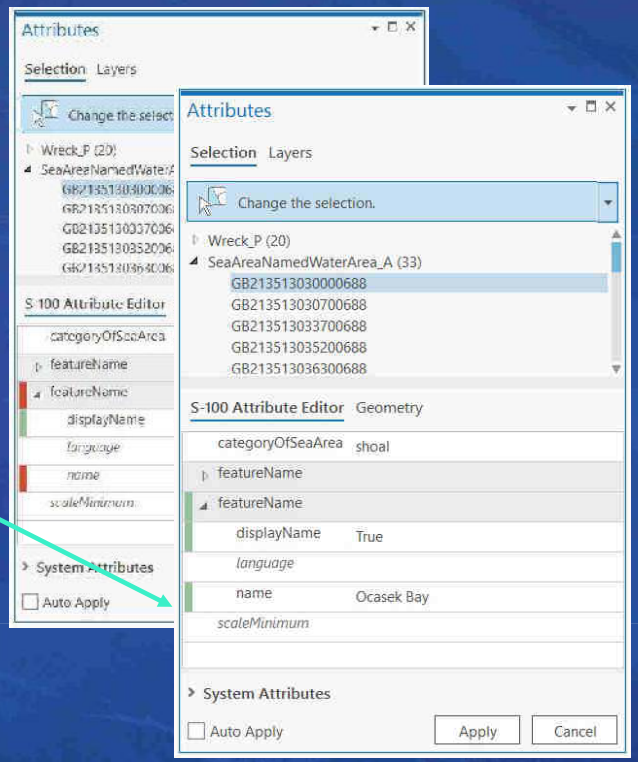




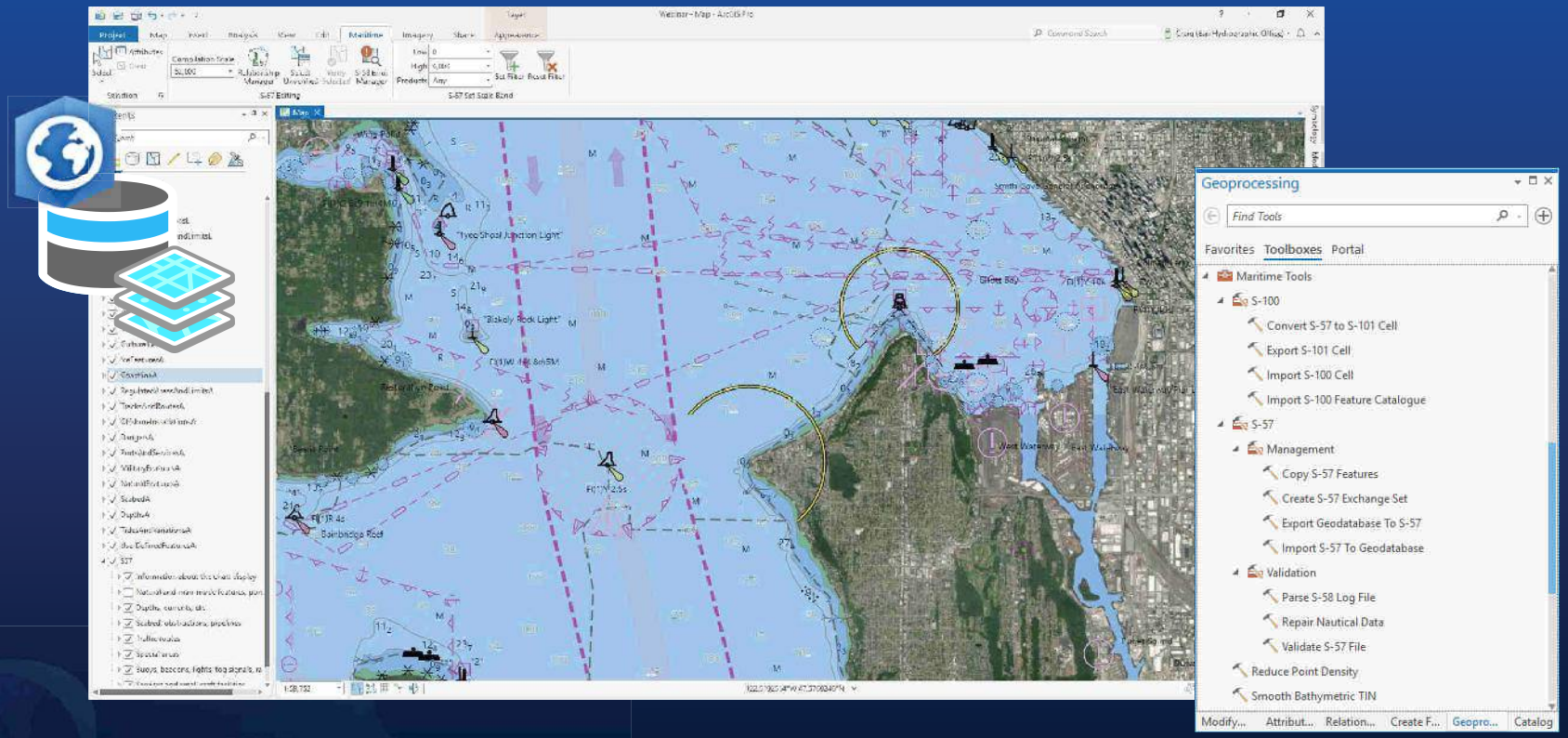
Enhanced S-100 editing tools

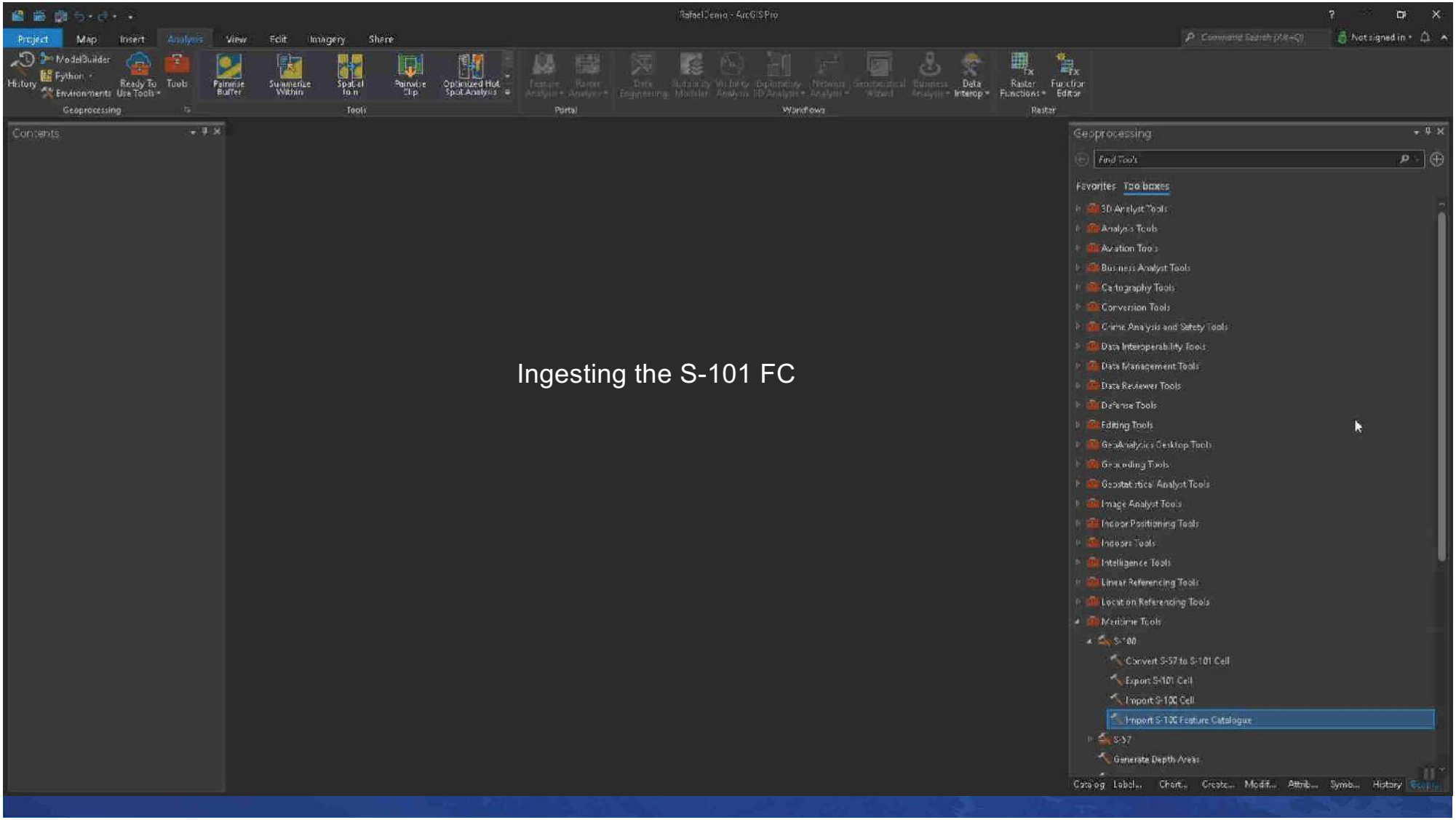


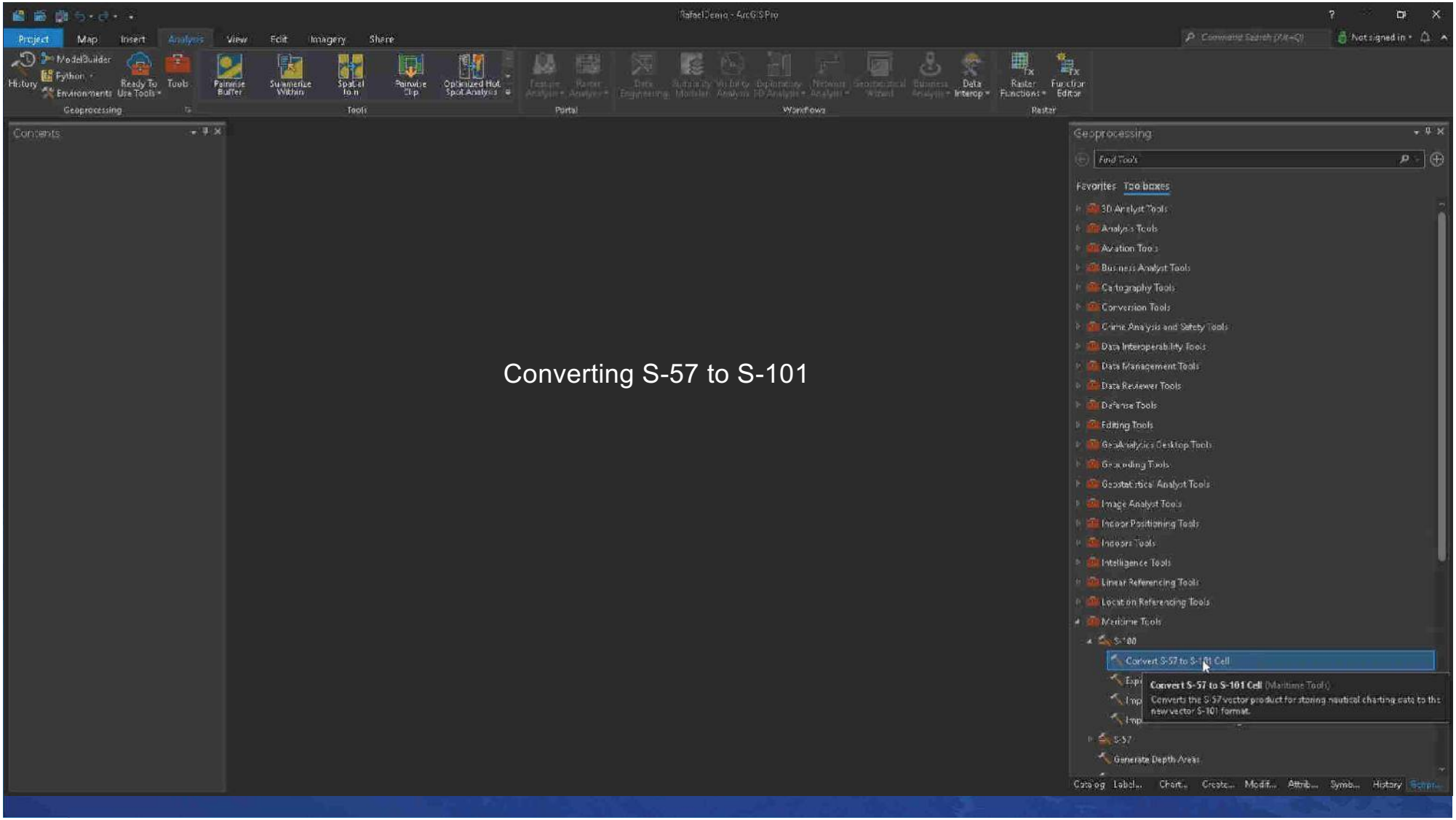
Feature Catalogue in runtime
for tooltips and validation

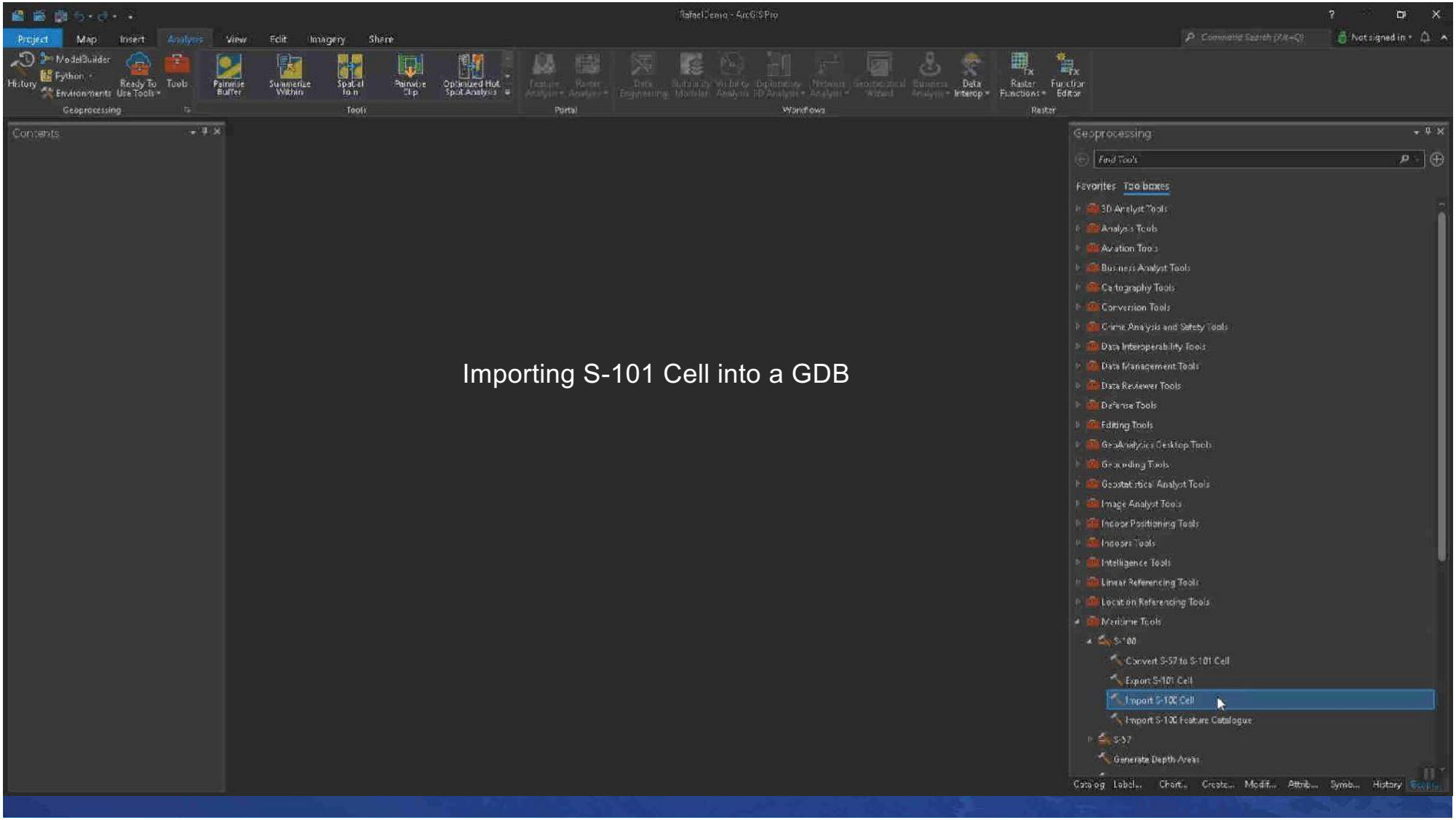


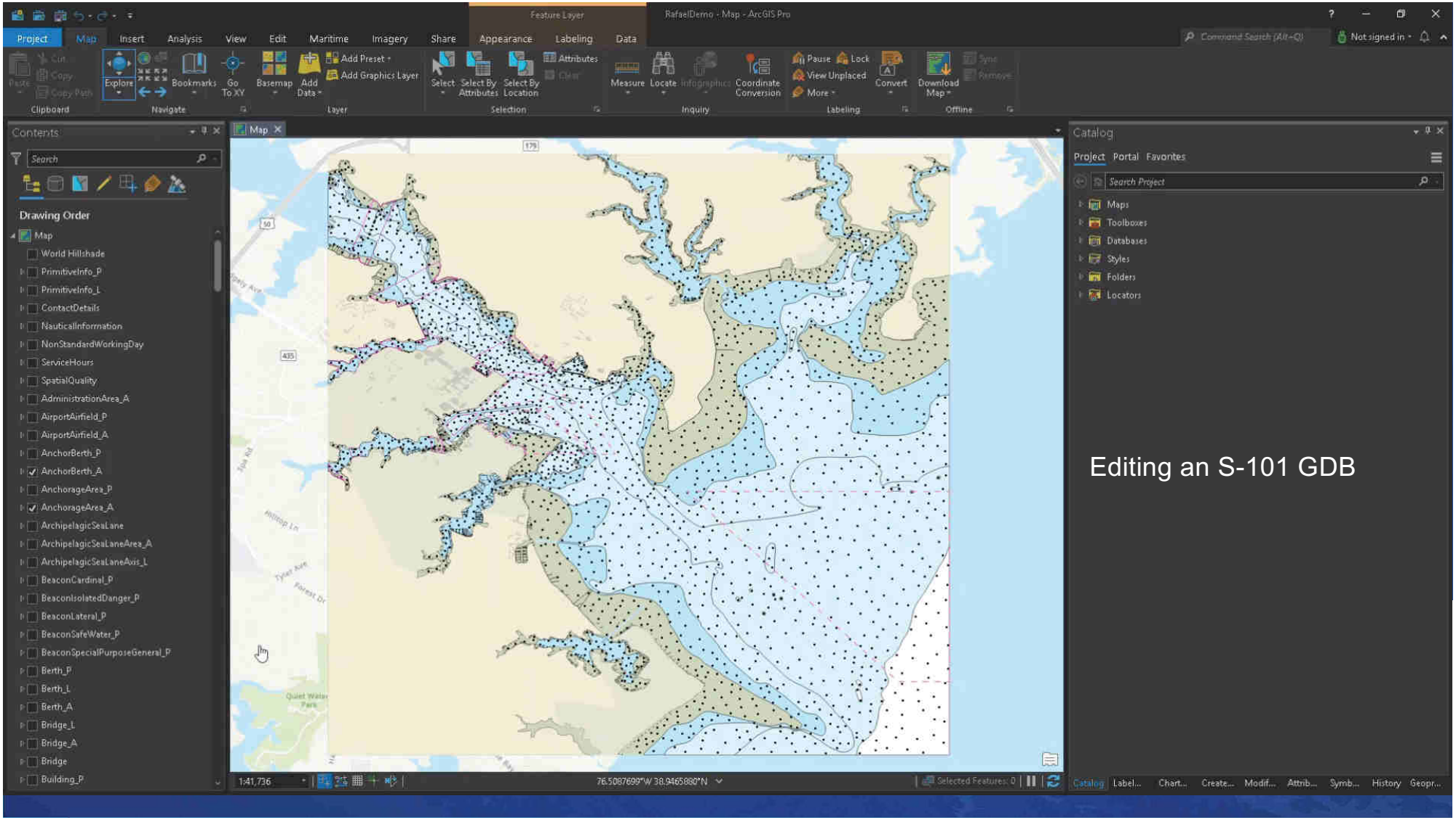
ArcGIS Maritime
Production tools

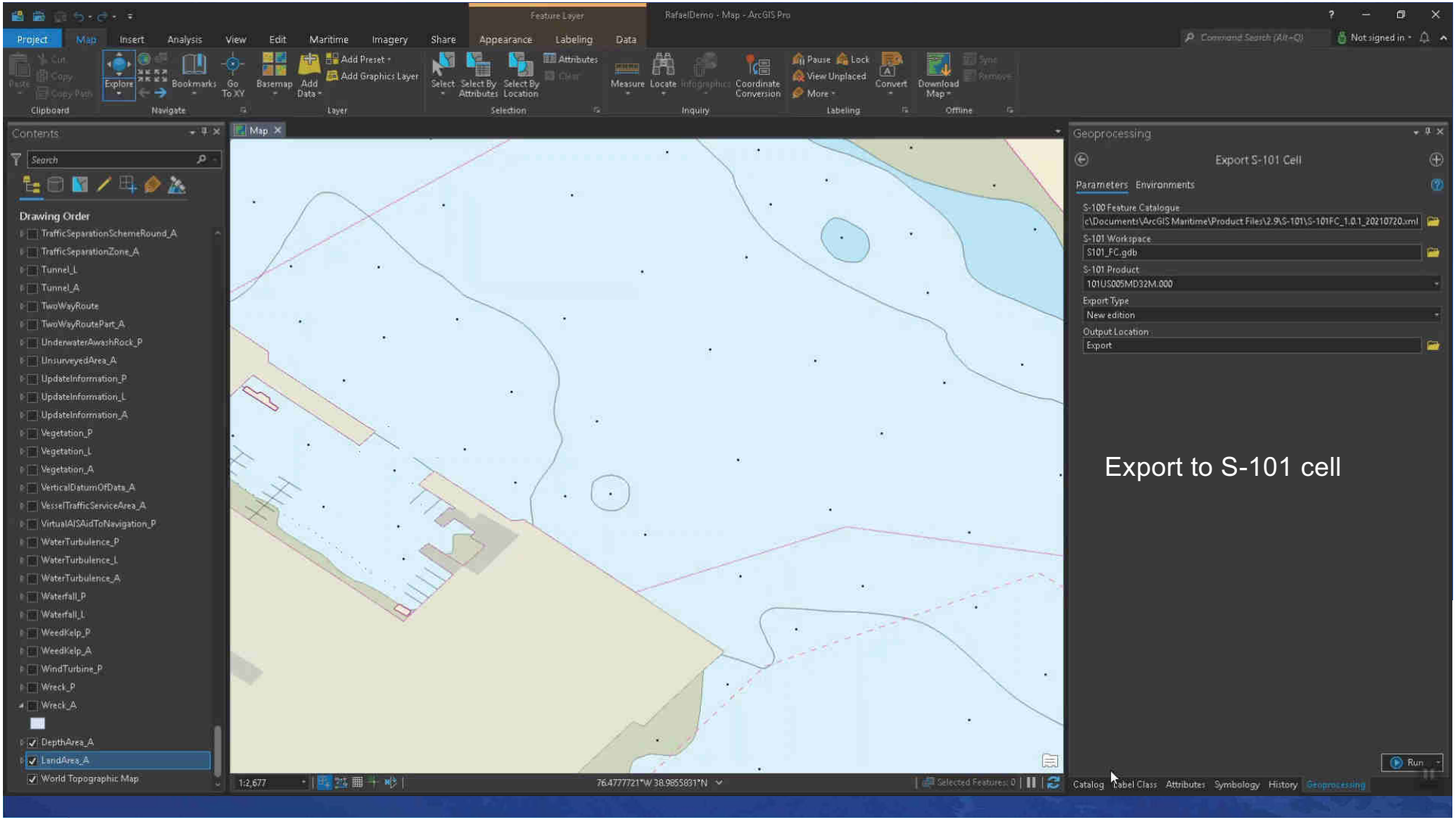


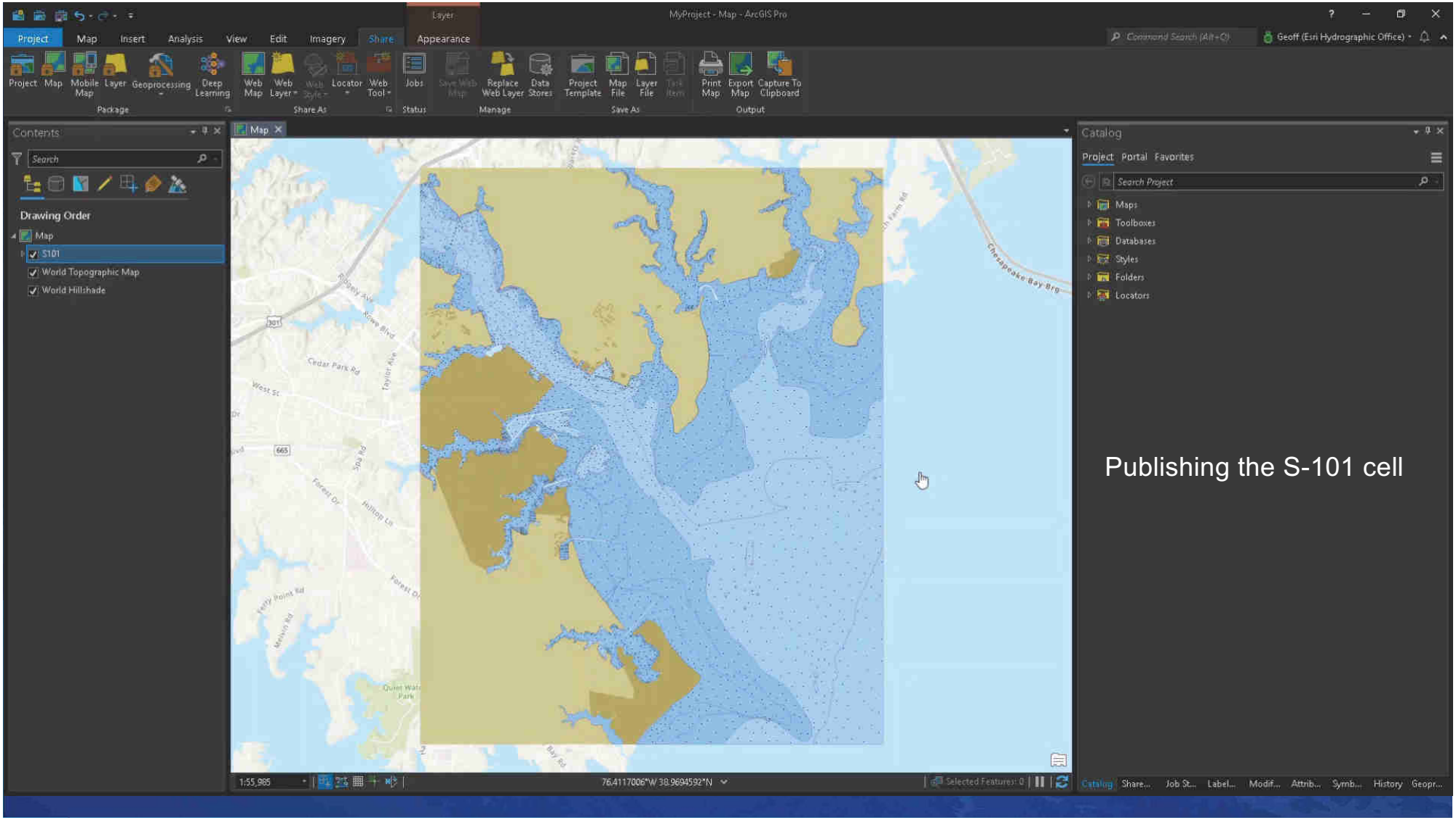

Ingesting the S-101 FC


Converting S-57 to S-101
Project
Map
Insert
Analysis
View
Edit
Imagery
Share
Contents
Geoprocessing
Favorites
Toolboxes
Convert S-57 to S-101 Cell
Convert S-57 to S-101 Cell (Maritime Tools)
Converts the S-57 vector product for storing nautical charting data to the new vector S-101 format.
Generate Depth Areas

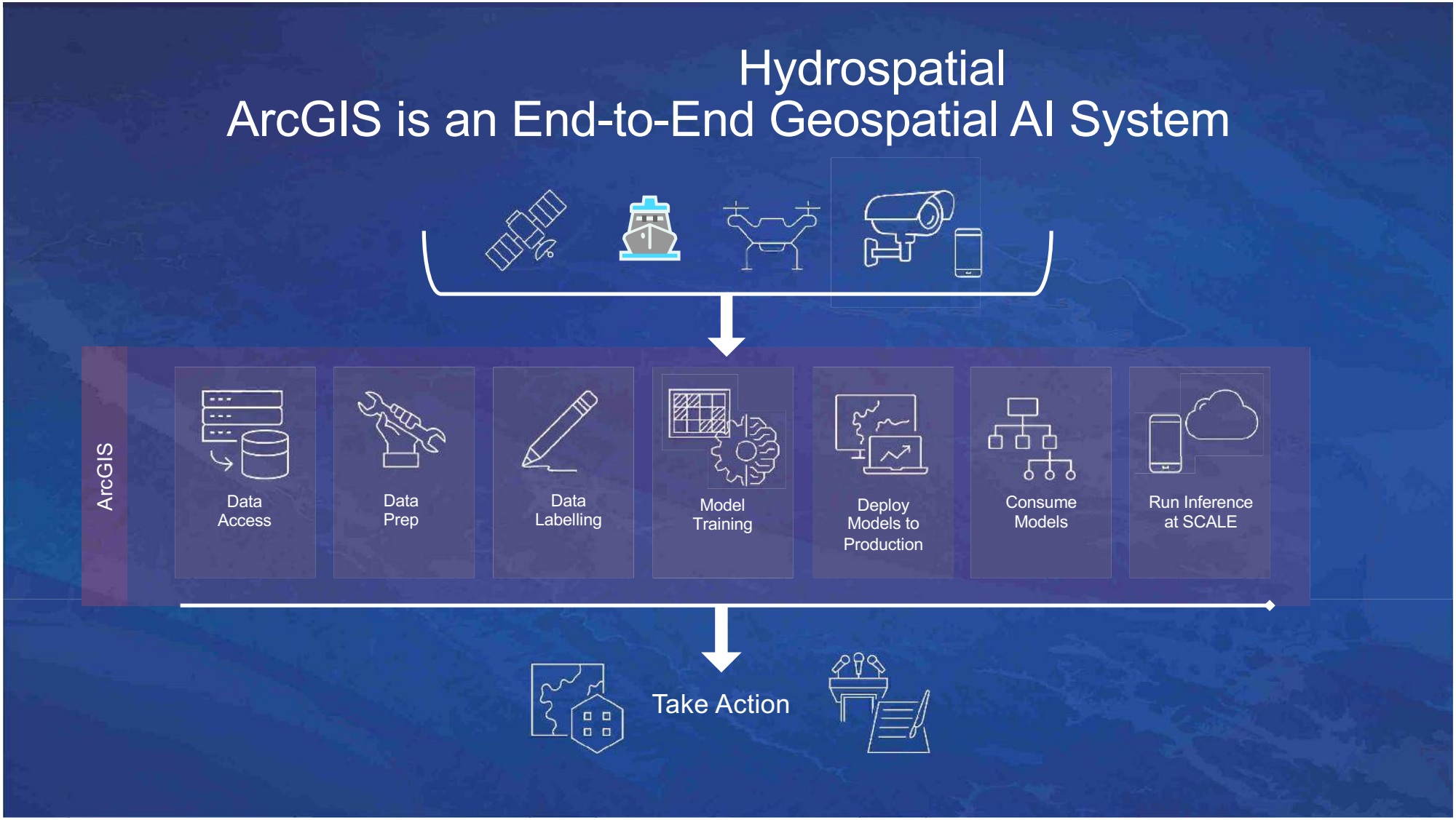

Importing S-101 Cell into a GDB
Project
Map
Insert
Analysis
View
Edit
Imagery
Share
Geoprocessing
Contents
Favorites
Tool boxes
Convert S-57 to S-101 Cell
Export S-101 Cell
Import S-100 Cell
Import S-100 Feature Catalogue
Generate Depth Areas


Editing an S-101 GDB

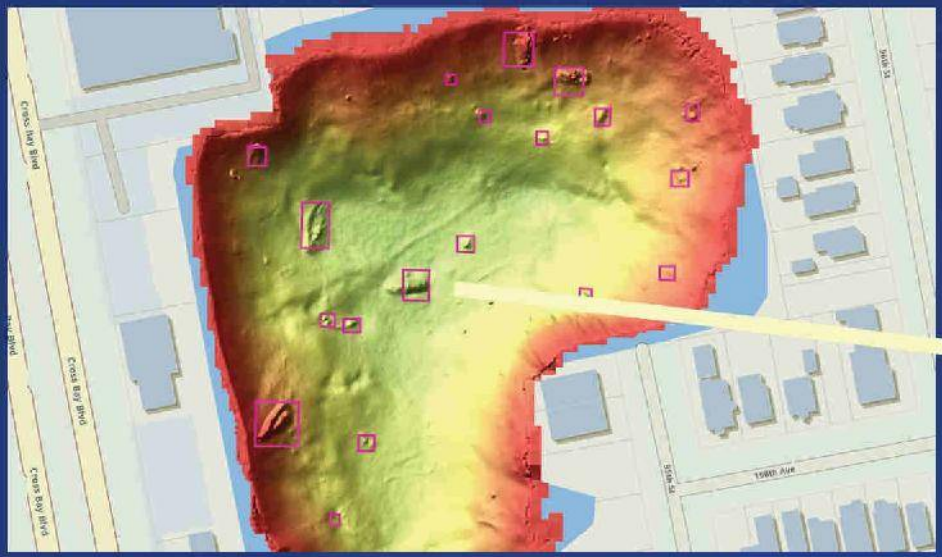

Export to S-101 cell


MyProject - Map - ArcGIS Pro
Project
Map
Insert
Analysis
View
Edit
Imagery
Share
Appearance
Contents
Drawing Order
Map
S101
World Topographic Map
World Hillshade
Catalog
Project
Portal
Favorites
Maps
Toolboxes
Databases
Styles
Folders
Locators
Publishing the S-101 cell

Hydrospatial
ArcGIS is an End-to-End Geospatial AI System



Machine Learning: Wreck detection

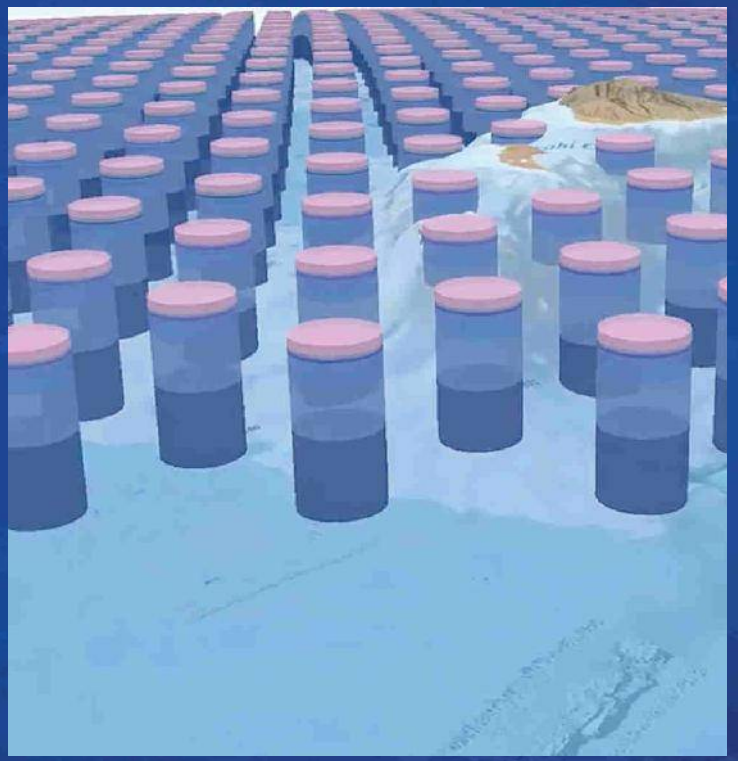


Sample web map

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

Ecological Marine Units

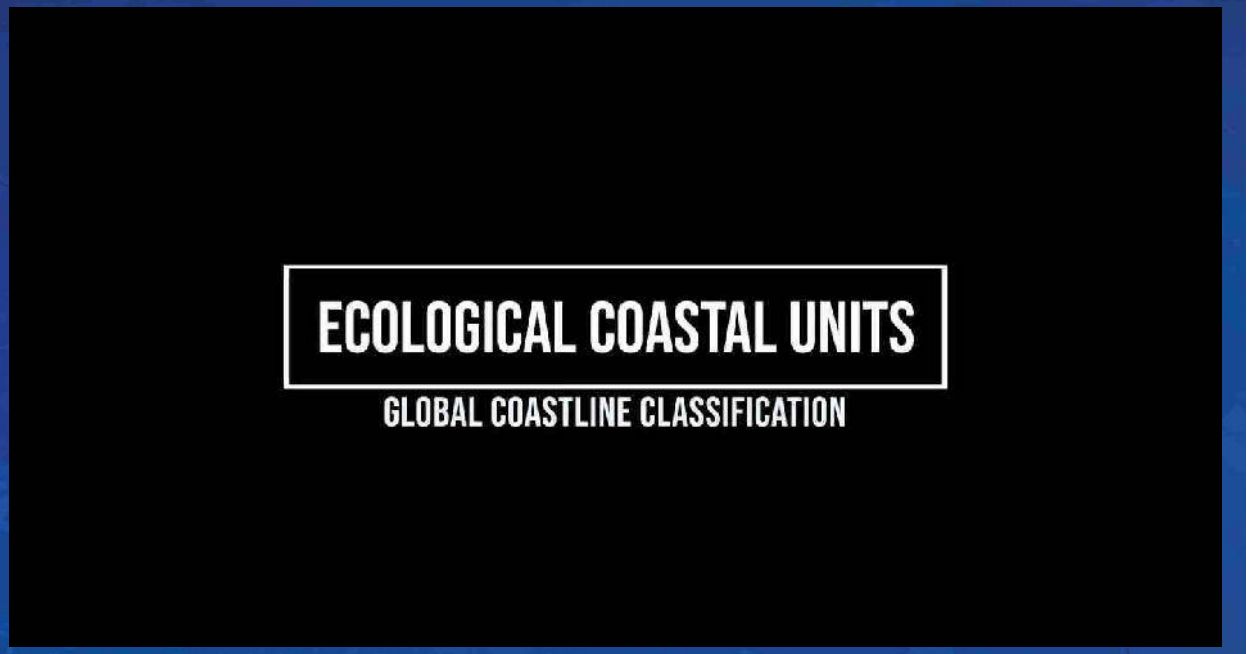
- The Group on Earth Observations (GEO), commissioned a global map of EMUs to support the wise use of ocean resources and the preservation of environmental resilience.
- EMUs are globally comprehensive, quantitatively data driven and truly 3D.
  - 37 physically and chemically distinct volumetric regions where chemical properties most likely to drive ecosystem responses
  - 52 million data points from the World Ocean Atlas (NOAA)
  - Parameters gathered every 27 Km (3D grid)
  - Seafloor morphology
  - Statistical techniques grouping results into categories
- Available to all interested MPAs
- Individuals can gauge indicators of positive or negative trends and use data to make informed decisions that preserve marine environments



https://livingatlas.arcgis.com/emu/

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.

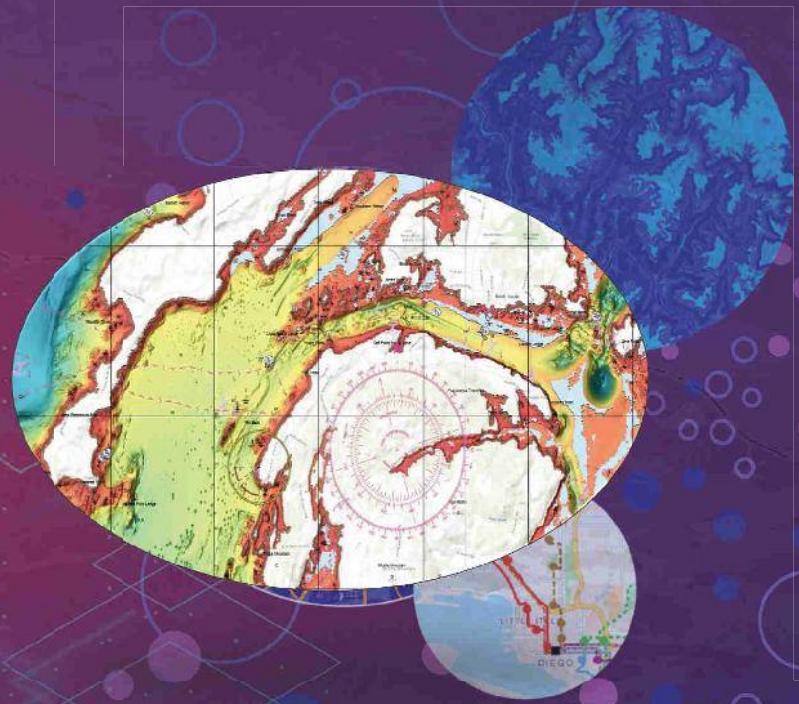


https://www.esri.com/arcgis-blog/products/arcgis-living-atlas/mapping/ecus-available/

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

Dissemination

Converting Data into Information

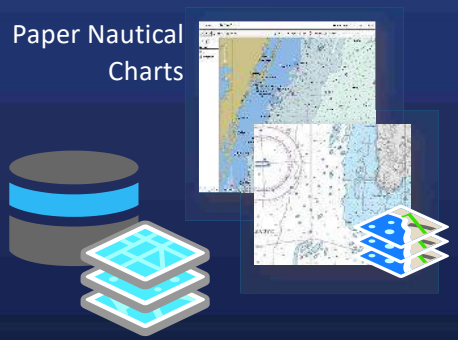


ArcGIS Maritime

Desktop

System of Record

Paper Nautical Charts



Electronic Navigational Charts

Server

System of Engagement

ArcGIS Maritime server extension

Maritime Chart Server

Print on Demand

ArcGIS Maritime Server

Geoprocessing Services

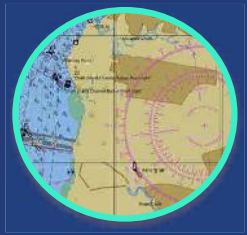
Maritime Chart Service

Support for multiple industries & agencies

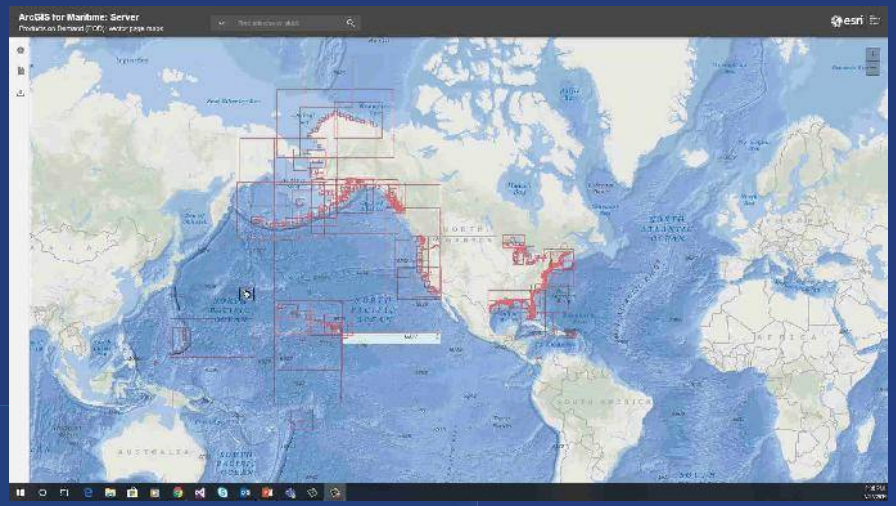
Highlights

- Anti-Piracy
- Amphibious Warfare
- Situational Awareness
- Border Patrol
- Natural Resources
- National Spatial Data Infrastructure
- Asset Management
- Common Operational Management
- Port Security
- Voyage Planning
- Operational Basemap
- Vessel Traffic Management
- Offshore oil, gas and minerals exploration and industry
- Environmental protection
- Basemap
- Etc

Credit: Royal Malaysian Navy's National Hydrographic Centre

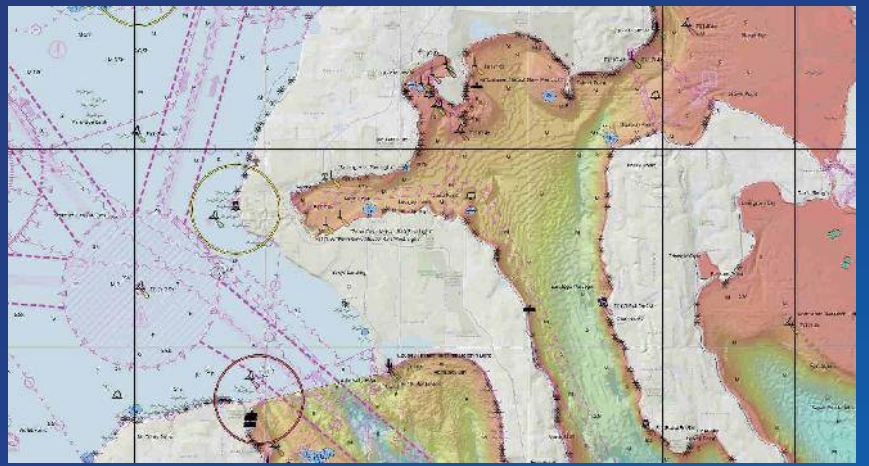


Custom Chart Builder



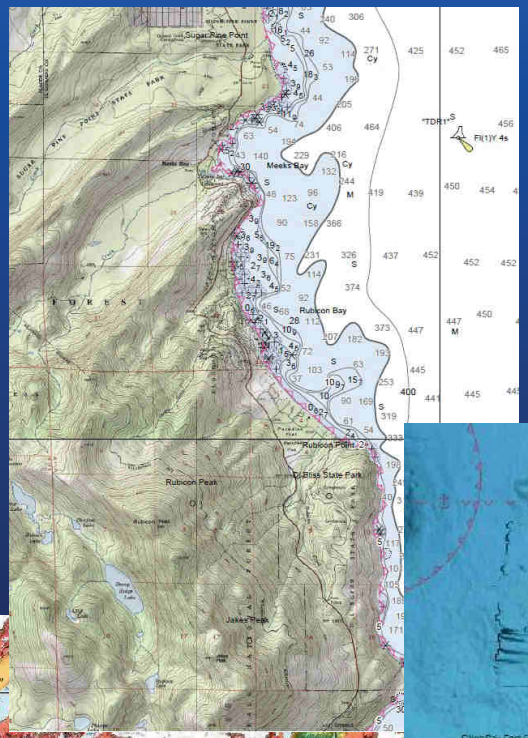
https://chartondemand.esri.com/ipod/

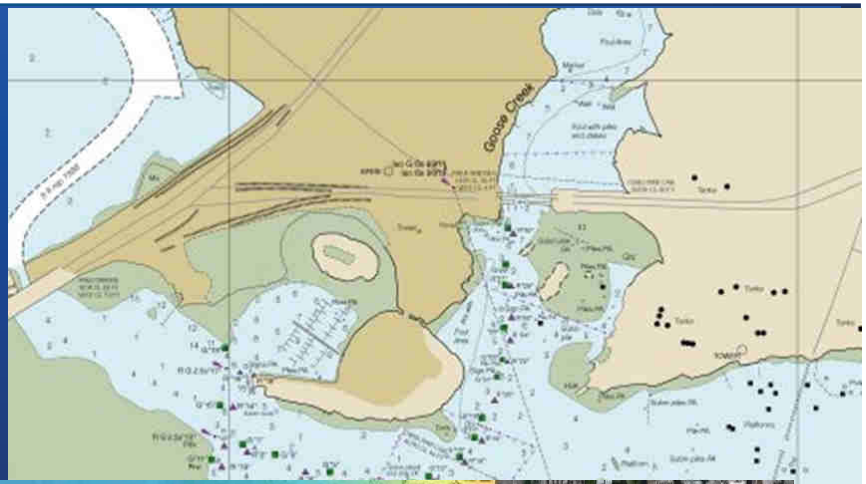
Mashups

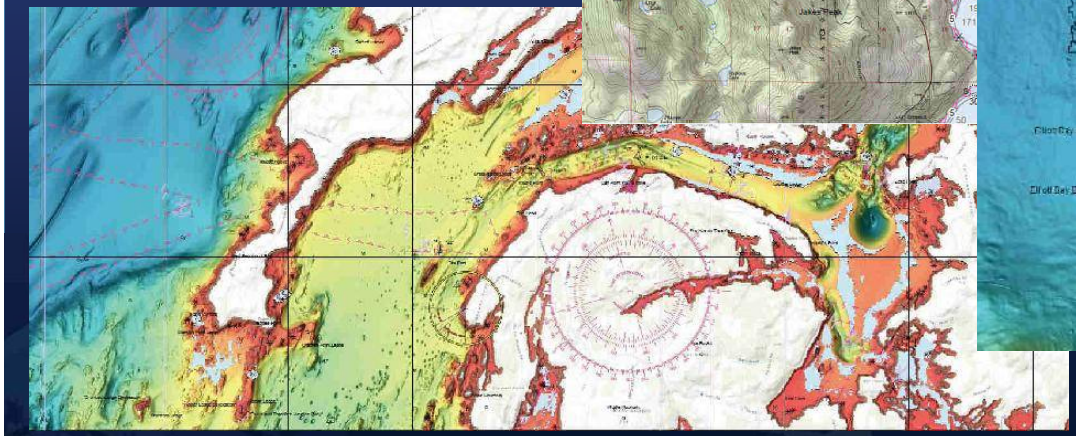


ArcGIS Maritime server

Charts as a service

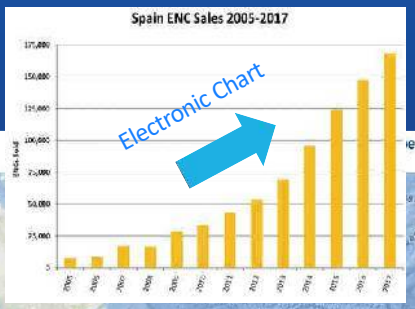


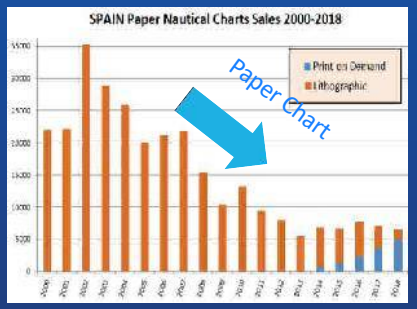


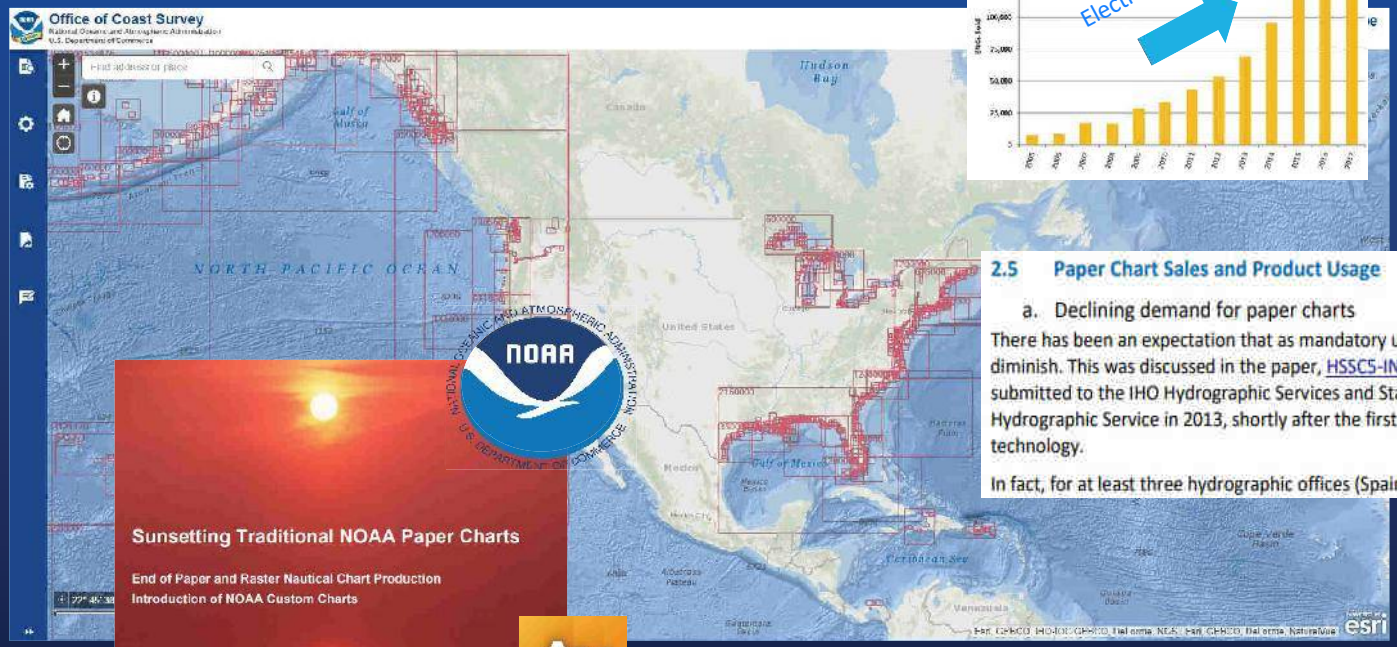


Transforming paper chart production

ArcGIS Maritime server – Custom Chart Builder





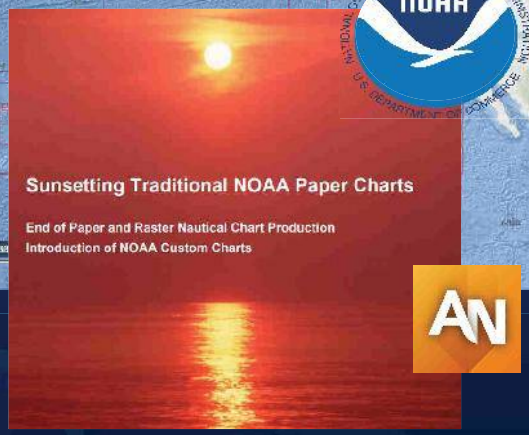


2.5 Paper Chart Sales and Product Usage

a. Declining demand for paper charts

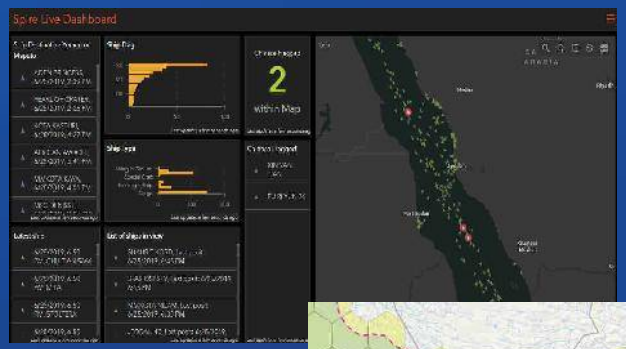
There has been an expectation that as mandatory use of ECDIS increases, demand for paper charts will diminish. This was discussed in the paper, HSSC5-INF7, "Future demand for Paper Nautical Charts", submitted to the IHO Hydrographic Services and Standards Committee (HSSC) by the Australian Hydrographic Service in 2013, shortly after the first ship types were required to implement ECDIS technology.

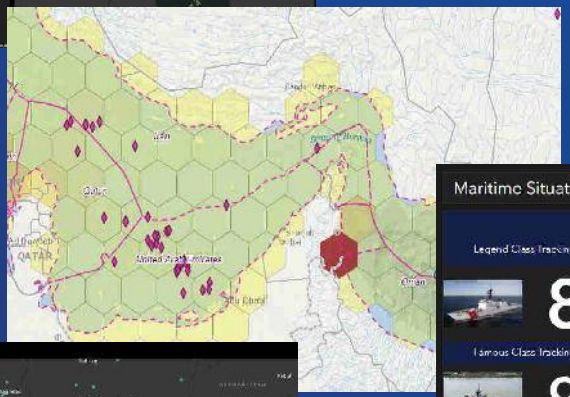
In fact, for at least three hydrographic offices (Spain, UK, and US), this decline started even earlier. The

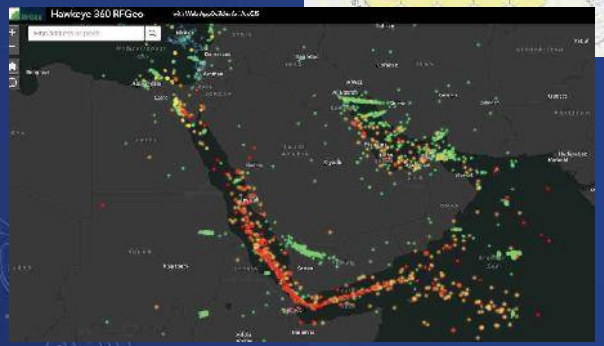


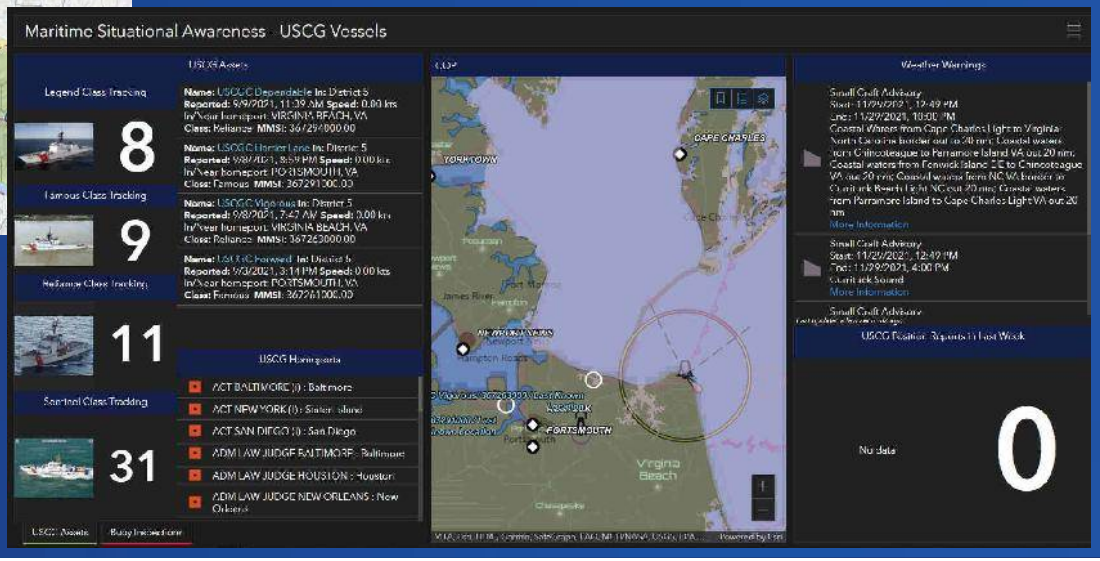
Maritime Domain Awareness

Situational Awareness
Real-Time Analyses
Historic Analysis
Big Data Analyses
Dark Target Analyses

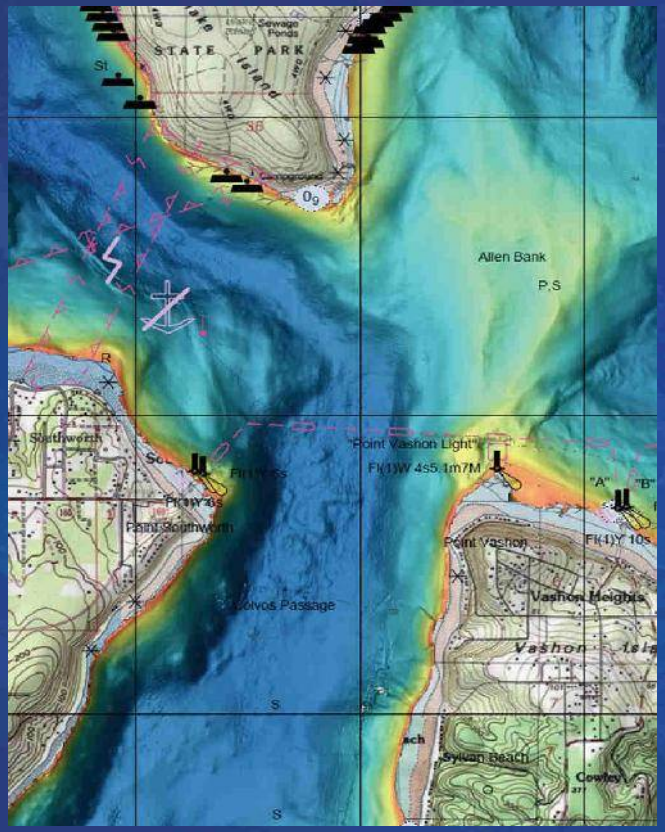


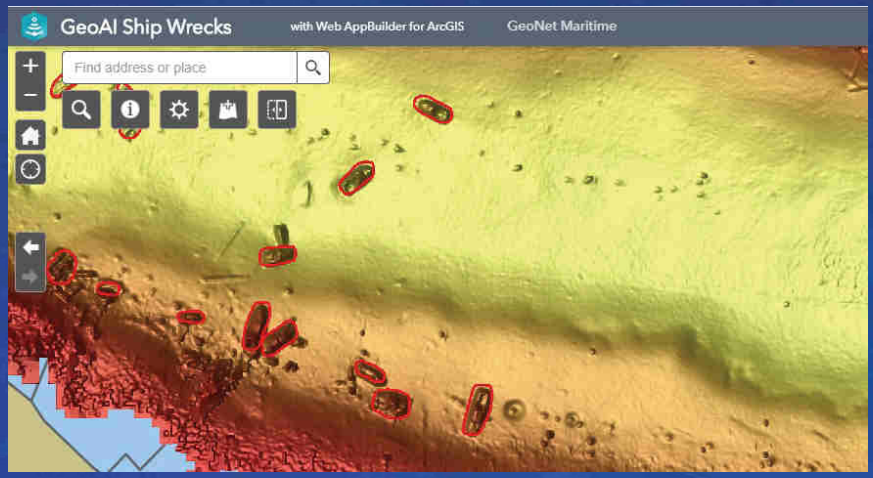


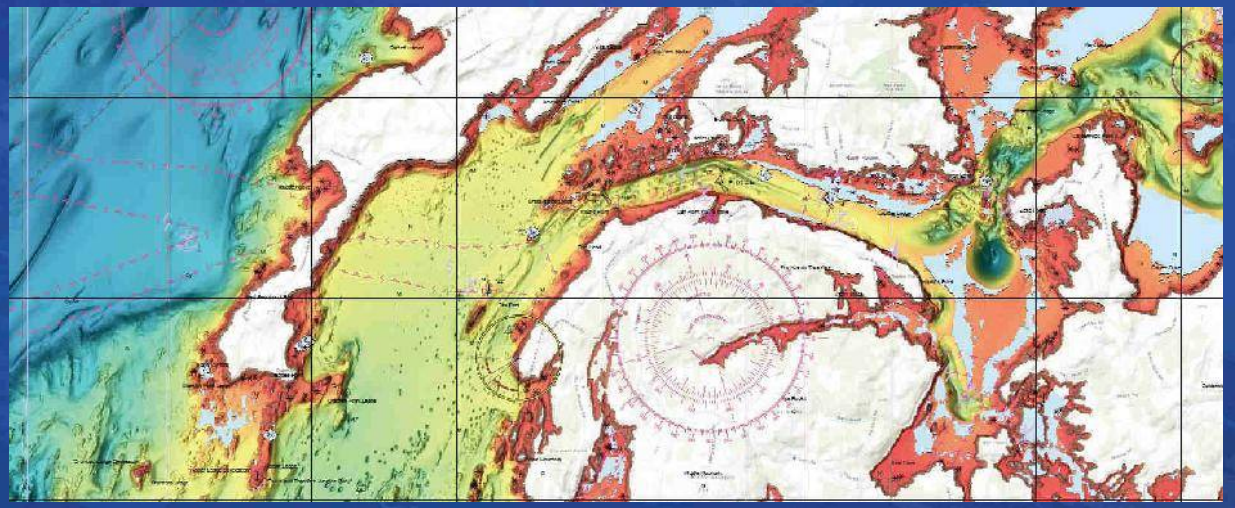




From GeoAI to Tactical Information products

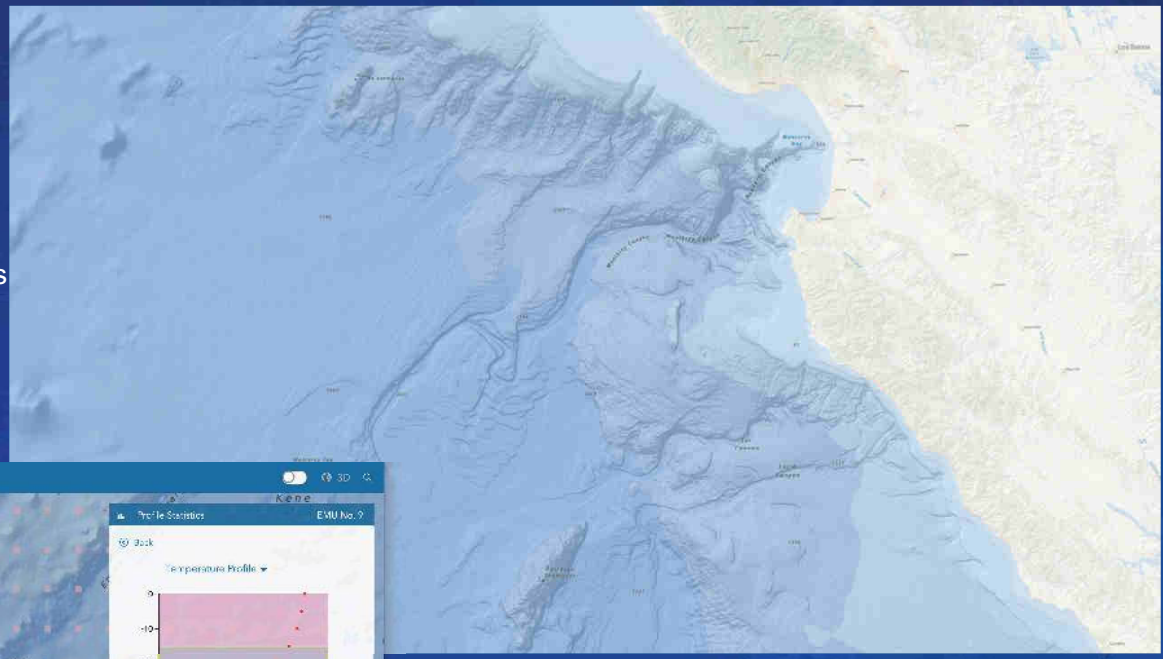


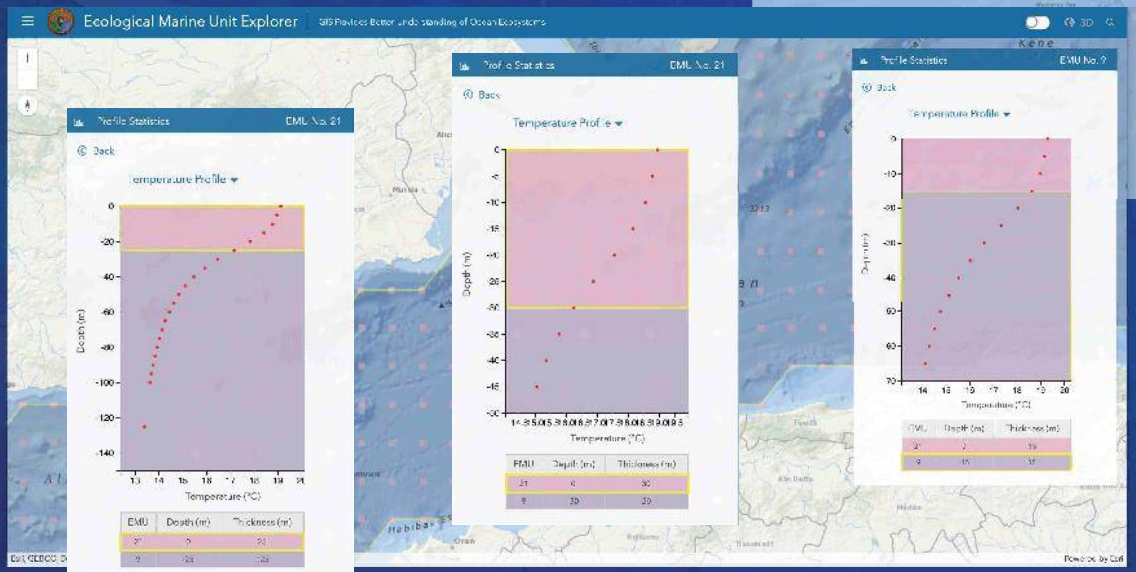




From the Seabed to the water column

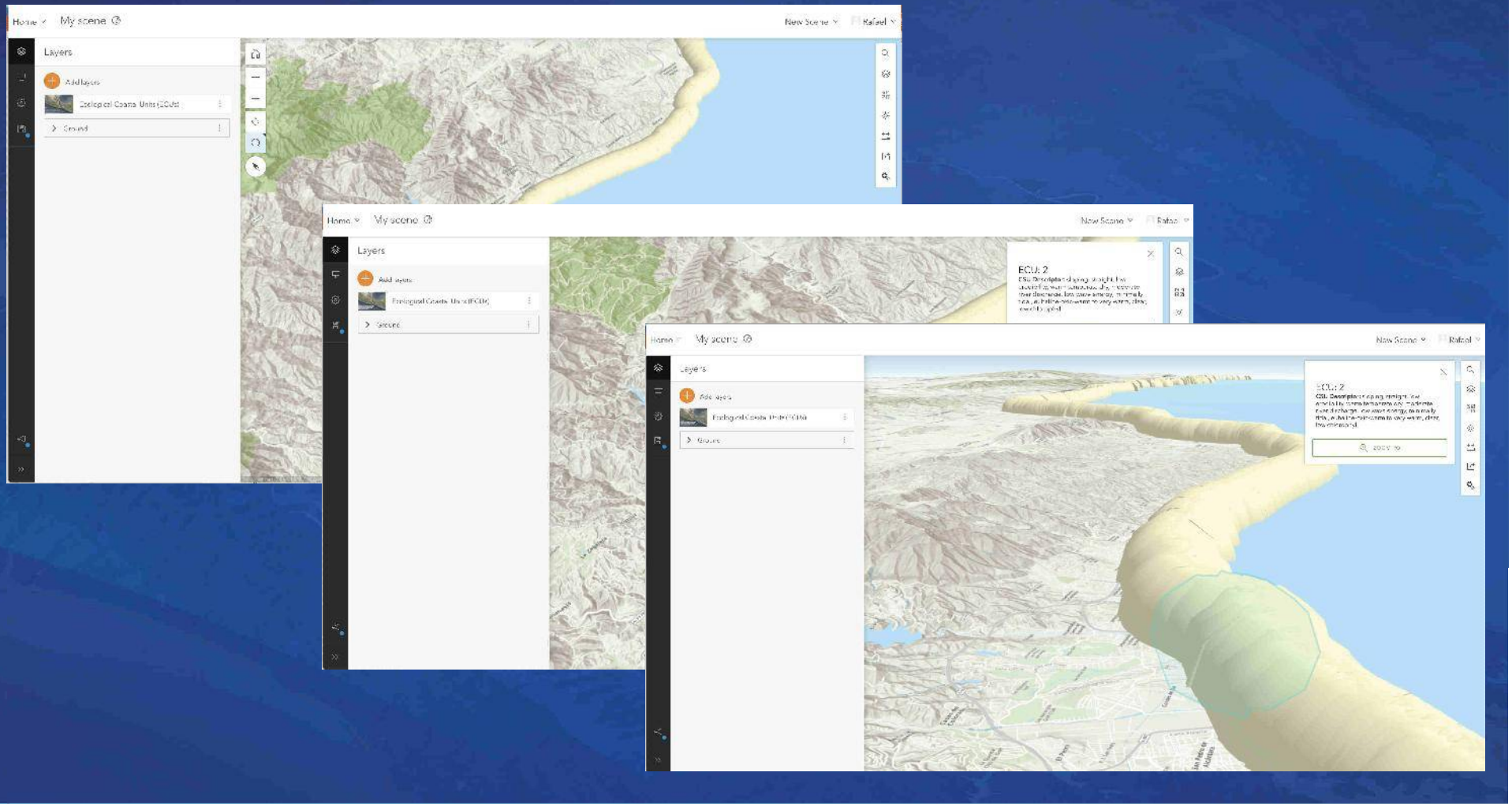
- METOC Ops.
- Command and Control
- Search and Rescue
- Law Enforcement
- Maritime Boundaries
- Marne Protected Areas
- Safety of Navigation





Understanding the Marine Environment

And the Coastal area…

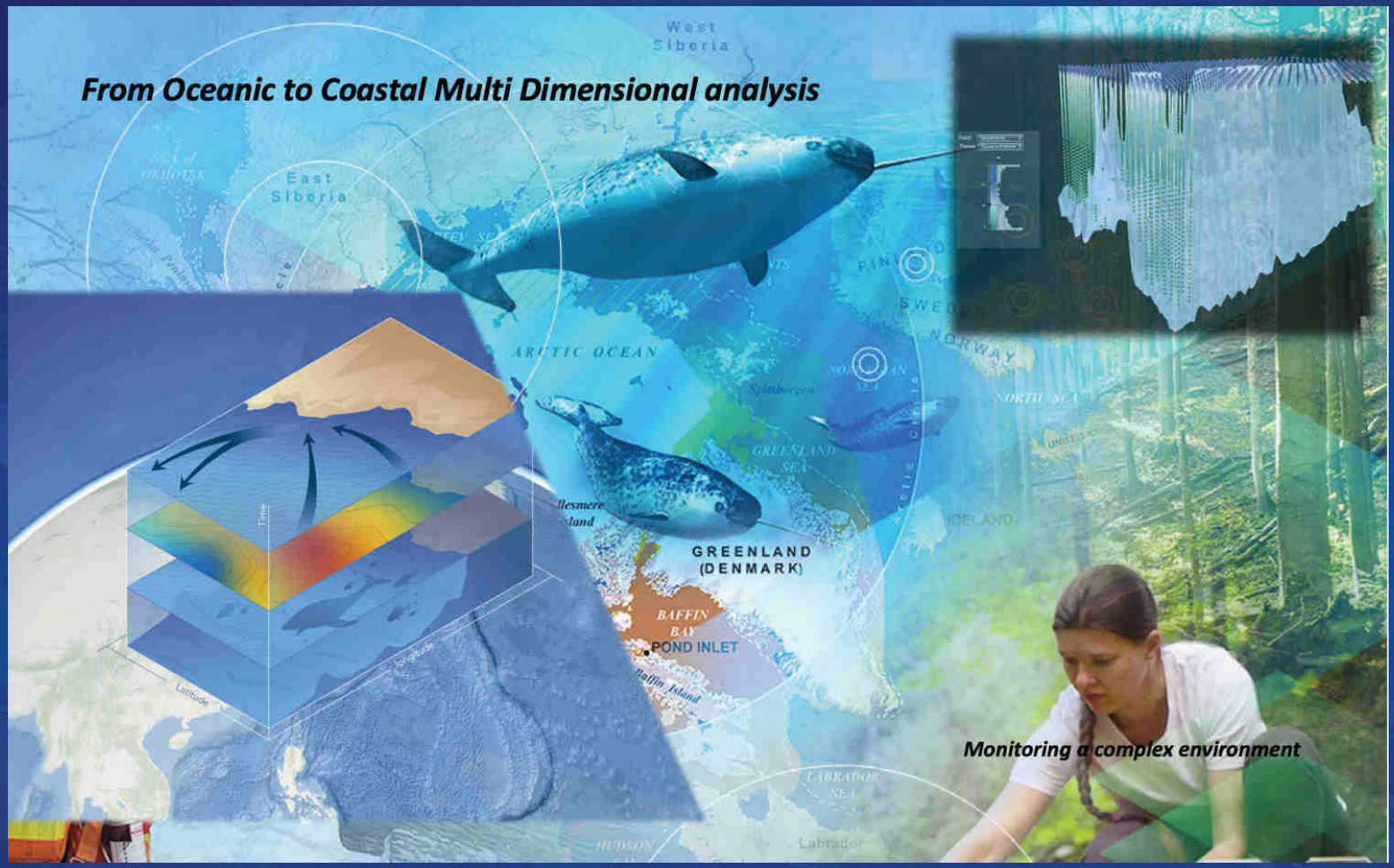


Real-Time Analysis

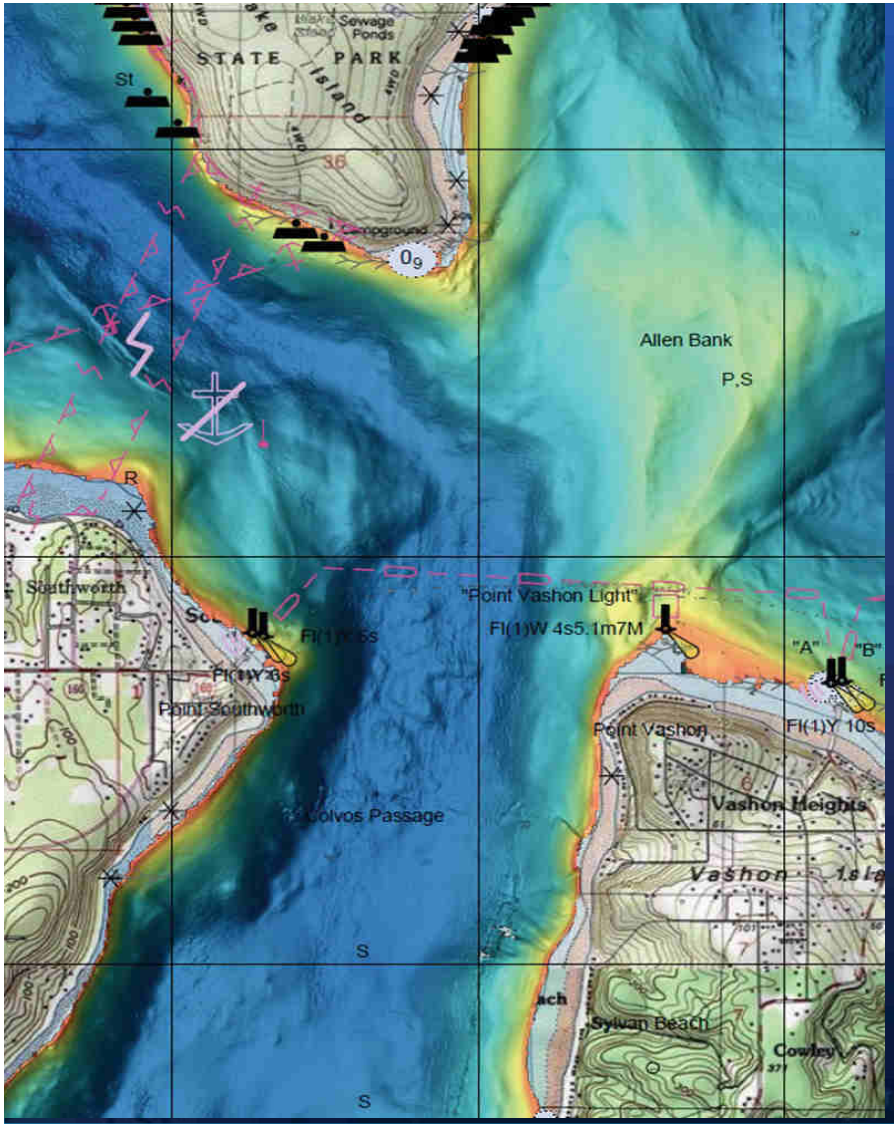
Supporting High-Velocity Data Streams

Tracking, Monitoring and Alerting

Collapsing the time from measurement to decision-making


From Oceanic to Coastal Multi Dimensional analysis
West Siberia
East Siberia
ARCTIC OCEAN
GREENLAND (DENMARK)
BAFFIN BAY
POND INLET
Monitoring a complex environment

S-100 is opening the door
to all these possibilities.
Enabling HOs to evolve to
Hydrospatial agencies
under a common framework



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

esri THE SCIENCE OF WHERE