Developing a Port ECDIS – a challenge mastered

EFFORTS WP 1.3 - Port ECDIS

Developing a Port ECDIS – a challenge mastered

Dieter Seefeldt (Hamburg Port Authority)

Navigation in Ports
Demonstration of Research Results of EFFORTS Project in Hamburg
on 14-15 September 2009
Developing a Port ECDIS – a challenge mastered

Partner

**Hamburg Port Authority** (Hamburg - Germany)
work package leader

**ISSUS** (Institute of Ship Operation, Sea Transport & Simulation)
(Hamburg - Germany)

**Caris BV** (Heeswijk, The Netherland)

**SevenC's** (Germany / United Kingdom) – sub contractor

Navigation in Ports
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Developing a Port ECDIS – a challenge mastered

the Port ECDIS story
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Developing a Port ECDIS – a challenge mastered

Starting with the question: "Why a Port ECDIS?"
Why a Port ECDIS

• The Subproject “Navigation in Ports” aims at the improvement of safety and efficiency of navigation in ports considering decreasing manoeuvring space (vessel size in relation to fairways and basins) and increasing traffic.

• Increase of vessel sizes and requirements for minimum dredging call for higher accuracy and reliability of navigation in fairways and ports not being met by equipment according to SOLAS Carriage Requirements.

• Safety is defined by risk of damage to vessels and infrastructure, efficiency is defined by turn around speed in ports.
Why a Port ECDIS

- Managing bigger vessels, increasing traffic, less harbour space, berth organisation, dredging purposes etc. requires accurate and up-to-date high resolution topographic and bathymetric data to provide all necessary information, in some cases also in real-time.
Developing a Port ECDIS – a challenge mastered

Why a Port ECDIS

- The chart requirements for manoeuvring big ships in narrow fairways (harbour access channels) and harbours and for the port maintenance go far beyond the current ECDIS standard in **scale, accuracy, chart objects and attributes** and call for a specific “Port ECDIS”.

Navigation in Ports
Demonstration of Research Results of EFFORTS Project in Hamburg
on 14-15 September 2009
Why a Port ECDIS

• Masters and pilots approaching a seaport usually use an **Electronic Chart Display and Information System (ECDIS)** to obtain the required navigational information they need.
• The common **ECDIS standard** supports navigation in the open sea and coastal areas ........
  • and also in seaports and harbours like the Port of Hamburg
• but without meeting the requirements ports have regarding navigational, manoeuvring, berthing, turning, docking and up to dateness, scale, accuracy aspects!
Why a Port ECDIS

• The Inland ECDIS standard was developed for navigation on inland waterways.

• but uses the same accuracy and quality definitions like the maritime ECDIS standard

• but also without meeting the requirements ports have regarding navigational, manoeuvring, berthing, turning, docking and up to dateness, scale, accuracy aspects!
Developing a Port ECDIS – a challenge mastered

Why a Port ECDIS

Comparison
HPA Basis Port ENC - BSH ENC

BSH ENC-cell Port of Hamburg
Federal Maritime and Hydrographic Agency
name: DE521500.000
date: 27.05.2005
scale: 1:15 000 / 1:30 000 - small scale!!
accuracy:
S-57 Object Class: M_QUAL
attribut: CATZOC = B (3) ±50m

On 14-15 September 2009
Why a Port ECDIS

Comparison
HPA Basis Port ENC - BSH ENC

<table>
<thead>
<tr>
<th>fixed marks / navigational aids</th>
<th>quay wall corner</th>
<th>pontoon corner</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>differences HPA-BSH</strong></td>
<td><strong>differences HPA-BSH</strong></td>
<td><strong>differences HPA-BSH</strong></td>
</tr>
<tr>
<td>East</td>
<td>North</td>
<td>Dist.</td>
</tr>
<tr>
<td>average</td>
<td>-0,01</td>
<td>0,01</td>
</tr>
<tr>
<td>min</td>
<td>-0,19</td>
<td>-0,62</td>
</tr>
<tr>
<td>max</td>
<td>0,15</td>
<td>0,56</td>
</tr>
</tbody>
</table>

Navigation in Ports
Demonstration of Research Results of EFFORTS Project in Hamburg
on 14-15 September 2009
Why a Port ECDIS

- For Port operations a new port related dataset is needed and required (result of the Port ECDIS questionnaire).

- Because ship traffic is very international it is from utmost importance that the format of the new Port ECDIS dataset (Port ENC or PENC) has to be standardized. For this the creation of a Port ECDIS standard is needed.

- Port ECDIS data should serve as the missing link between maritime ENCs and Inland ENCs.
Why a Port ECDIS

ECDIS data are not only used onboard but also in:

• Vessel Traffic Management and Information Systems (VTMIS)
• Route planning application
• Marine Simulators (ship handling, tug simulator…)
• ...

• Besides ECDIS more and more applications have been developed, they are use ENCs (Electronic Navigational Chart) as backdrop information

• And on base of ECDIS technology (GIS) it will be possible to link, combine or overlay other information to improve the interoperability of harbour related tasks.
Why a Port ECDIS

equose:
Hydrographic Survey-
Software packages that
use ENC data as
backdrop during their
operations will be used
on board of the HPA
survey vessel
Deepenschriewer
So it was clear: we need a Port ENC!

But a special Port ENC is currently not available!!

And to develop a prototype is a real challenge!!
Developing a Port ECDIS – a challenge mastered

Project task list

Task 1 - Functional user requirements
Task 2 - Port ECDIS - Technical specification
Task 3 - Prototype of a Port ECDIS
Task 4 - Testing of prototype
Task 5 - Defining requirements for follow-up developments and standardization (Port ECDIS Roadmap).

Targeted project results – the challenge:

The outcome should be a comprehensive concept as basis and input for European / international standardisation proved by validation and functional tests in the Port of Hamburg.
Developing a Port ECDIS – a challenge mastered

We informed about the project:

IHO - International Hydrographic Organisation
IMO - International Maritime Organization
Open ECDIS Organisation
Inland ENC Harmonization Group
EC - European Commission - Directorate-General Energy and Transport
UN/CECE - Economic Commission for Europe of the United Nations
CCNR - Central Commission for Navigation on the Rhine
DC - Danube Commission
IAPH - Head Office (Tokyo) - International Association of Ports and Harbors
IAPH - Europe Office (Rotterdam)
IHMA - International Harbour Masters' Association
EHMC - European Harbour Masters' Committee
PIANC - International Navigation Association
BMVBS - Federal Ministry of Transport, Building and Urban Affairs, Germany
IALA - International Association of Marine Aids to Navigation and Lighthouse Authorities
IMPA - International Maritime Pilots Association
EMPA - European Maritime Pilot's Association
EMSA - European Maritime Safety Agency

The EU Project - Port ECDIS - Development of a new enhanced ENC standard for use in ports and harbours.

Why a Port ECDIS? Masters and pilots approaching a seaport usually use an Electronic Chart Display and Information System (ECDIS) to obtain the required navigational information they need. The common ECDIS standard supports navigation in the open sea and coastal areas; the Inland ECDIS standard was developed for navigation on inland waterways. The chart requirements for manoeuvring big ships in narrow fairways (harbour access channels) and harbours and for the port maintenance go far beyond the current ECDIS standard in scale, accuracy, chart objects and attributes ("object catalogue", in future "feature catalogue") and

Navigation in Ports
Demonstration of Research Results of EFFORTS Project in Hamburg on 14-15 September 2009

Projectno: FP6-034688
Project acronym: EFFORTS
Project title: Effective Operation in Ports

WP 1.2 PortECDIS
Port ECDIS information paper

Hamburg Port Authority
SIXTH FRAMEWORK PROGRAMME

International Hydrographic Organisation
International Maritime Organization
Open ECDIS Organisation
Inland ENC Harmonization Group
Task 1 - Functional user requirements
Developing a Port ENC – a challenge mastered

Task 1 - Functional user requirements

- specific user requirements and questionnaire results:
- all the answers are reflecting more or less exact the impression we had and why we are thinking, a precise Port ENC is necessary and a benefit for port navigation, manoeuvring and maintenance work!

Efforts WP 1.3 Port ECDIS Workshop Questionnaire
8. April 2008
Hafenklub - Hamburg

Name: ........................................................................................................
Organisation: ............................................................................................
Job / function: ...........................................................................................

1 Questions about group membership
What Group do you belong to? (Choose from the list of groups)

1.1 Group A – main user

1.1.1 Group A1
- Harbour master
- Harbour pilots
- Vessel Traffic Management and Information System (VTMIS)
- Radar surveillance
- other ...........................................................

1.1.2 Group A2
- Dredging
- Hydrology
- Hydrographic Survey
- Maintenance
- other ...........................................................

1.1.3 Group A3
- Tugs
- other ...........................................................

1.2 Group B

1.2.1 Group B1
- Navigation
- Harbour Police
- Fire Brigade
- other ...........................................................
Task 1 - Functional user requirements

Navigation in ports and fairways (harbour access channels) with minimal under keel clearance and port maintenance require information distinct from sea and inland navigation. The available ECDIS / Inland ECDIS standards lack the following items to comply with the specific port requirements:

- high accuracy charts (for using RTK-DGPS, local RTK - DGPS services deliver cm accuracy, position and depth information must fulfil or be better than IHO - S44 Standards for Hydrographic Surveys - Special Order)
- large scale information (1:500 up to 1:5000) with up to date information
- including special objects / features for port navigation and operation such as:
  - e.g. bollards, quay ladder, fenders etc.
- 3D possibilities (Grid / Raster / TIN)
- designed / constructed reference models e.g. for dredged areas.
Developing a Port ECDIS – a challenge mastered

Task 2 - Port ECDIS - Technical specification
Task 2 - Port ECDIS - Technical specification

Port ECDIS specification document

Project no: FP6-031486
Project acronym: EFFORTS
Project title: Effective Operation in Ports

Instrument: Integrated Project
Thematic Priority: Integrating and Strengthening the European Research Area

D1.3.2 Port ECDIS specification (document)
Task 2 - Port ECDIS - Technical specification

Study about data quality in the following IHO standards:

- ECDIS
- Inland ECDIS
- Standards for Hydrographic Surveys

Definition of Data Quality in Standards used for ENC Data

EC FP6 project Efforts WP 1.3 Port ECDIS
Task 2 - Port ECDIS - Technical specification

Result: IHO S57 ECDIS definitions - (Zone of Confidence)

<table>
<thead>
<tr>
<th>ZOC Table:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Position Accuracy</td>
<td>Depth Accuracy $^3$</td>
<td>Seafloor Coverage</td>
<td>Typical Survey Characteristics $^5$</td>
</tr>
<tr>
<td>ZOC $^1$</td>
<td>$^2$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>+ 5 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a = 0.5</td>
<td>b = 1</td>
<td>Full seafloor ensonification or sweep. All significant seafloor features detected and depths measured.</td>
<td>Controlled, systematic, high accuracy Survey on WGS 84 datum, using DGPS or a minimum three lines of position (LCP) with multibeam channel or mechanical sweep system.</td>
</tr>
</tbody>
</table>

Depth (m) | Accuracy (m)
---------|------------
10 | + 0.6
30 | + 0.8
100 | + 1.5
1000 | + 10.5
Developing a Port ECDIS – a challenge mastered

Task 2 - Port ECDIS - Technical specification

Result: IHO S44 Ed. 5 (new) Minimum Standards for Hydrographic Surveys
February 2008

<table>
<thead>
<tr>
<th>Chapter 2 and note 5</th>
<th>Positioning of fixed aids to navigation and topography significant to navigation. (95% Confidence level)</th>
<th>2 metres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 2 and note 3</td>
<td>Positioning of the Coastline and topography less significant to navigation (95% Confidence level)</td>
<td>10 metres</td>
</tr>
<tr>
<td>Chapter 2 and note 5</td>
<td>Mean position of floating aids to navigation (95% Confidence level)</td>
<td>10 metres</td>
</tr>
</tbody>
</table>
Task 2 - Port ECDIS - Technical specification

Port ENC - data quality definition

We made a suggestion about combining information about the underlying topographic and bathymetric accuracy
Task 2 - Port ECDIS - Technical specification

PENC - data quality definition - suggestion

Object Class: **Accuracy of ENC data**
Acronym: \textit{m\_aenc}

Set Attribute\textsubscript{A}: \textit{batacc; topacc;}
Set Attribute\textsubscript{B}: \textit{INFORM; NINFOM; ntxtdc; txtdsc;}
Set Attribute\textsubscript{C}: \textit{RECDAT; RECIND; SORDAT; SORIND;}

The attribute \textit{batacc} is from the type “enumerated”. There is one attribute value, this value is based on the IHO Standards for Hydrographic Surveys (Special Publication N° 44 Ed.5) and be called Special.

<table>
<thead>
<tr>
<th>ID</th>
<th>Meaning</th>
<th>Max. allowable THU</th>
<th>Max. allowable TVU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Special</td>
<td>±2 m</td>
<td>( a = 0.25 , \text{m} ) ( b = 0.0075 )</td>
</tr>
</tbody>
</table>

Tab.1: allowable uncertainty for bathymetric data

S44 Ed. 5 (new)
Minimum Standards for Hydrographic Surveys
February 2008
Hydrographic survey
**Task 2 - Port ECDIS - Technical specification**

**PENC - data quality definition - suggestion**

<table>
<thead>
<tr>
<th>ID</th>
<th>Meaning</th>
<th>Object class</th>
<th>Positional accuracy</th>
<th>Vertical accuracy</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Zone A</td>
<td>(BCNCAR), (bcncar), (BCNISD), (bcnissd), BCNLAT, bcnlat (BCNSAW), (bcnsaw), (BCNSPP), (bcnspp), bridge, chblnd, close, DRYDOC, FLODOC, flood, OATCCN, goacon, HULKES, hulke, lock, MORFAC, PIPNIT, PONON, PONTON, PONON, PYNLS, SLCCONS, SLCONS</td>
<td>± 0.1 m</td>
<td>± 0.1 m</td>
<td>Fixed object relevant for berthing, docking and lock passage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>berths, EUISGL, HRBFAC, hrbfac, LNDMRK, NAVLINE, (RADLINE), RADSTA, RESARE, resare, (RSCSTA), RTPBCN, SILTNC, sistat, sistaw</td>
<td>± 0.5 m</td>
<td>± 0.5 m</td>
<td>Fixed object relevant for navigation (maneuvering, turning, towage)</td>
</tr>
</tbody>
</table>
### Task 2 - Port ECDIS - Technical specification

#### PENC - data quality definition - suggestion

<table>
<thead>
<tr>
<th>ID</th>
<th>Meaning</th>
<th>Object class (example)</th>
<th>Positional accuracy</th>
<th>Vertical accuracy</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Zone B</td>
<td></td>
<td>± 0.5 m</td>
<td>± 0.5 m</td>
<td>Fixed object relevant for berthing, docking and lock passage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(BCNCAR), (bcncar),</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(BCNISD), (bcnlsd),</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>BCNLAT, bcnlat,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(BCNLSW), (bcsnaw),</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(BCNSSP), (bcssnps),</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>bridge, cblond,</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>cldsc, DRYDCC,</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>FLODCC, flodcc,</td>
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<tr>
<td></td>
<td></td>
<td>CATCON, catcon,</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>HULKES, hukes,</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>lcton, MORFAC,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PIBPNT,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PONTON, ponton,</td>
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<tr>
<td></td>
<td></td>
<td>pylons, sllcn,</td>
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<td></td>
<td></td>
<td>sllcn,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>bertho, EUSSL,</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>HRBFAC, birbfac,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LNDRNK, NAVLNE,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(RADLNE), RADSTA,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>RESARC, resarc,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(RISTDRA), RTPBCN,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SILTBN, sistbn,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SISTAT, sistat,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SISTAW,</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tab. 2: The characteristic of the attribute “Accuracy of topographic data”

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Navigation in Ports
Demonstration of Research Results of EFFORTS Project in Hamburg on 14-15 September 2009

HPA
Hamburg Port Authority

SIXTH FRAMEWORK PROGRAMME

EU
Task 2 - Port ECDIS - Technical specification

PENC - data quality definition - suggestion

The meta object m_aenc should be represented by an S-52 representation over the whole chart. There are two possibilities to assign the S-52 representation. On the one hand ID=1 (batacc) and ID=2 (topacc), on the other hand ID=1 (batacc) and ID=1 (topacc). Both possibilities are summarized in the next table.

<table>
<thead>
<tr>
<th>ID</th>
<th>S-52 representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>bathymetric</td>
<td>topographic</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Tab.3: S-52 representation for the meta object “Accuracy of ENC data”
Task 2 - Port ECDIS - Technical specification

new Port ECDIS objects (examples)
Task 2 - Port ECDIS - Technical specification

new Port ECDIS objects (examples)

connection rod and radar refector

bridge clearance
Task 2 - Port ECDIS - Technical specification

new Port ECDIS objects (examples)

- quay ladder
- fender
- double bollard
- fender line
- berth name & nominal depth
Task 2 - Port ECDIS - Technical specification

new Port ECDIS objects (examples)

dredge field
Task 2 - Port ECDIS - Technical specification

Port ECDIS encoding guide

Encoding Guide for Port ENCs

Edition 1.0
Developing a Port ECDIS – a challenge mastered

Task 3 - Prototype of a Port ECDIS
Gradation of the S-57 ENC products

**Standard exist**

**maritime ENC (ENC)**

Product ID 1

- an ENC fulfils the basic standard
- no special requirements for top. accuracy

**ENC Product Specification (IHO)**
(Object and Attribute definitions according to IHO Object Catalogue)

**ENC object definitions**
Gradation of the S-57 ENC products

**maritime ENC (ENC)**

- Standard exist
- Product ID 1
- an ENC fulfils the basic standard
- no special requirements for top. accuracy

**Inland ENC (IENC)**

- Standard exist
- Product ID 10 +
- an IENC fulfils not complete the ENC standard

**ENC Product Specification (IHO)**
(Object and Attribute definitions according to IHO Object Catalogue)

- ENC object definitions

**Product Specification for Inland ENC**
(Inland ECDIS Harmonization Group IEHG)
(Object and Attribute definitions according to IENC Feature Catalogue)

- ENC object definitions (not complete all)
+ IENC specific extensions
Gradation of the S-57 ENC products

- **maritime ENC (ENC)**
  - Product ID 1
  - An ENC fulfils the basic standard
  - No special requirements for top. accuracy

- **Inland ENC (IENC)**
  - Product ID 10
  - An IENC fulfils not complete the ENC standard

**ENC Product Specification (IHO)**
(Object and Attribute definitions according to IHO Object Catalogue)

**ENC object definitions**

- **Product Specification for Inland ENC**
  (Inland ECDIS Harmonization Group IEHG)
  (Object and Attribute definitions according to IENC Feature Catalogue)

**ENC object definitions** (not complete all) + IENC specific extensions

---

Navigation in Ports
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on 14-15 September 2009

Hamburg Port Authority

SIXTH FRAMEWORK PROGRAMME
Gradation of the S-57 ENC products

- **maritime ENC (ENC)**
  - Standard exist
  - Product ID 1
  - an ENC fulfils the basic standard
  - no special requirements for top. accuracy

- **Inland ENC (IENC)**
  - Standard exist
  - Product ID 10
  - an IENC fulfils not complete the ENC standard

- **Port ENC (PENC)**
  - Standard under development
  - Product ID 20
  - a PENC fulfils the IENC special requirements for accuracy => very precise

**ENC Product Specification (IHO)**
(Object and Attribute definitions according to IHO Object Catalogue)

- **ENC object definitions**

**Product Specification for Inland ENC**
(Inland ECDIS Harmonization Group IEHG)
(Object and Attribute definitions according to IENC Feature Catalogue)

- **ENC object definitions** (not complete all) + IENC specific extensions

**PENC Product specification (EFFORTS)**
(Object and Attribute definitions according to PENC Feature Catalogue)

- **ENC object definitions** (all are needed) + IENC specific extensions (all are needed) + PENC specific extensions

**Navigation in Ports**
Demonstration of Research Results of EFFORTS Project in Hamburg on 14-15 September 2009
Gradation of the S-57 ENC products

- **maritime ENC (ENC)**
  - Product ID 1
  - Standard exist
  - an ENC fulfils the basic standard
  - no special requirements for top. accuracy

- **Inland ENC (IENC)**
  - Product ID 10
  - Standard exist
  - an IENC fulfils not complete the ENC standard

- **bathymetric ENC (bENC)**
  - Draft Product Specification by SevenCs

- **Port ENC (PENC)**
  - Product ID 20
  - Standard under development
  - a PENC fulfils the IENC
  - special requirements for accuracy => very precise

ENC Product Specification (IHO)
(Object and Attribute definitions according to IHO Object Catalogue)

ENC object definitions

Product Specification for Inland ENC
(Inland ECDIS Harmonization Group IEHG)
(Object and Attribute definitions according to IENC Feature Catalogue)

ENC object definitions (not complete all) + IENC specific extensions

PENC Product specification (EFFORTS)
(Object and Attribute definitions according to PENC Feature Catalogue)

ENC object definitions (all are needed) + IENC specific extensions (all are needed) + PENC specific extensions

Navigation in Ports
Demonstration of Research Results of EFFORTS Project in Hamburg on 14-15 September 2009
Gradation of the S-57 ENC products

- **maritime ENC (ENC)**
  - Product ID 1
  - an ENC fulfils the basic standard
  - Draft Product Specification by SevenCs
  - Standard exist

- **Inland ENC (IENC)**
  - Product ID 10
  - no special requirements for top. accuracy
  - Standard exist
  - Specification by the EFFORTS project

- **Port ENC (PENC)**
  - Product ID 20
  - a PENC fulfils the IENC special requirements for accuracy => very precise
  - a PENC fulfils the IENC special requirements for accuracy => very precise
  - Standard under development
  - Gridded bathymetry

ENC Product Specification (IHO)
- Object and Attribute definitions according to IHO Object Catalogue
- ENC object definitions

Product Specification for Inland ENC (Inland ECDIS Harmonization Group IEHG)
- Object and Attribute definitions according to IENC Feature Catalogue
- ENC object definitions (not complete all) + IENC specific extensions

PENC Product Specification (EFFORTS)
- Object and Attribute definitions according to PENC Feature Catalogue
- ENC object definitions (all are needed) + IENC specific extensions (all are needed) + PENC specific extensions

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Gradation of the S-57 ENC products

- **maritime ENC (ENC)**
  - Product ID 1
  - an ENC fulfils the basic standard
  - Draft Product Specification by SevenCs
  - Standard exist

- **Inland ENC (IENC)**
  - Product ID 10
  - an IENC fulfils not complete the ENC standard
  - Standard exist
  - Specification by the EFFORTS project

- **Port ENC (PENC)**
  - Product ID 20
  - a PENC fulfils the IENC special requirements for accuracy => very precise
  - Port ENC Product specification (EFFORTS)
  - gridded bathymetry
  - channel reference model
  - Standard under development

ENC Product Specification (IHO)
- (Object and Attribute definitions according to IHO Object Catalogue)
- ENC object definitions

Product Specification for Inland ENC (Inland ECDIS Harmonization Group IEHG)
- (Object and Attribute definitions according to IENC Feature Catalogue)
- ENC object definitions (not complete all) + IENC specific extensions

PENC Product specification (EFFORTS)
- (Object and Attribute definitions according to PENC Feature Catalogue)
- ENC object definitions (all are needed) + IENC specific extensions (all are needed) + PENC specific extensions

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Components of the Port ENC Chart

As part of the EFFORTS project, there are a number of new port specific objects, as well as requirements for the accuracy of these objects. These new requirements will ensure that the Port ENC makes the most accurate data available to the port users.

The use of gridded bathymetry, channel outlines and channel depth model data will allow the users of the Port ENC to have an accurate and up to date 3D information of the depth situation within the port. This will improve both, safety of navigation as well as port maintenance.

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Hamburg Port Authority
SIXTH FRAMEWORK PROGRAMME
Task 4 - Testing of prototype
Task 4 - Testing of prototype

Remark:

All the tests running very successful and delivering very promising results and they demonstrating the outstanding quality and accuracy of the developed Port ENC!!
Port ECDIS – PPU accuracy and functional test

- PPU and accuracy test on board of survey vessel Deepenschriewer II

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Port ECDIS – PPU accuracy and functional test

- PPU and accuracy test on board of survey vessel Deepenschriewer II
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Port ECDIS – PPU accuracy and functional test

- PPU and accuracy test on board of survey vessel Deepenschriewer II

"bow – print"
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Port ECDIS – PPU accuracy and functional test

- PPU and accuracy test on board of survey vessel Deepenschriewer II

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Port ECDIS – accuracy and functional test

Onboard ENC (inaccurate)

Port ENC (precise)

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Port ECDIS – accuracy and functional test

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Port ECDIS – TSHD (Trailer Suction Hopper Dredger) functional test

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Port ECDIS – TSHD (Trailer Suction Hopper Dredger) functional test

Official maritime ENC

Lat 53.31.42.892 N
Lon 9.57.18.314 E
Gyro 354.9

Speed 0.1
Pegel 0.7
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Port ECDIS as base information for the TUG simulator

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Port ECDIS as base information for the TUG simulator

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Hamburg Port Authority

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Port ECDIS – PPU onboard of a Container vessel

Container Vessel
Yang Ming Uberty
Length 333.5m
Breadth 42.8m
Draught: 11.0m)

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Port ECDIS – PPU onboard of a Container vessel
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Port ECDIS – PPU onboard of a Container vessel

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Port ECDIS – PPU onboard of a Container vessel

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Port ECDIS – PPU onboard of a Container vessel
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Port ECDIS – as base information in a VTMIS

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Port ECDIS – as base information in a VTMIS

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Port ECDIS – as base information in a VTMIS

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Port ECDIS – as base information in a VTMIS

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Innovative aspects
Innovative aspects

- The new standard takes into account the different accuracy definitions of S57- ECDIS / Inland ECDIS and also of IHO S44 – IHO Standards for Hydrographic Surveys and defines a new Port ENC accuracy definition / class.

  - Accuracy of ENC data – \( m_{aenc} \) and
  - the characteristic of these object = combined bathymetric and topographic accuracy meta objects \( \rightarrow batacc \) and \( topacc \)
Innovative aspects

- The proposed Port ENC standard has a far higher density of information, allowing more precise navigation / manoeuvring et cetera.

- The proposed Port ENC standard introduces additional data models and includes information not available in current standards, like gridded bathymetry (in BAG format) and 3D reference/channel models, allowing new usages. New data representations allow for new visualization methods (3D) and new functionality for better data analysis.
Innovative aspects

• The Port ECDIS dataset, the PENC, is a special GIS (Geo Information System) and can be used in combination with other related source data to support Port Information Systems.

• The step into the new IHO S100 standard - the new IHO Hydrographic Geospatial Standard for Marine Data and Information have been considered.

• So also the requirements of the IHO Marine Spatial Data Infrastructures (MSDI) initiative can be fulfilled!
Expected role of contribution in the final EFFORTS - results
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Expected role of contribution in the final EFFORTS - results

To improve and enhance the final EFFORTS results the WP 1.3 – Port ECDIS approach have been used together with other applications, for example:

- in the SP1 - Navigation in Ports
  - as base information within the TUG simulator (WP 1.1 – TUG Assistance) and
  - within the PPU (WP 1.2 - Precise Navigation and Manoeuvring in Ports)

- in the SP3 – Port Organisation
  - as base information (GIS) for the WP 3.1 – Port Processes
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Implementation of results within the port industry and beyond
Implementation of results within the port industry and beyond

- If more and more data becomes available in the proposed (open) PENC standard, the data can be used for numerous other GIS driven approaches like:
  - Port planning / strategy
  - Port Maintenance (dredging, embankment monitoring ....)
  - Vessel Traffic Management and Information System (VTMIS)
  - Tug and maritime simulation
  - Route planning
  - Hydrological research
  - Harbour police resource planning
  - Fire brigade resource planning
  - Terminal resource planning
  - Port services (stowage, logistics, public transport management etc.)
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The Port ECDIS results
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The Port ECDIS results

- Masters and pilots, captains of the arriving and departing vessels, TUG operators and organisations, they work on port water area related maintenance tasks, they all need and can use the higher accuracy and additional information of the Port ECDIS.

- They can navigate and work more easily, safely and precise within the PENC covered port area (river, channel, port basin, turning basin…).

- The new within the Port ENC presented information fills the current ECDIS - Inland ECDIS data lack.
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the Port ENC & the Port ECDIS viewer - examples

This software must not be used as an aid to navigation.

The Efforts Port ECDIS Viewer was designed and developed exclusively as a demonstrator. The idea is to give an impression how Port ECDIS data can be visualized and how Port ECDIS data can help to make Operations in Ports more effective.

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Precise ENC Base Chart
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Precise ENC Base Chart
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Precise ENC Base Chart
Bathymetric ENC (bENC)

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Precise ENC Base Chart

Gridded Data [BAG] absolute depth

Navigation in Ports

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- Precise ENC Base Chart
- Gridded Data [BAG]
  - safety depth

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Precise ENC Base Chart

Channel Reference Model

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Precise ENC Base Chart

Gridded Data [BAG] CRM vs. depth

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3 D – view
Bathymetry

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3 D – view
Channel Reference Model

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3 D – view
Bathymetry versus CRM

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Task 5 - Defining requirements for follow-up developments and standardization (Port ECDIS Roadmap).
Task 5 - Defining requirements for follow-up developments and standardization (Port ECDIS Roadmap).

Now we are start defining the follow up requirements.

If you have some additional requirements or new ideas, please let us know!!
Final statement

It must be reliable and clear, that the master, the pilot, the harbourmaster and all other user can trust the topographic and bathymetric information within the Port ENC!

So the Port ENC can be used as reference system for navigation!

"If the vessel sails on land the positioning of the vessel is inaccurate, not the Port ENC!"
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Thank you for your attention!!