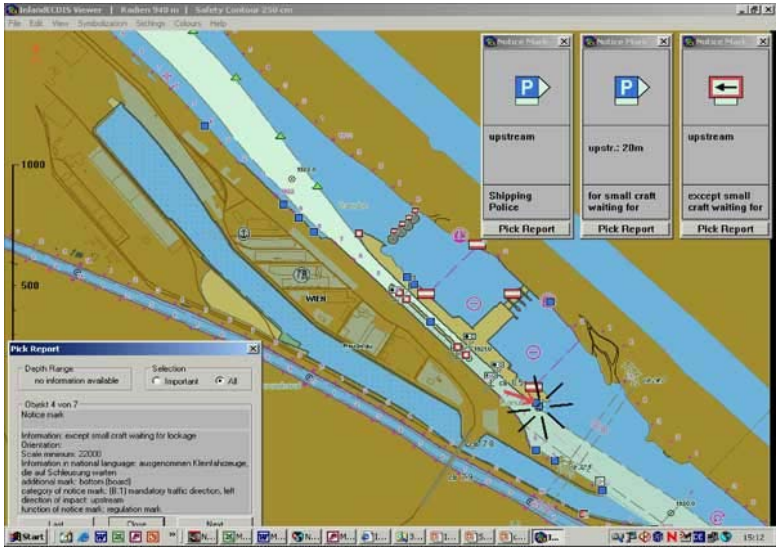

Inland ENC

Inland ENC
Harmonization Group

Content

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Inland waterways

- Maritime navigation is governed by worldwide regulations of IMO, e.g. COLREG
- Inland waterways (e.g. Mississippi, Amazon, Rhine, Danube, Volga, Yangtze, and all smaller navigable rivers and lakes) have specific features and specific regulations (specific signals, markings, and traffic rules, groins, groundsills, revetments, …)

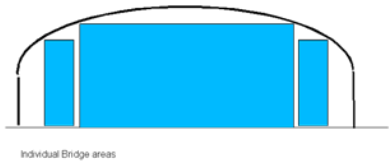
- The lower parts of the big inland waterways are used by both inland and maritime vessels
- Inland ENCs need to meet the requirements of inland waterways, but should also be available for maritime vessels

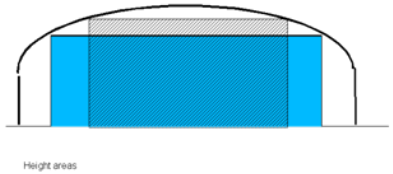
The need for Inland ENCs

- Waterborne traffic on inland waterways is not regulated by COLREG or SOLAS, but by regional or national regulations:
  - Europe: European Code for Inland Waterways (CEVNI) of the United Nations
  - USA: Code of Fed. Regulations 33 CFR
  - Russia: Rules of navigation along the inland waterways of RF
  - Brazil: a set of national and regional regulations
  - China:
  - South Korea:
- These regulations contain specific waterway signals, signs and markings

Why are ENCs not sufficient?

- Objects such as bridges can only be encoded in a very basic form for maritime ENCs, but are extremely important for inland navigation
- In inland navigation it is normally not possible to take another route, if there is a problem on the original route: detailed information is critical for voyage planning (e.g. dimensions and operating hours of locks and movable bridges)





Definition of Inland ENC

the database, standardized as to content, structure and format, for use with inland electronic chart display and / or information systems operated onboard of vessels transiting inland waterways. An IENC is issued by or on the authority of a competent government agency, and conforms to standards [initially] developed by the International Hydrographic Organization (IHO) and [refined by] the Inland ENC Harmonization Group. An IENC contains all the chart information necessary for safe navigation on inland waterways and may contain supplementary information in addition to that contained in the paper chart (e.g. sailing directions, machine-readable operating schedules, etc.) which may be considered necessary for safe navigation and voyage planning. [IENC Encoding Guide, Edition 2.2, Feb 2010]

The S-57 → S-100 approach

- Inland ENCs are similar to ‘maritime’ ENCs, with a few exceptions:
  - Use of S-57 object classes, attributes and attribute values, as much as possible
  - Introduce new combinations of existing elements, when necessary
  - Include new features, attributes or enumerations, if necessary
- Prior to the adoption of S-100, it was necessary to assign small case acronyms for S-57 object classes that were used with additional or new attributes/enumerations and for new elements
- Small case elements will be replaced by elements from the HYDRO and the IENC domains in a future Product Specification, which will be based on S-101

Copied and new elements

- The S-57 attribute VERDAT (vertical datum) only contains enumerations for vertical datums for maritime navigation
- In inland navigation there are different vertical datums in use (e.g. , Ohio River Datum, Russian Project Water Level, Reference Low water Level of Danube Commission, etc.)
- Inland ENCs contain a copied attribute “verdat” with these additional enumerations
- With this copied attribute it is also necessary to introduce a copied feature “m_sdat”
- For some features that are not covered by S-57 it was necessary to introduce new features (e.g. notice marks)

Features | Attributes | Enumerations

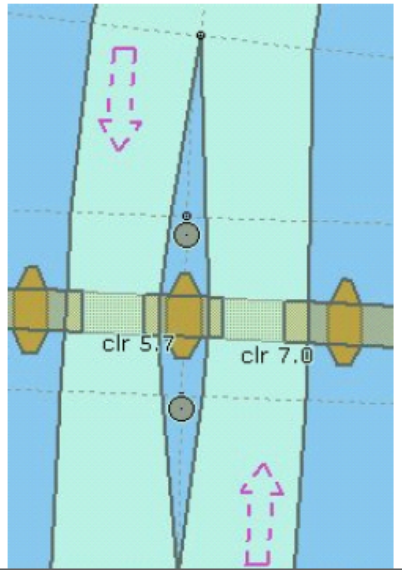
Encoding Guide for Inland ENCs

- To ensure a common understanding and consistent encoding for all worldwide regions, there is a very detailed Encoding Guide for Inland ENCs (which replaces the section “Use of the Object Catalogue” of S-57)
- See following example for the encoding of a bridge with bridge arches:

D - Cultural Features

D.7 Bridges with bridge arches

A Bridge with hasn't a straight construction but a bridge arch

Graphics	Coding Instructions	S-57 Object Coding
Real World  *IENC Symbolization* 	A) Bridge piers should be encoded as PYLONS (A) with [CATPYL= 5(bridge pier), WATLEV =2 (always dry)] covered with a LNDARE object and bordered with a SLCONS (L). B) Pylons shall be encoded as PYLONS (please refer to D8 – Bridge, cable, pipeline support) C) Create separate bridge objects only when attributions of navigable spans are different (e.g. vertical clearance, horizontal clearance). D) Bridge approaches (over the bankline) should be encoded. E) Road and railroad features do not cross the bridge feature. F) Separate bridge object for span over navigable channel, and separate BRIDGE object for each approaching span. G) Place LIGHTS on navigable span and piers bounding navigable span.	**Object Coding** **Object Class =** bridge.(A) (M) CATBRG = [1 (fixed bridge)] (O) HORCLR = xx.x e.g. 34.2 (meters) (M) VERCLR = [xx.x e.g. 13.2 (meters)] (C) verdat = [31 (local low water reference level), 32 (local high water reference level), 33 (local mean water reference level), 34 (equivalent height of water (German GlW)), 35 (Highest Shipping Height of Water (German HSW)), 36 (reference low water level according to Danube Commission), 37 (highest shipping height of water according to Danube Commission), 38 (Dutch river low water reference level (OLR)), 39 (Russian project water level), 40 (Russian project water level)] (M) PICREP = (see A.1 General Guidance for naming convention) (O) unlocd = [ISRS code] (M) INFORM = [Structure height, height

Usages

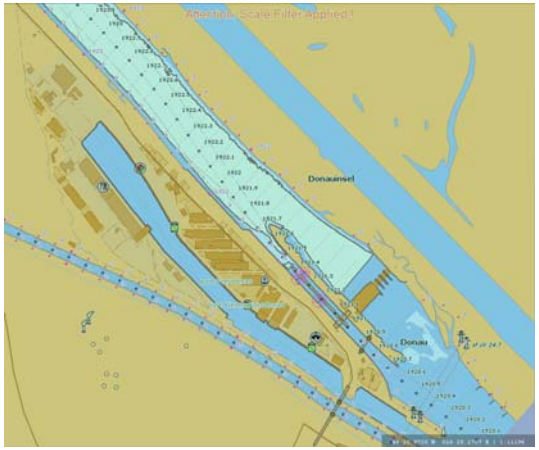
- On major inland waterways, Inland ENCs are normally produced and used at a larger scale than ‘maritime’ ENCs
- While the largest scale for ‘maritime’ ENCs is usage 6 (berthing), for Inland ENCs there are three usage codes:
  - 7 - river
  - 8 - river harbour
  - 9 - river berthing

Overlay cells

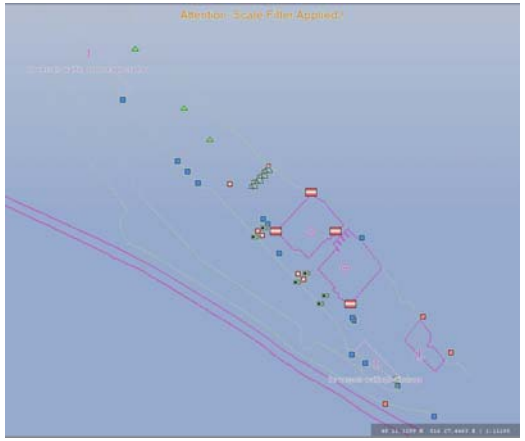
- In some regions, different authorities are responsible for the maintenance of the waterway, and for the traffic regulation (e.g. buoys, beacons, notice marks, signals).
- Depth information is extremely important on inland waterways (e.g., 50 cm between keel and riverbed is normal) and in some areas depth are constantly changing.
- As such, it may be necessary to update the depth information much more frequently then the rest of the Inland ENC
- Inland ENCs provide the possibility to use “overlay cells”.

Overlay cells

- Overlay cells do not contain skin of the earth features
- They are displayed by an Inland ECDIS together with an Inland ENC of usage 1 to 9
- The Inland ECDIS uses the display priorities to compose the display



+



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Product Specification for Inland ENCs

- The Product Specification for Inland ENCs is based on IHO S-57, edition 3.1.
- It contains the necessary amendments to enable the encoding of additional features for inland waterways.
- It describes the differences (e.g., in the cell header) that identify the cell as an Inland ENC, the usage, and so on.

Depth data and water levels

- Depth data in ENCs is based on a vertical datum, which is a horizontal plane
- Depth data in Inland ENCs of rivers is referred to sloped and non-linear reference water level
- The actual water level is irregular and can not be determined by tide tables. Instead, it has to be derived from water level gauges
- Due to variations of the area of cross sections and the base slope of the riverbed different water levels are not parallel to one another
- Water level models are needed to calculate the actual depth at a specific point of the waterway at a specific moment

Depth data and water levels

- A standardized data exchange format is available to transmit the results derived from water level gauge readings and water level models to the on board applications
- This information can be used to display the actual water depth in the Inland ECDIS without changing the Inland ENC

The Inland ENC Harmonization Group

- **Objective**: to develop and to maintain a harmonized standard for Inland Electronic Navigational Charts (IENCs) suitable for inland navigation that is based on the standards of IHO for ‘maritime’ ENC

- **Goal**: to agree upon specifications for Inland ENCs that are suitable for all known inland ENC data requirements for safe and efficient navigation in European, North and South American, Russian Federation and Asian inland waterways.
  - It is further intended that IENC standards meet the basic needs for Inland ENC applications, worldwide

IEHG - recognition

- As the competent international technical group on Inland ENC technical standards development, implementation and maintenance, IEHG is recognized by:
  - Europe - European Union and the Central Commission for Navigation on the Rhine
  - North America – US Army Corps of Engineers
  - Russian Federation - Russian Ministry of Transport
  - Brazil, Peru and Venezuela – Hydrography and Navigation Services
  - Asia – Ministry of Transport of PRC and KHOA of Republic of Korea
  - International Hydrographic Organization (IHO)
- Since there are several countries with Inland Navigation that are not Member States of IHO, IEHG does not intend to become a member of IHO.
- Instead, IEHG supports, advises and provides input to IHO regarding Inland ENC matters as a recognized NGIO.

IEHG – recognition (continued)

- In 2009, IEHG has been recognized by IHO as a Non Governmental International Organization (NGIO) with observer status
- Current members of IEHG are all European countries with inland waterways, Russian Federation, USA, Brazil, China, Republic of Korea, Peru and Venezuela

Regulatory status of Inland ENCs in Europe

- The European Inland ECDIS Standard (includes the Inland ENC Product Specification and a performance and test standard for Inland ECDIS applications), has been adopted by
  - the United Nations www.unece.org (2007)
  - the Central Commission for Navigation on the Rhine www.ccr-zkr.org (2006)
  - the Danube Commission www.danubecommission.org (2008)
  - the European Union (publication pending)
- Member states of the European Union are obliged to provide a complete coverage of the bigger waterways (class Va and above) within 30 months after the publication of the standard

Regulatory status of Inland ENCs

- USA: The US Army Corps of Engineers (USACE) is responsible for the production and provision of Inland ENCs
- Russian Federation: Federal task program on GLONASS development (Government regulation No. 587) includes the production of Inland ENCs for the inland waterways of Russian Federation (48000 km)
- Brazil: The Directorate for Hydrography of the Brazilian Navy (DHN) is responsible for the production and provision of Inland ENCs

Coverage of Inland ENCs

- USA: 20 inland waterways with 11 160 km have been covered with Inland ENCs in September 2010
- Russian Federation: 26 000 km of RF inland waterways have been covered with Inland ENCs in September 2010
- Brazil: DHN is capturing data for the production of Inland ENCs for approximately 8000 km of inland waterways

Coverage of Inland ENCs in Europe

Country	class	coverage	published	available for free	used version of standard
Austria	Va +	full	yes	www.doris.bmvit.gv.at	2.1
Belgium (Flanders)	Va +	full	yes (with exception of sea harbours)	ris.vlaanderen.be www.vts-scheldt.net	2.0
Bulgaria	Va +	full	planned	www.appd-bg.org	1.02
Switzerland	Va +	full (Rhine)	yes	www.portofbasel.ch	2.0
Czech Rep.	IV	full	yes	www.lavdis.cz	1.02, 2.0 in 2011
Germany	Va +	3000/4000 rkm	yes	www.elwis.de, free webviewer	1.02, 2.0 and 2.1 (Main, MDK, Danube)
France	Va +	30 km Garonne		www.vnf.fr	1.02
Croatia	IV +	full	yes	www.crup.hr	1.02 and 2.0, 2.1 in preparation
Hungary	Va +	full	Yes(edition 2007)	www.pannonris.hu	1.02, 2.0 in preparation
Luxemburg	Va +		yes	no	1.02
Netherlands	IV +	Almost full	yes	www.risserver.nl	2.0
Poland	Va +	full in 2011	planned	Not decided yet	2.1
Romania	Va +	Full (Black sea canal in near future)	yes	www.afdj.ro/not free for Black Sea Canal	1.02
Serbia	Va +	full	yes	www.plovput.co.yu	1.02
Slovakia	Va +	full	Under disc.	yes	1.02
Ukraine	Va +	full	yes	no	1.02

Users of Inland ENCs

- USA:
- Russia: more than 600 users (58 have been using Inland ENCs in September 2010)
- In Europe alone there are already more than 11 000 users of Inland ENCs (~6000 commercial navigation and ~5000 pleasure crafts)

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Website: http://ienc.openecdis.org

The websites provides the Terms of Reference, list of members, minutes of meetings and all the documents of the standards for download

The website also provides links to international organizations, national or regional authorities, and private companies who are dealing with Inland ENCs

Abbreviations

COLREG	Collission Regulations of IMO
ECDIS	Electronic Chart Display and Information System
ENC	Electronic Nautical Chart
GLONASS	Globalnaja Nawigazionnaja Sputnikowaja Sistema
IENC	Inland Electronic Nautical Chart
IEHG	Inland ENC Harmonization Group
IHO	International Hydrographic Orgainzation
IMO	International Maritime Organization
NGIO	Non Governmental International Organization