

# CARIS Hydrographic Production Database (HPD) for Inland ENC and Inland Paper Chart Production

By Juan Carballini

9<sup>th</sup> IEHG Meeting  
Chongqing, People Republic of China  
October 2011

# Summary

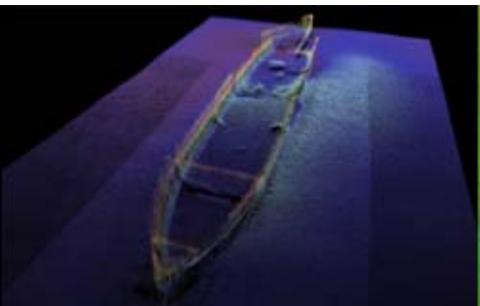
- Over 30 Years in the GIS Software Development Business
- Successful CARIS installations in over 85 countries
- 170 employees in total between Canada, Netherlands, USA, Australia and the UK
  - Developers (85), Project Management (5), Sales (10), Marketing (5), Tech Support (35), QA testers (10), General (20)
- Industry leading team of Technical Support professionals with industry experience and academic backing
- 20+ Alliance Companies in other countries
- ISO 9001:2008 certified
- Focused on the use and development of GIS standards
  - OGC, ISO/TC 211, IHO, ONSWG, MSDIWG



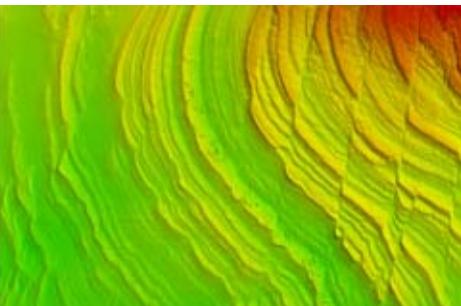
# Ping-to-Chart™ Solution

- CARIS is the only organization able to offer the marine community a complete and streamlined GIS solution from Ping-to-Chart
  - i.e. data processing through to chart production and subsequent distribution of the marine information and chart products
  - Seamless data transfer and interoperability

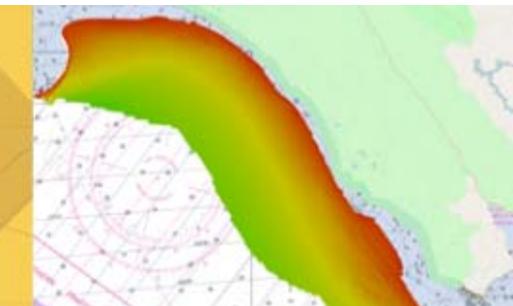
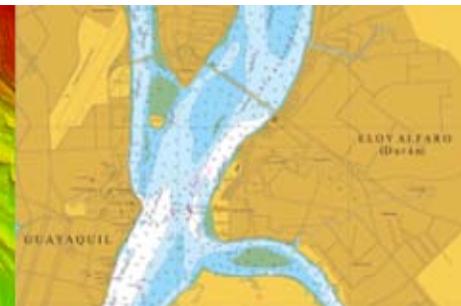
**Processing**



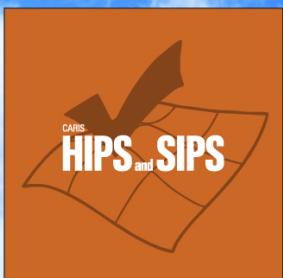
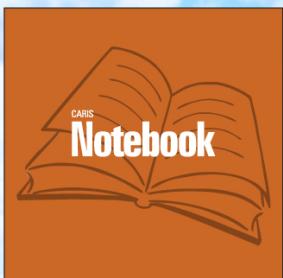
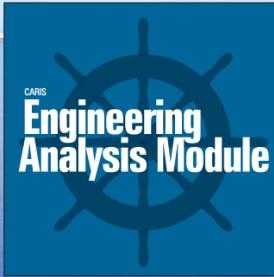
**Analysis**



**Production**

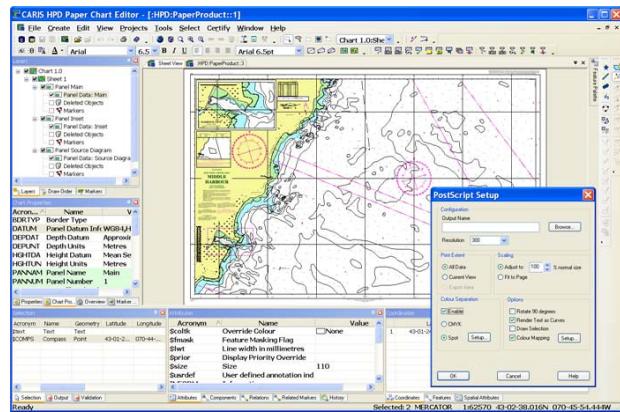
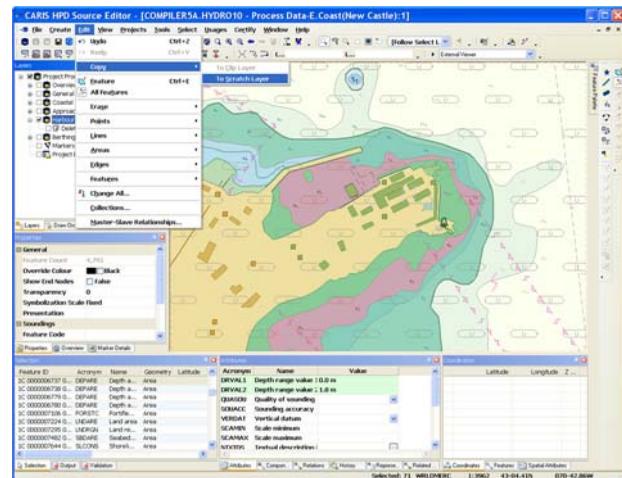


## CARIS Ping-to-Chart Workflow

**PROCESSING****ANALYSIS****PRODUCTION****DISCOVERY****CARIS Notebook****CARIS BASE Editor****CARIS HPD****CARIS Engineering Analysis Module****CARIS LOTS****WORKFLOW MANAGEMENT**

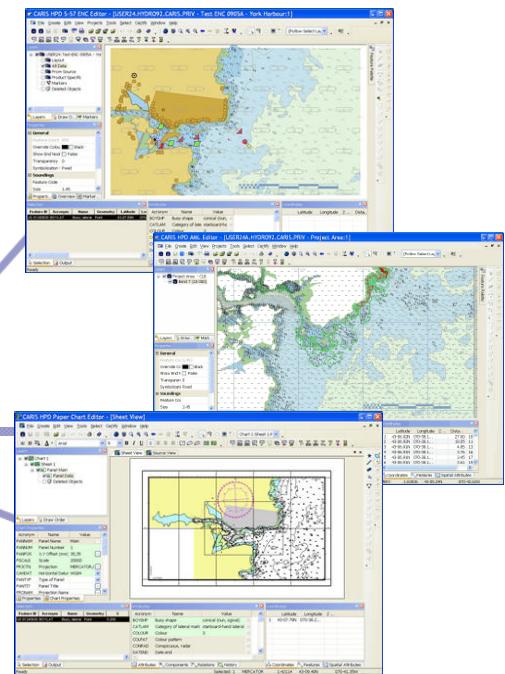
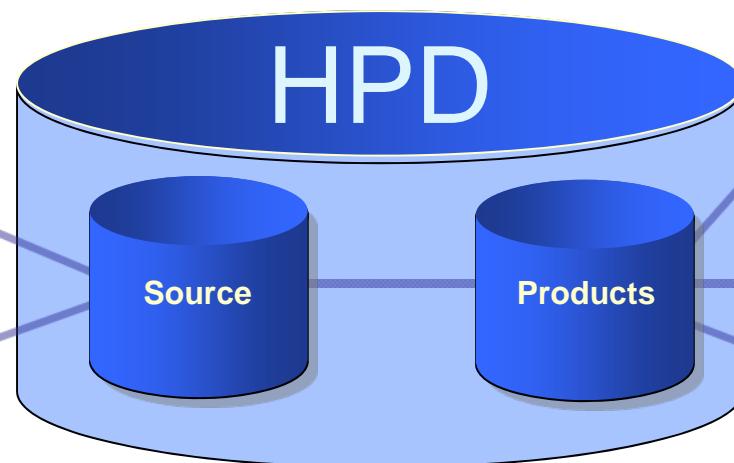
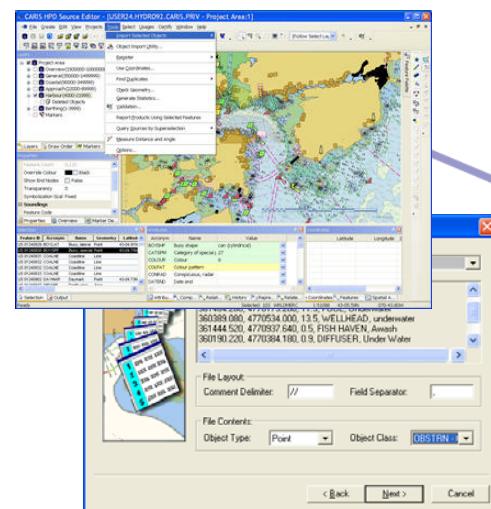
# Introduction: What is CARIS HPD?

- CARIS HPD is a new suite of software to
  - manage digital hydrographic and other data
  - store this in an efficient, integrated database driven environment
  - support multi-user access to the data
  - allow single copies of source data features to be maintained
  - generate multiple product types from these source features, including S-57 Electronic Navigational Charts and standard nautical Paper Charts
  - derive and manage products at multiple different scale ranges



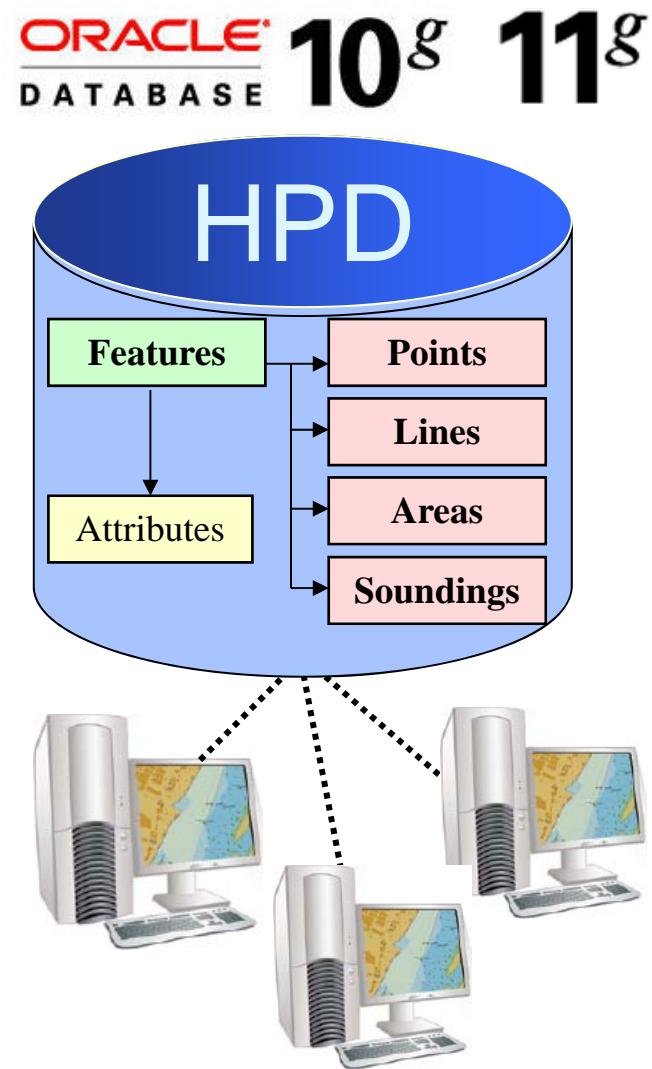
# HPD Theory and Concepts

- HPD databases store “source” and “product” information in one central database server which is accessed simultaneously from multiple client computers
  - one feature can be represented in many products
  - update features in the source only once
  - automatic product updating



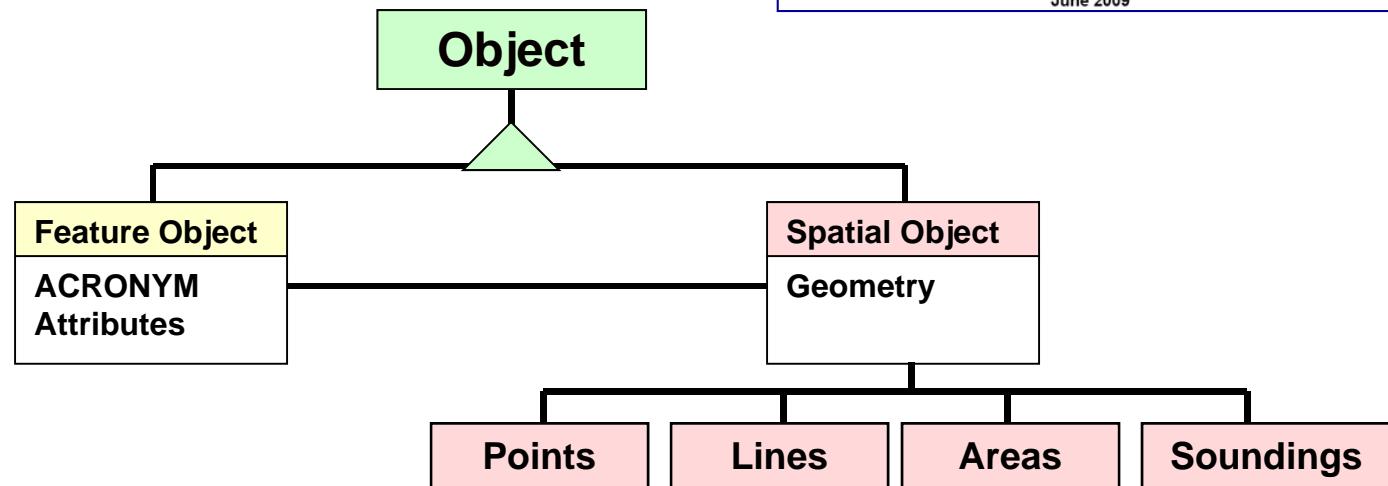
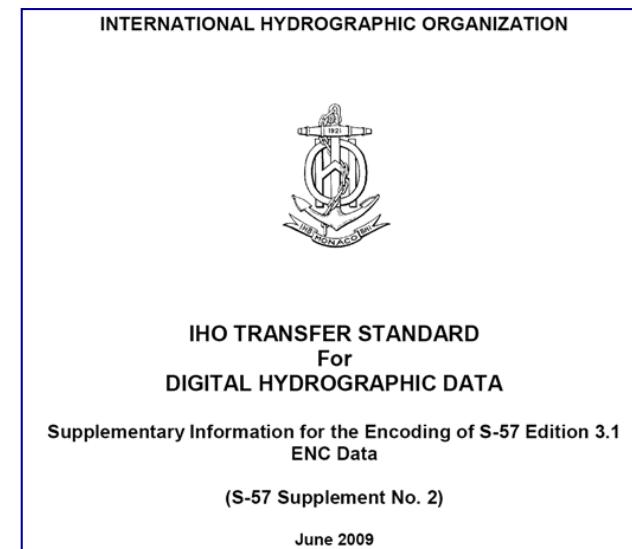
# HPD Data Storage

- All data – geometry and attributes – is stored and maintained in Oracle
  - world's leading database management solution
  - HPD uses no special data structures
  - client-server environment
  - multi-user data access
  - security and access to tasks and data
  - separation of data from presentation
  - separation of data from software applications
  - can use Oracle backup and restore capabilities
- There are no sets of separate data files to manage with CARIS HPD



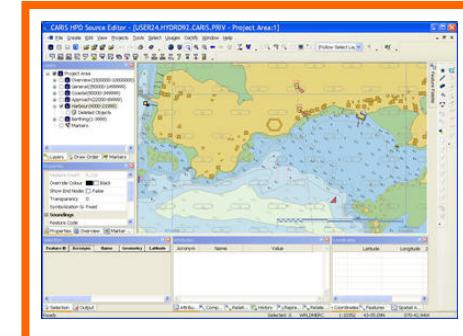
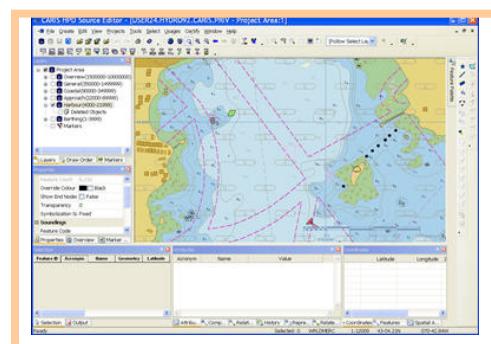
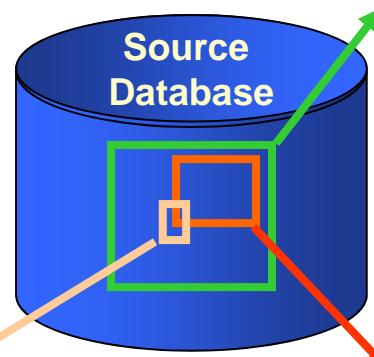
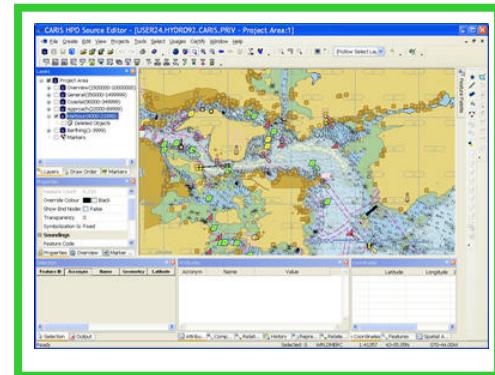
# HPD S-57 Data Model

- Object oriented design based on the internationally adopted S-57 and DIGEST Standards
- Stores real world entities as “objects” having a
  - “Feature object” component: descriptive details
  - “Spatial object” component: positional information



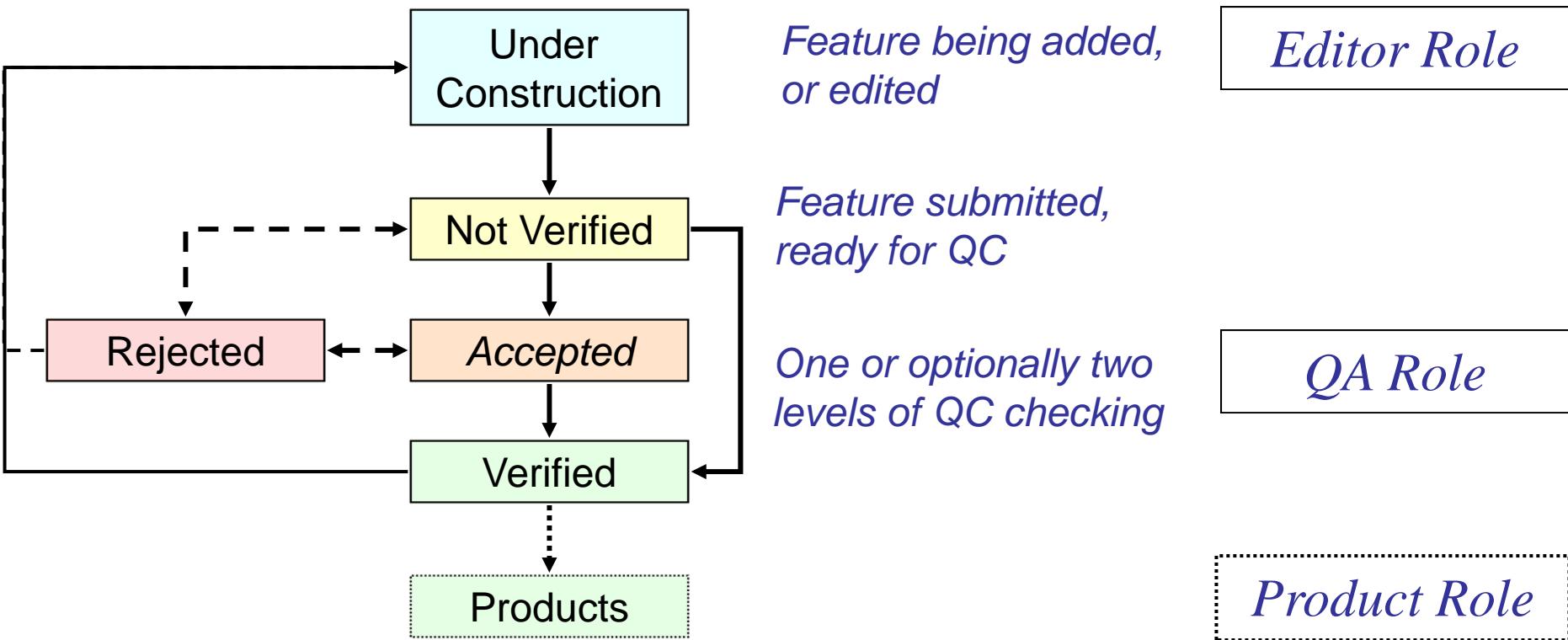
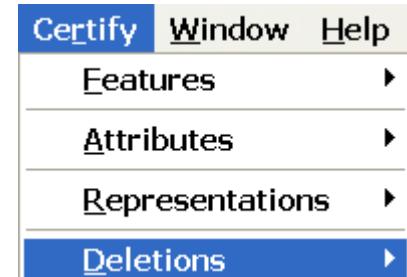
# HPD Database Access & Coverage

- Access database features by a graphical interface
- Multi-user concurrent access
  - access and edit features in the same geographic area
  - individual objects are locked during editing
- ‘Seamless’ coverage
  - no file/chart boundary limitations



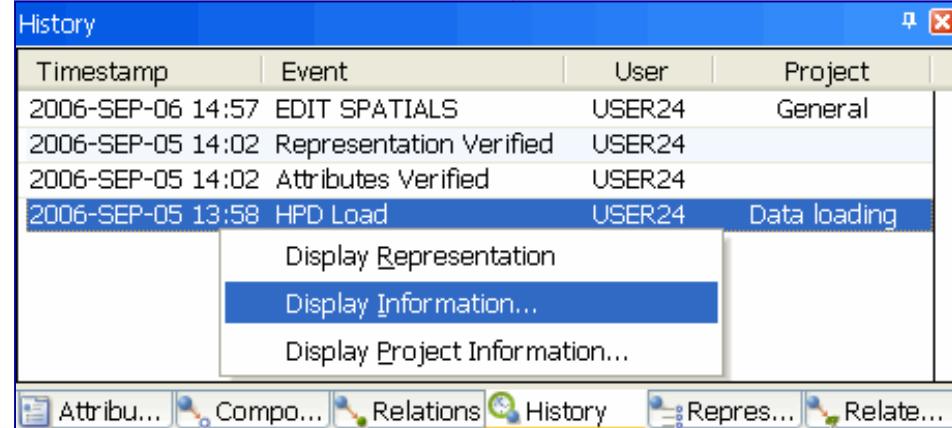
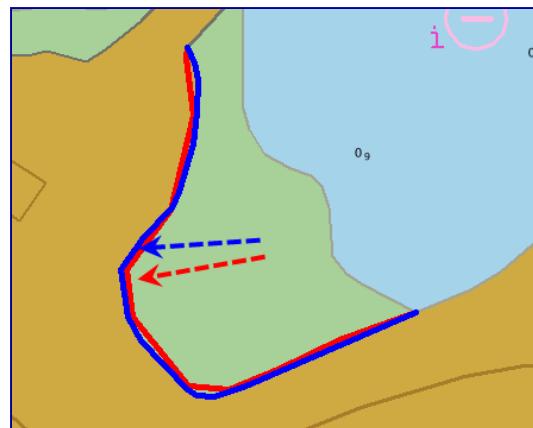
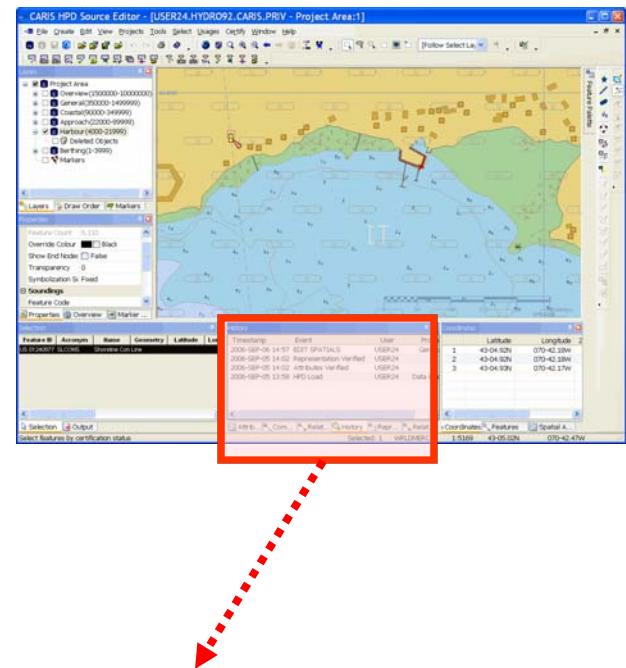
# HPD Feature Certification

- All HPD features have a certification status, used to track changes, and in quality assurance
  - “Roles” control what functions a user can perform



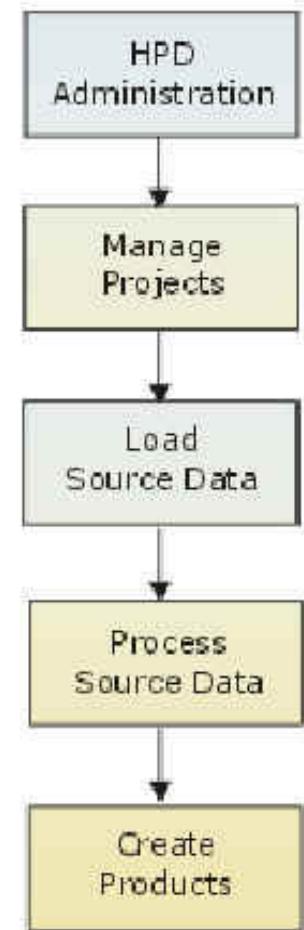
# HPD Feature History

- Feature change tracking history
  - The history of changes to all source and product features is tracked
  - All changes are stored: spatial, attribute, relational, ...
  - HPD records the time, associated user and project names in the history
  - Deleted objects are *not* removed from the database, and can be viewed later



# HPD Programs & Workflow

- 1: Administration Tools
  - Install software, set up accounts, etc.
- 2: Project Manager
  - Create and manage “Projects”
- 3: Data Import Options
- 4: Source Editor
  - Add, edit, delete source data
  - Assign new feature representations
  - Certify features
- 5: Product Creation: ENC, Paper Chart ...
  - Create new product, then export
  - Update with modified source data
  - Create product updates





# HPD Administration Tools

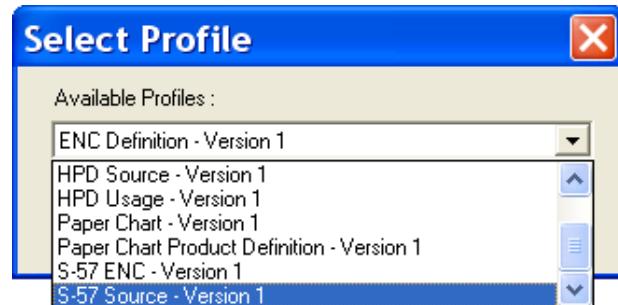
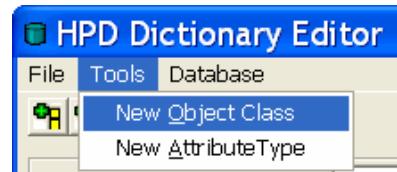
- Administration Tools are used to manage
  - user accounts and their associated roles
  - database usages and scale bands
  - the object and attribute dictionary and its customization

The screenshot displays four windows from the HPD Administration Tools:

- User Manager**: Shows a list of users (ADMIN24, BROWSER24, PROJECT24, USER24) with their agency and subagency names. It includes sections for Role Management and Available User Roles.
- Edit Usages**: A dialog box showing a list of usages: Berthing(1-3999), Harbour(4000-21999), Approach(22000-89999), Coastal(90000-349999), General(350000-1499999), and Overview(1500000-10000000). Buttons for Add Usage, Insert Usage, and Delete Usage are at the bottom.
- Usage Attributes**: A dialog box with fields for MAXSCA (4000), MINSCA (21999), and USGNAM (Harbour(4000-21999)). An "Apply" button is at the bottom.
- HPD Dictionary Editor**: A main window for managing the object and attribute dictionary. It shows a list of entries under "Attribute" view, including Acronym and Name columns. The "Acronym" column lists categories like CATCHP, CATCDA, CATCON, CATCOV, CATCRN, CATCTR, CATDAM, CATDIS, CATDOC, CATDPG, CATFIF, CATFNC, CATFOG, CATFOR, CATTRY, CATGAT, and CATHAF. The "Name" column describes them. On the right, there are tabs for General, Type, and Other, and sections for Attribute Type (set to Enumerated) and Possible Values. The "Possible Values" table includes rows for Number (1-6) and Description (steep coast, flat coast, sandy shore, stony shore, shingly shore, and a placeholder entry).

# HPD Object Catalogue Management

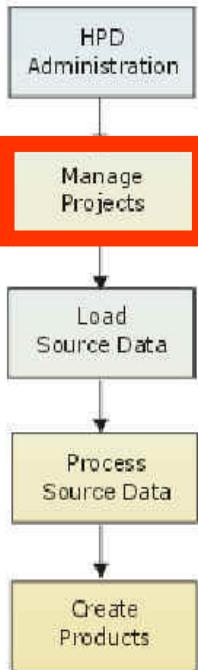
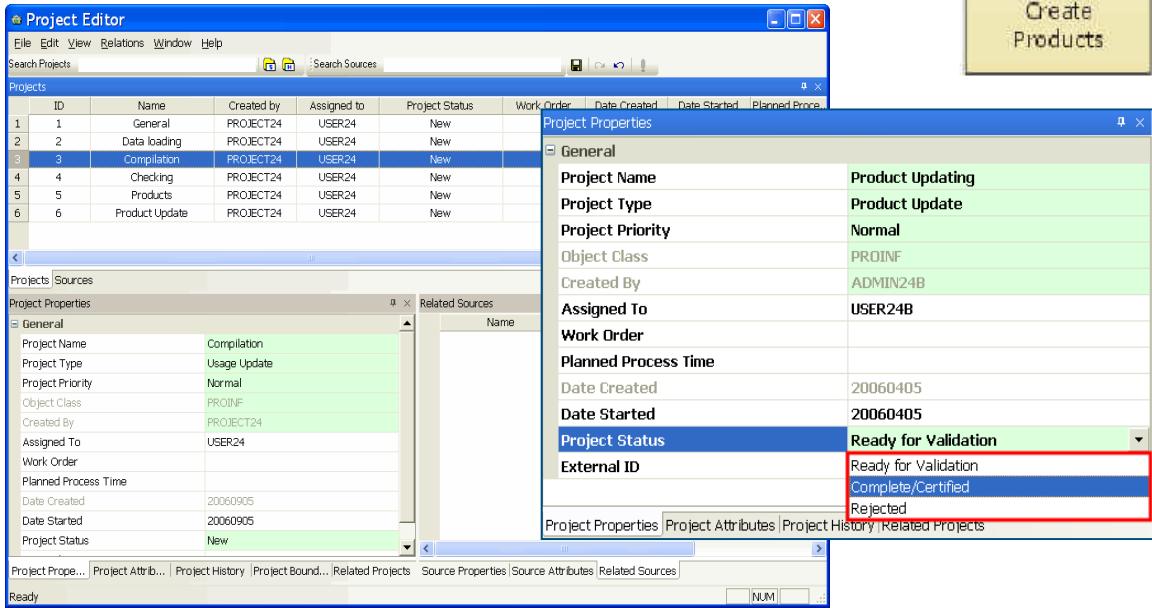
- The HPD object model allows the dynamic addition of new objects, attributes and values
- Changing the object catalogue can be done by users without changing the software or database model
- Multiple “profiles” can be created to link specific sets of objects and attributes
  - e.g., ENC and chart products have their own separate profiles





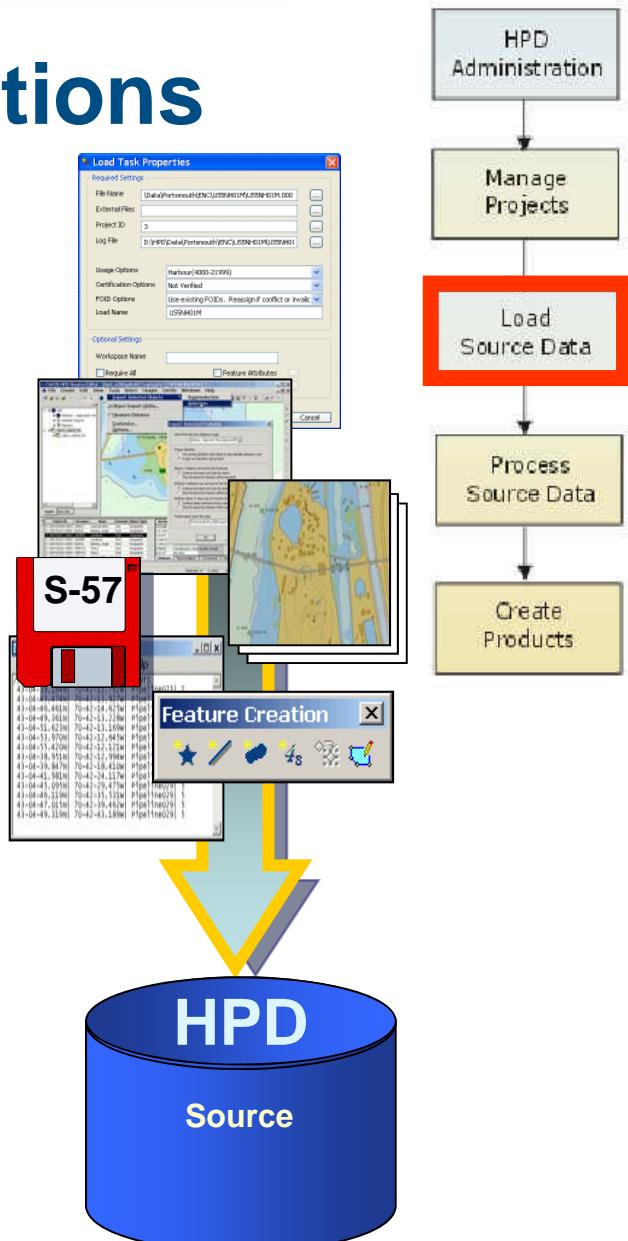
# HPD Project Editor

- HPD “Projects”
  - HPD workflow is managed using “Projects” & “Sources”
  - Projects are used to track workflow, and may be associated with specific Sources
  - All HPD transactions are associated with Projects



# HPD Data Import Options

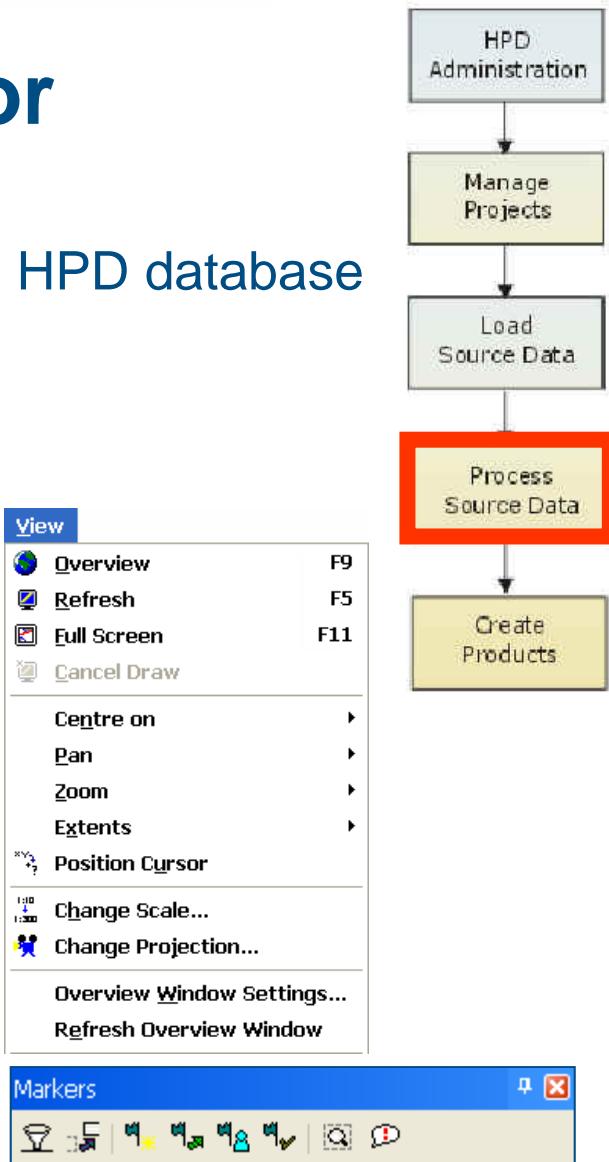
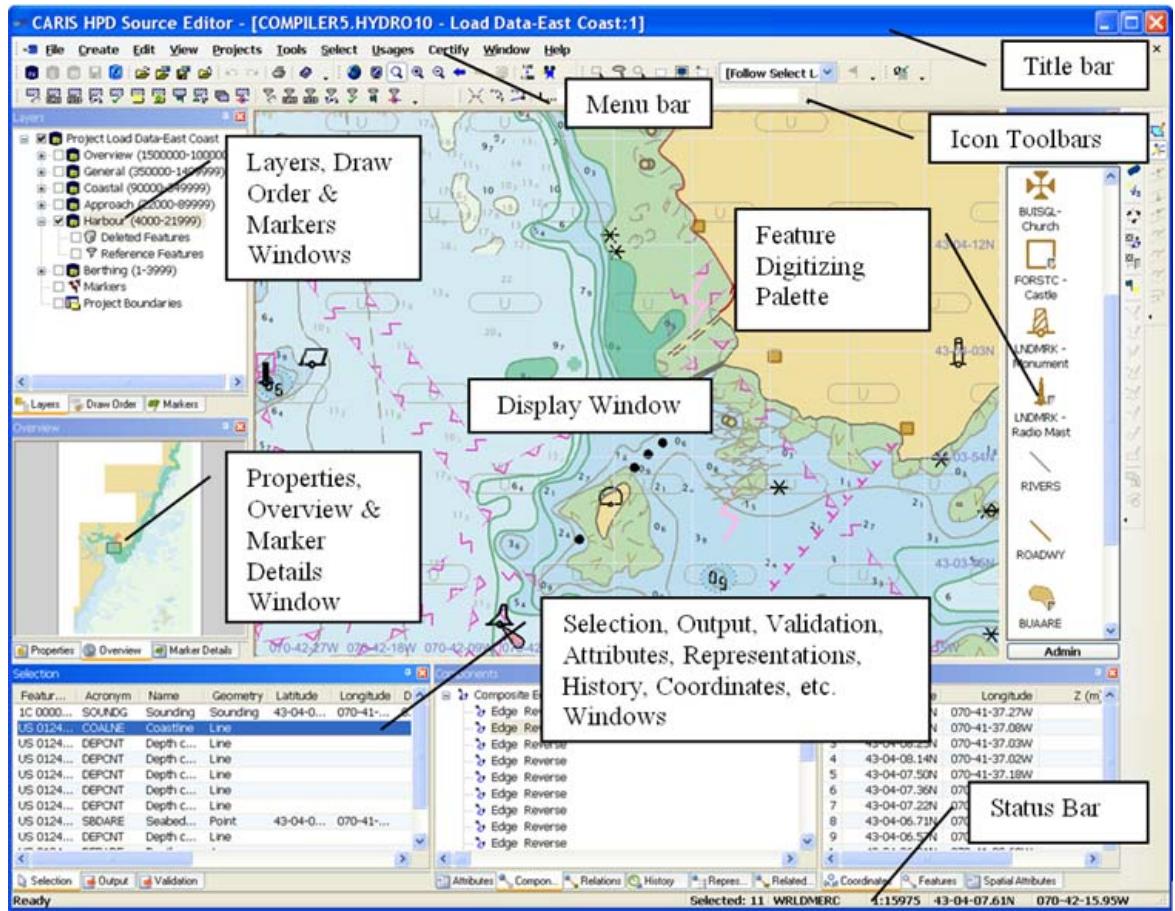
- HPD Batch Data Loader program
  - Load S-57 format data: S-57 ENC, IENC, AML or Stand-alone (S-57) HOB
- HPD Editor programs – interactive import
  - Text/SHP Files, ODBC sources
  - Selected S-57 objects
  - Vector features from CARIS, DGN, SHP, DWG, DXF, VPF, ... files
- Data not in S-57 format
  - Feature mapping options: e.g., CARIS file to S-57, DNC-ENC, ...
  - On-screen digitising, line following, raster-to-vector, ...





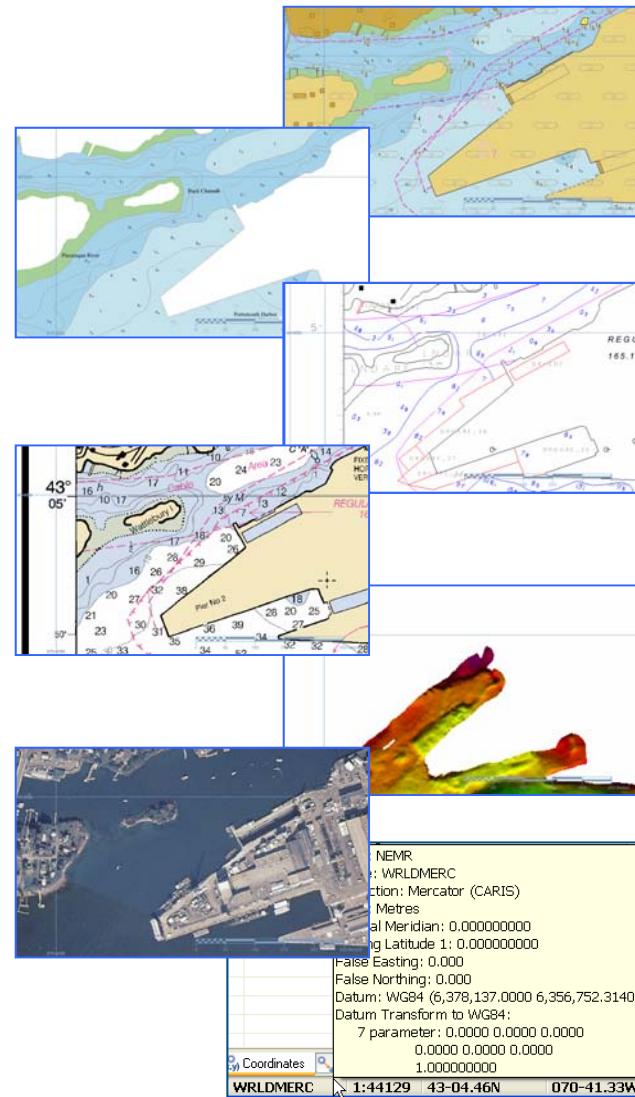
# HPD Source Editor

- Provides a graphical view of the contents of an HPD database



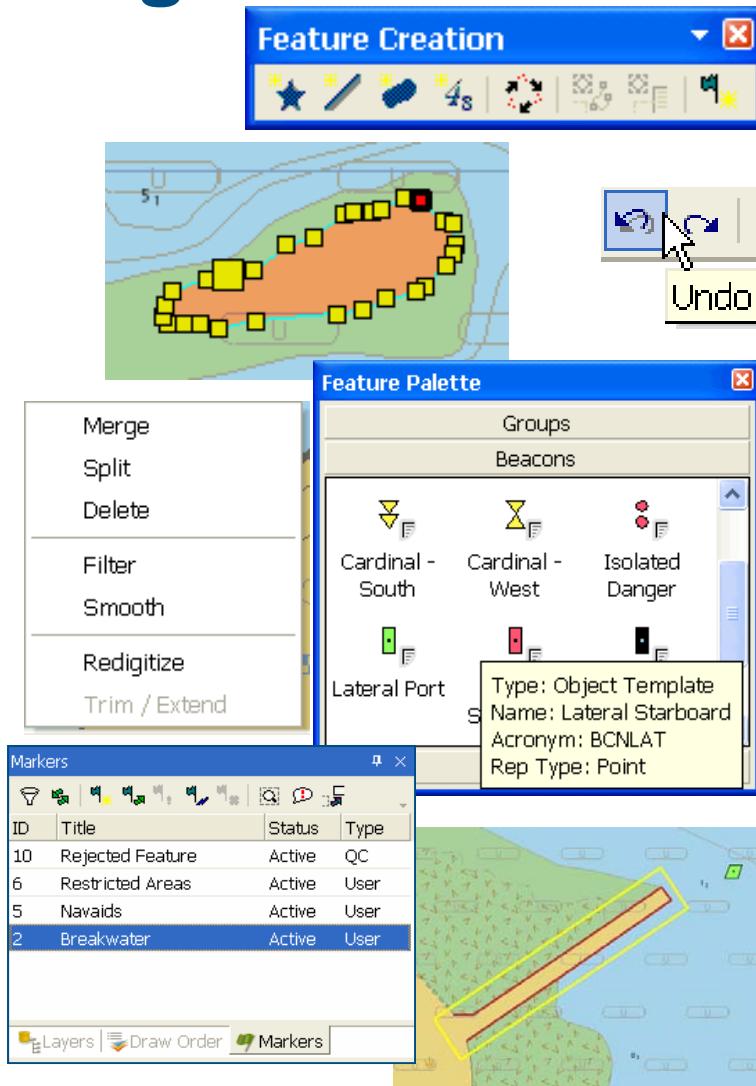
# View External Data Files in HPD

- Other data files can be viewed with an HPD database directly, *without* importing or converting the data files
- Vector data formats include
  - S-57/ENC, Standalone HOB, VPF
  - CARIS, DGN, SHP, DWG, DXF...
- Raster data formats include
  - GeoTIFF, TIF/TFW, MrSID ...
  - BSB and HCRF raster charts
- Change the viewing coordinate system
  - Data is reprojected on the fly



# HPD Digitizing & Editing Tools

- Source Editor has tools to *digitize* new features manually
- Geometries and attributes of existing features can be *edited*
- GIS-like tools to perform operations like intersection, clip, split, merge ...
- Continuous *topology* is maintained automatically
- Add “markers” to features to store processing/QC notes





# HPD Quality Control Tools

- Data entry checks
- Geometry checking tools
- Validation checks
- S-58 QC tools
  - help ensures data integrity
  - can be customised by users
    - E.G: IENC recommended validation test

**Beacon, lateral (BCNLAT) Attributes**

Acronym	Name	Value
BCNSHP	Beacon shape	lattice beacon
CATLAM	Category of lateral to preferred channel to sta	
COLOUR	Colour	
COLPAT	Colour pattern	
CONDTN	Condition	
CONRAD	Conspicuous radar	

**Check Geometry**

Dangles

Overshoots

Tolerance  m on the ground

Undershoots

Tolerance  m on the ground

Straight Line

Nearest Edge

Export to File

OK  Cancel

**Validation Checks**

Validation Check	Description
Duplicate Objects	Check for duplicate objects.
Prohibited Objects	Check for prohibited objects.
Prohibited Primitives	Check for prohibited primitives.
Conditional Attributes	Check conditional attributes.
Invalid Attributes	Check for invalid attributes.
Mandatory Attributes	Check for mandatory attributes.
Prohibited Attributes	Check for prohibited attributes.
Adjacent Areas	Check for adjacent areas.
Points Inside Areas	Check for points inside areas.
Lines Bordering Areas	Check for lines bordering areas.
Lines to Merge	Check for lines to merge.
Duplicate Edges	Check for duplicate edges.
Edges to Merge	Check for edges to merge.
Intersecting Edges	Check for intersecting edges.
Overlapping Edges	Check for overlapping edges.
Self-crossing Spatial	Check for self-crossing spatial.
Feature with Duplicate Vertices	Check for feature with duplicate vertices.

Validation report:  ...

Large Icons  Small Icons  Details

**Output**

===== BEGIN: Soundings And Related Areas Test ===== 2006-09-13 15:44:45 =====

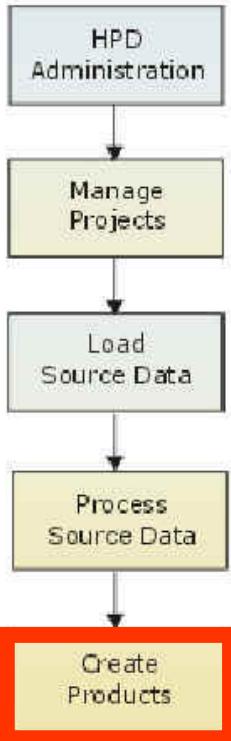
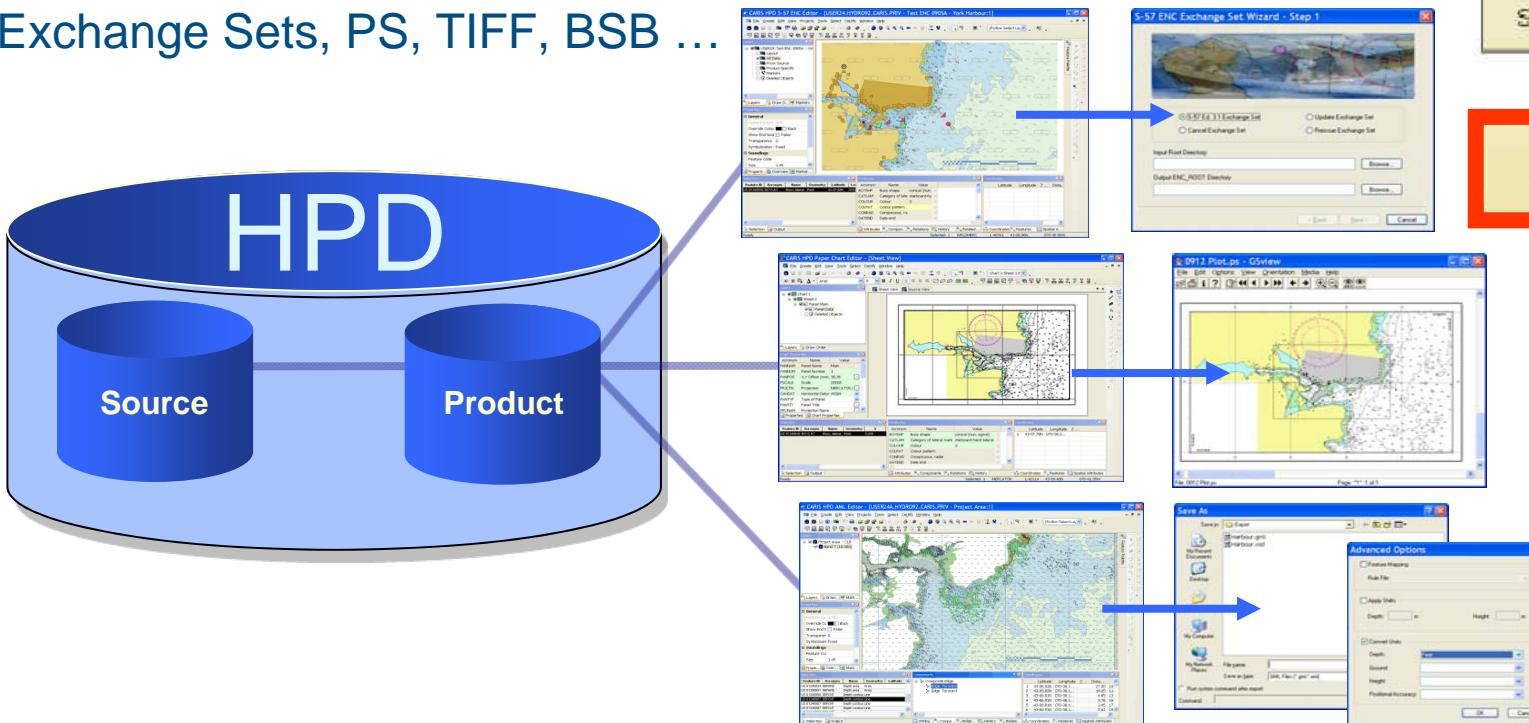
1 error found.

Test Id: 20,254  
Warning Level: WARNING  
Message: DEPARE or DRGARE object does not contain a SOUNDG feature.  
Reference: Logical consistency.  
Number of Objects: 184  
[\(Select All\)](#)

US 0124088356 02247 DEPARE  
US 0124083585 02247 DEPARE

# HPD Product Creation

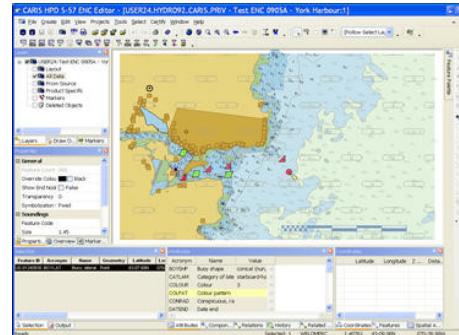
- The HPD data model supports multiple product types generated from the same database features
  - ENC, IENC, AML, Paper Charts, Raster Charts ...
- Export formats
  - Exchange Sets, PS, TIFF, BSB ...



# HPD Product Editor Programs

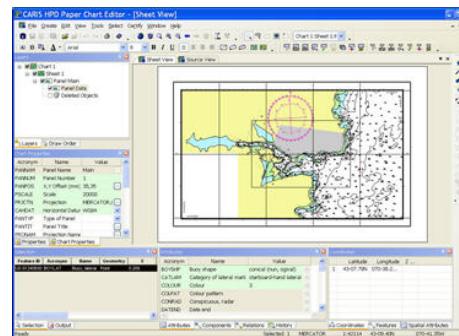
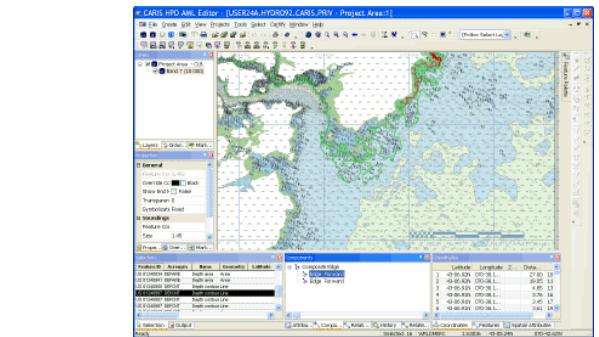
- **Product Editor**

- S-57 ENC: export to S-57 ENC Exchange Sets
- S-57 IENC: export to S-57 IENC Exchange Sets
- S-57 AML: export to S-57 AML Exchange Sets
- Custom products: export to GML



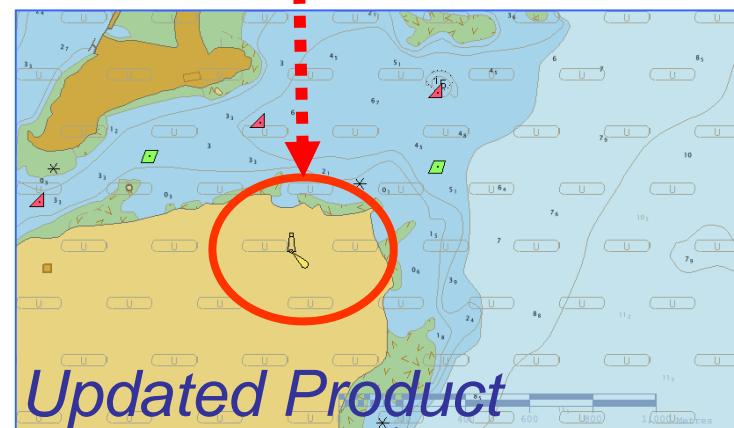
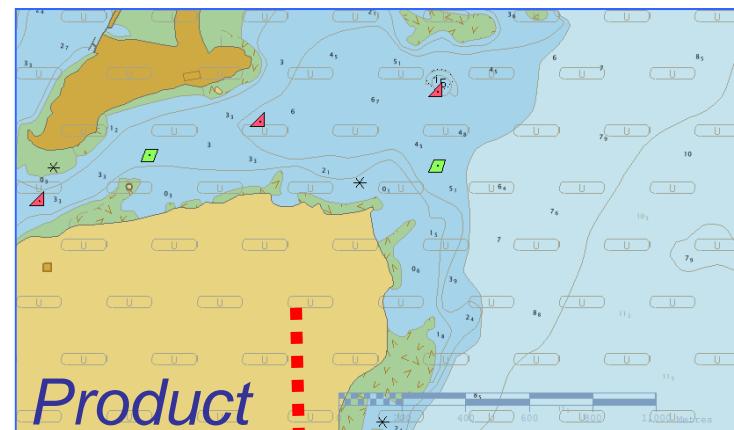
- **Paper Chart Editor**

- Vector charts: export to Postscript or TIFF
- Optional: export raster chart to PS or TIFF
- Optional: export chart to BSB raster chart format



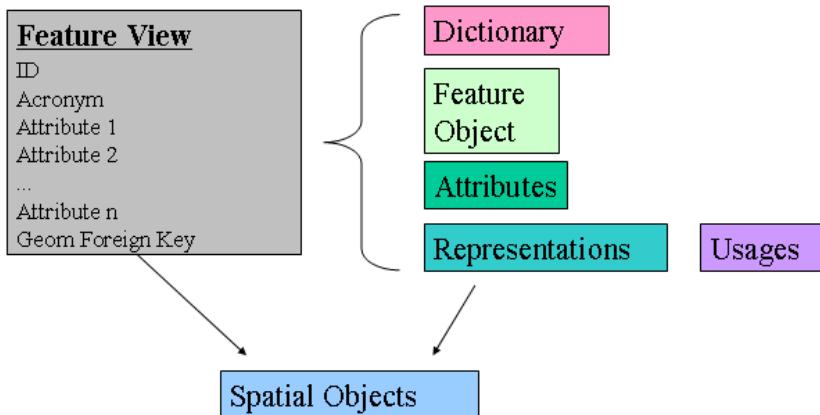
# HPD Product Updating

- Changes made to HPD source features are not reflected instantly in products
- HPD product programs include tools to
  - Automatically compare the Product to Source looking for the latest verified changes
  - Apply all or user-selected new, updated or deleted features
  - Complete and check the updated product
  - Export the product as an update

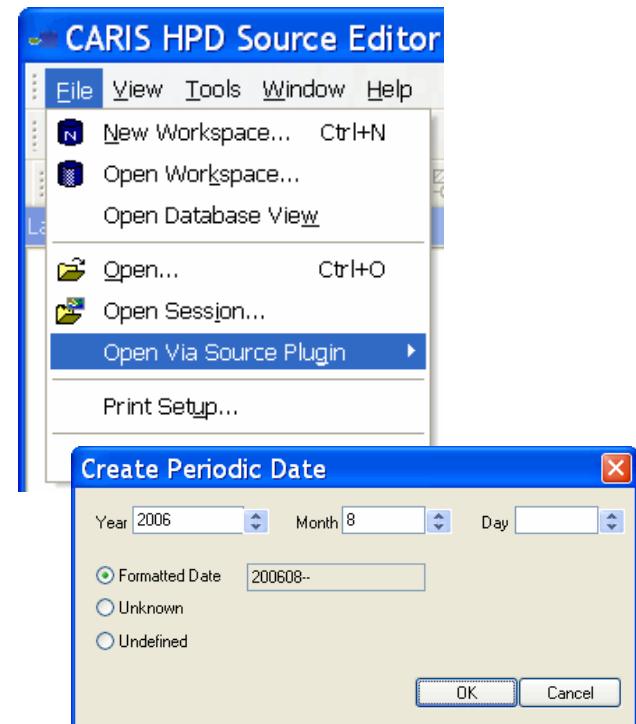


# HPD API

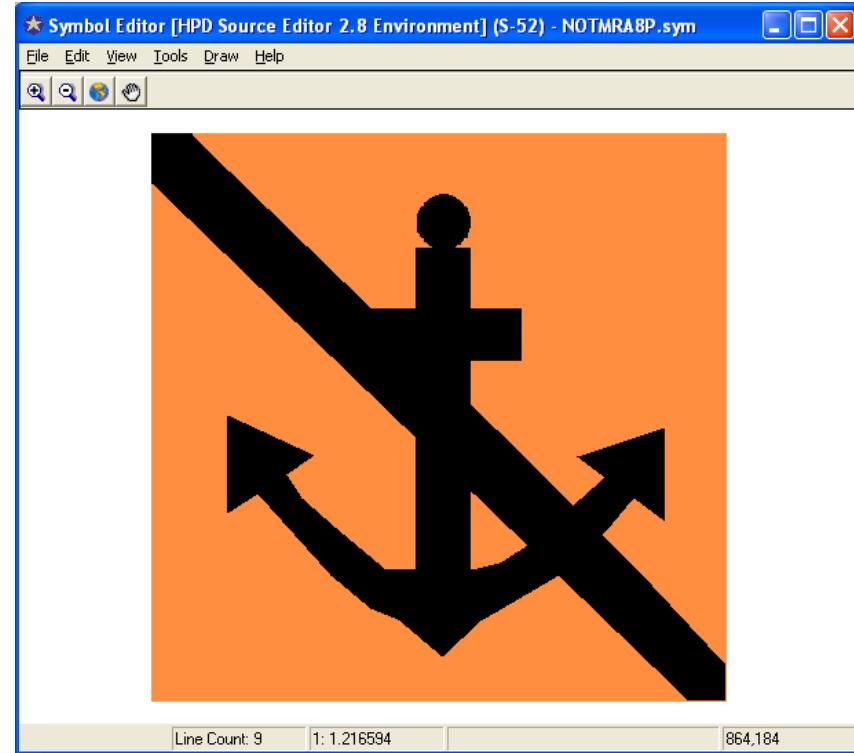
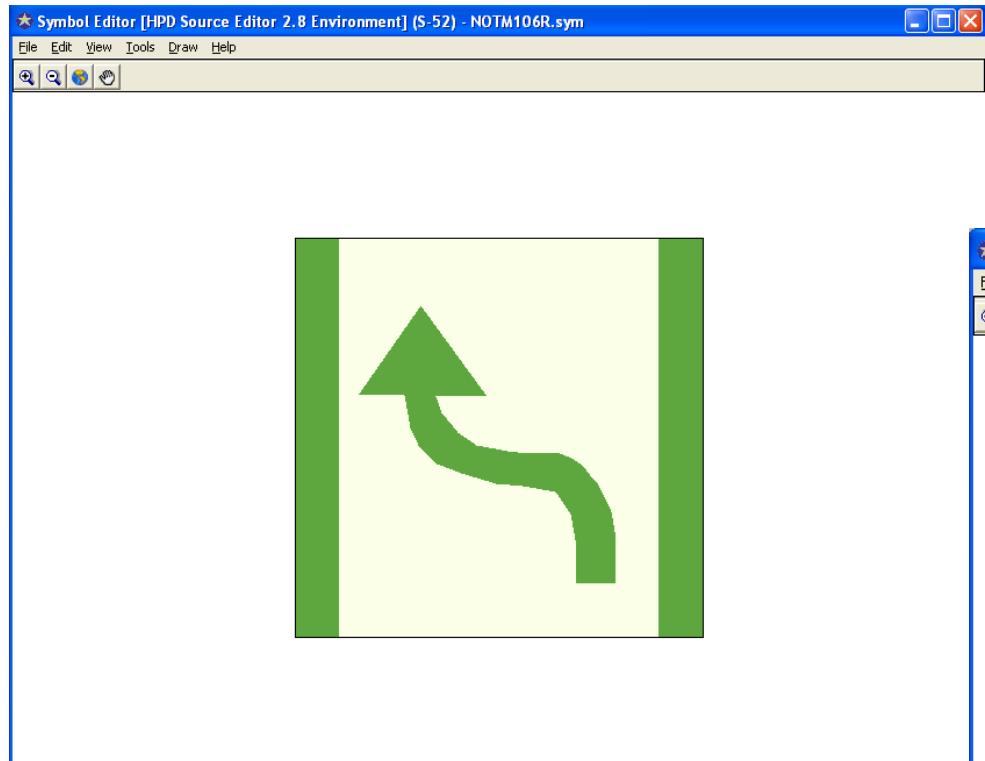
- HPD Application Programming Interface (API)
  - Database interface allowing client/integrator to access and update database, e.g., to integrate with an existing workflow management system
- Application interface
  - Allows 3<sup>rd</sup> party plug-ins to developed
  - Plug-ins can be integrated in HPD



Name	Type	Description
ADDENCDEFINITION	Function	Adds an S57 ENC product definition
ADD_SOURCE_EXTRACTION	Procedure	Adds a new S57 ENC Source Extraction
GET_PRODUCT_UPDATES	Procedure	Information regarding the ENC product updated for a given source project
GET_PENDING_UPDATES	Procedure	Information regarding updates that are pending for a given ENC product
GET_APPLIED_UPDATES	Procedure	Information regarding the updates that were applied to a ENC product
GET_REJECTED_UPDATES	Procedure	Information regarding the updates that were rejected for an ENC product
ENC_VIEW	View	List of S57 Products defined on an HPD Server



# HPD Symbol Editor – S-52 and INT1



Line Count: 9 1: 1.216594

864,184

# HPD User Community

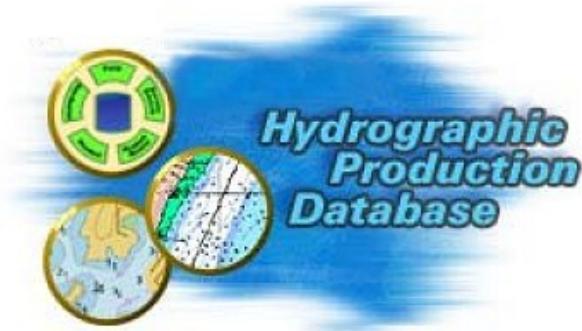
- NAVO
- US NGA
- United Kingdom Hydrographic Office
- Canadian Hydrographic Service
- Royal Australian Navy (evaluation)
- IIC Technologies
- Belgium Hydrographic Office
- Chilean Hydrographic Office
- Brazilian Hydrographic Office
- Ecuador Hydrographic Office
- Land Information New Zealand
- Taiwan Hydrographic Office
- BSH Germany
- Venezuelan Navy
- Argentinean Navy
- Royal Netherlands Navy
- Portuguese Hydrographic Office
- Mexican Navy
- Peruvian Navy
- Maritime Safety Admin. China
- SHOM France
- Port of Hamburg Germany
- KHOA, Korea
- NHO India
- Panama Canal Authority

# Optional HPD Modules

- Publications Module
  - Currently in development to streamline the production of Notices to Mariners (NtM) booklets, Lists of Lights, etc.
    - To be released with HPD 2.9 Service Pack 1 (4<sup>th</sup> Quarter 2011)
  - The Publications Module for HPD will provide capabilities to maintain and produce the NtM Booklet, containing:
    - NtMs (chart announcements and corrections, permanent, temporary and preliminary)
    - Light list corrections
    - Corrections to Publications
    - Navigational Warnings
    - Corrections to Radio Signals

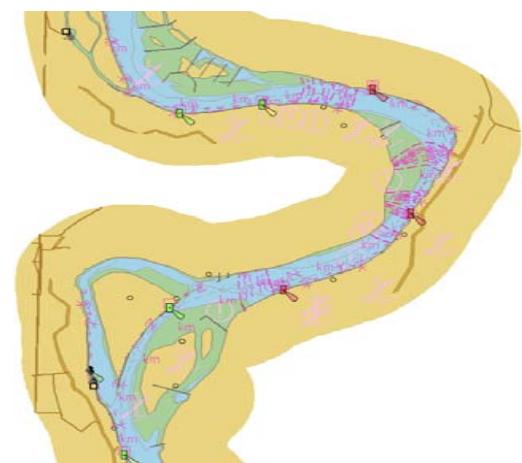
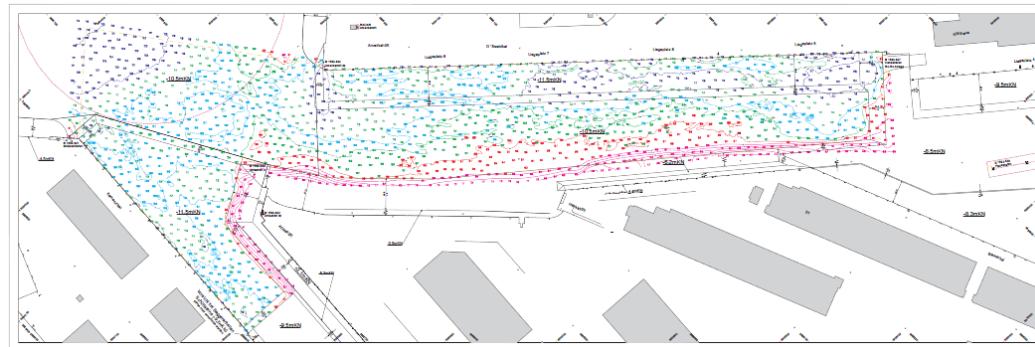
# CARIS HPD Summary

- All data is stored and maintained in Oracle
  - open data structure, use Oracle backup/restore
- Multi-user database allowing concurrent access
  - no concurrent file/chart limitations
- No duplicate objects
  - supports multiple representations on different usages
- All changes are tracked and a history maintained
  - projects are used to manage workflows
- Source features and products are integrated
  - allows for automatic product update
- Data model supports multiple product types
  - ENC, IENC, AML, Paper Charts, Raster...



# CARIS in Waterway Environments

- Port of Hamburg, Germany
  - Port of Hamburg Authority
- US Inland Waterways
  - USACE and IIC Technologies

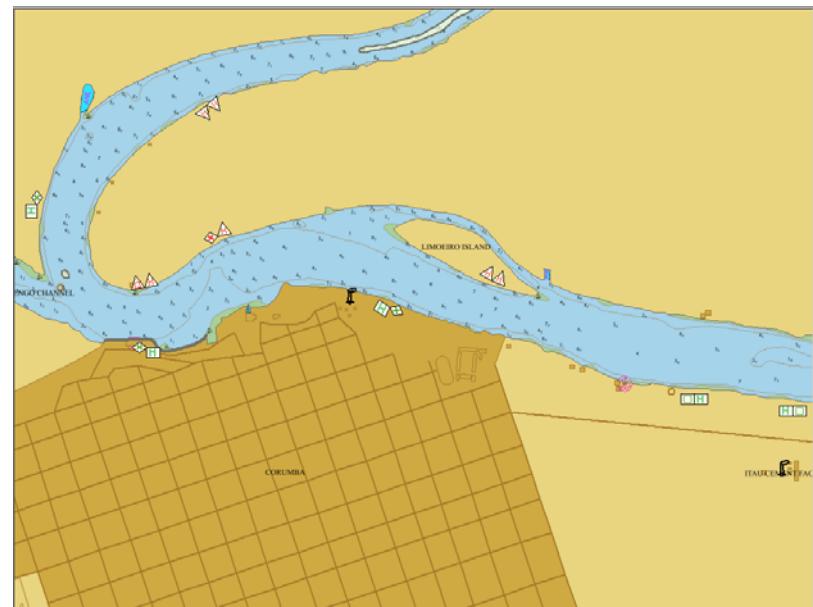
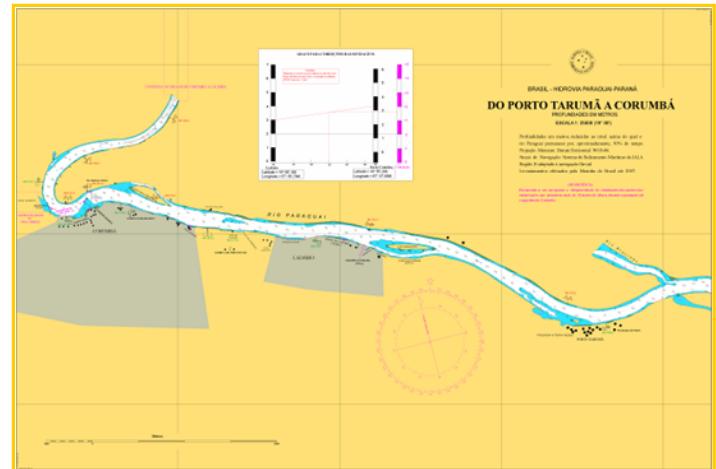


# CARIS In Waterway Environments

- Saint Lawrence Seaway,  
Canada
  - Canadian Hydrographic  
Service (CHS)
- Dutch Inland Waterways,  
The Netherlands
  - Rijkswaterstaat (RWS):  
The Dutch Ministry  
of Transport, Public  
Works, and Water  
Management

# Brazil: Project Paraguay – Parana Waterway

- 1832 KM
- Inland ENC 2.2
  - 200 charts
- Paper Charts

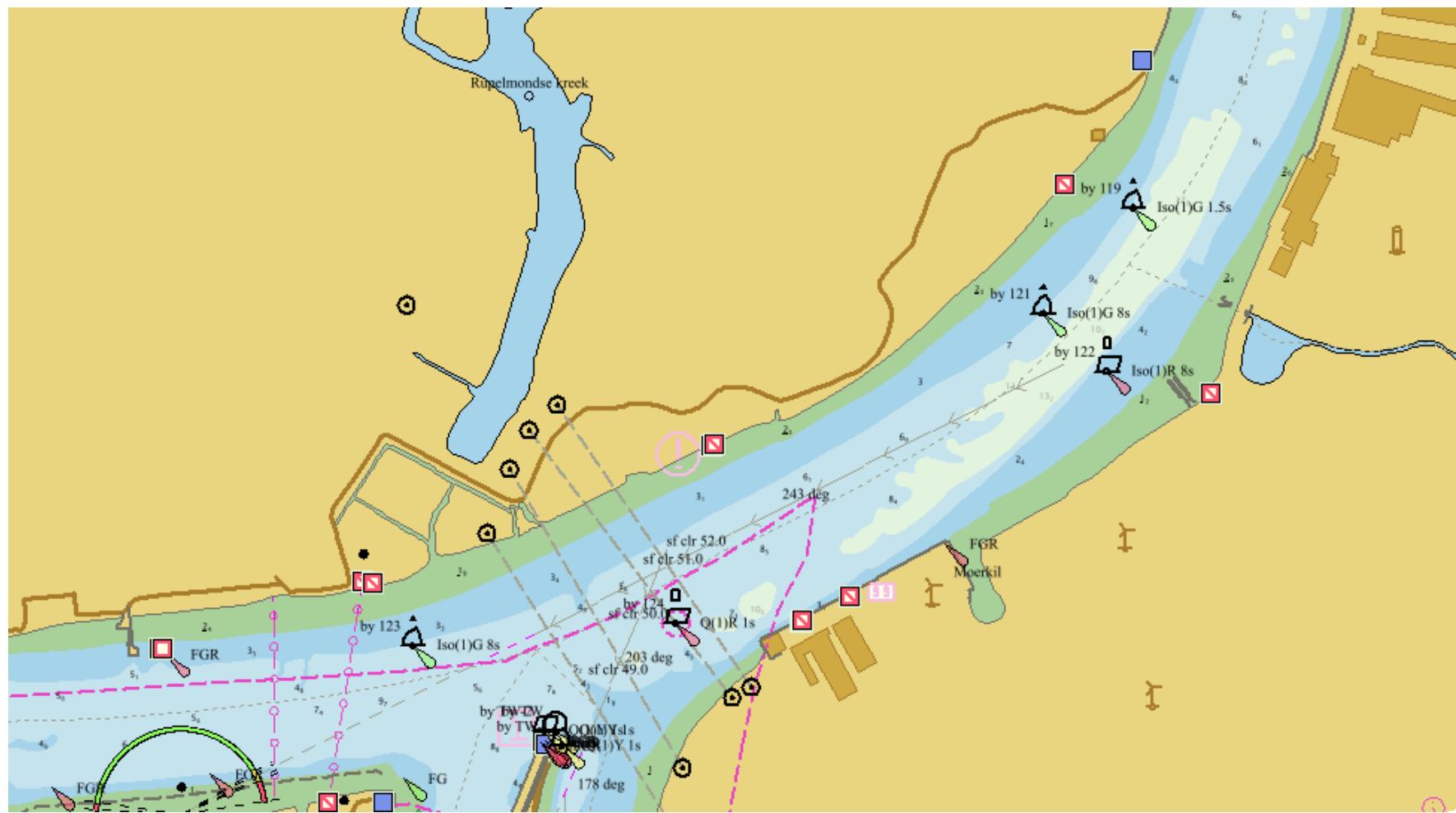


# Flemish Hydrography (Belgium)

- ENC's
- Inland ENC's
  - IENC 2.3
  - IENC Specific Validation tests
- Paper Charts
- High Density Bathymetric Electronic Charts
- Paper Survey Plans



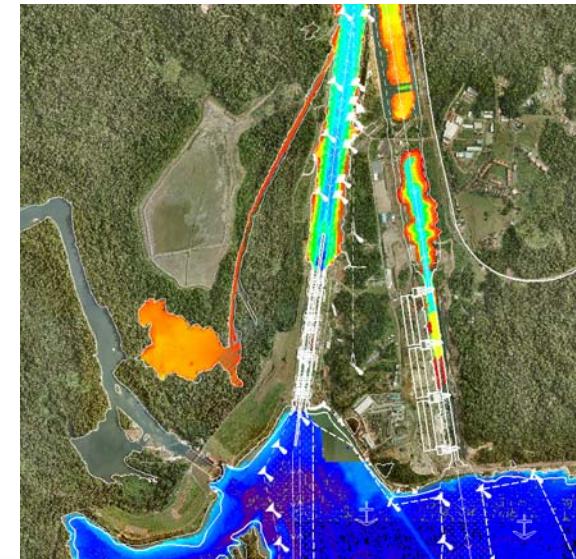
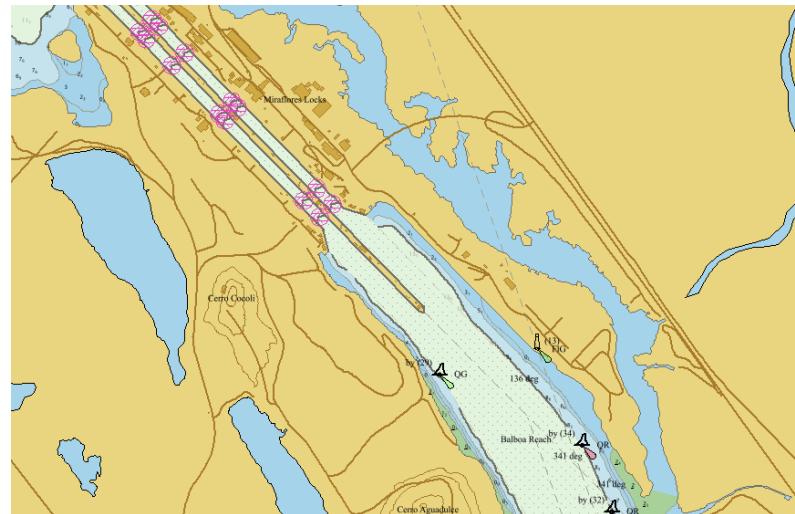
# Flemish Hydrography (Belgium)



Antwerp area, Belgium, IENC 2.3

# Panama Canal

- IENCs and ENCs
- Paper Charts
- Customized Products
  - Pilot Handbooks
  - Hydrographic charts





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