# Status Quo Report on ENC Activities

**AT – via donau**

<table>
<thead>
<tr>
<th>Document ID:</th>
<th>O 5.19</th>
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<tbody>
<tr>
<td>Activity:</td>
<td>5.2</td>
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<tr>
<td>Author / Project Partner:</td>
<td>Date:</td>
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<tr>
<td>Johannes Nemeth / via donau</td>
<td>2009-09-28</td>
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<td>Johannes Nemeth / via donau</td>
<td>2009-10-30</td>
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<td>Johannes Nemeth / via donau</td>
<td>2009-01-14</td>
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**“NETWORK OF DANUBE WATERWAY ADMINISTRATIONS”**

South-East European Transnational Cooperation Programme
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# LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CCNR</td>
<td>Central Commission for Navigation on the Rhine</td>
</tr>
<tr>
<td>DC</td>
<td>Danube Commission</td>
</tr>
<tr>
<td>DoRIS</td>
<td>Donau River Information Services</td>
</tr>
<tr>
<td>EC</td>
<td>European Commission</td>
</tr>
<tr>
<td>ECDIS</td>
<td>Electronic Chart Display and Information System</td>
</tr>
<tr>
<td>ENC</td>
<td>Electronic Navigational Chart</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographical Information System</td>
</tr>
<tr>
<td>IENC</td>
<td>Inland Electronic Navigational Chart</td>
</tr>
<tr>
<td>IHO</td>
<td>International Hydrographic Organization</td>
</tr>
<tr>
<td>RNW</td>
<td>Low water level according to the recommendations of the Danube Commissions</td>
</tr>
</tbody>
</table>
2 SCOPE OF DOCUMENT

Activity 5.2 ‘ENC harmonisation’ is related to the harmonisation of activities in the field of Inland ENC production and distribution.

According to description of work Activity 5.2 (Task 5.2.3) every partner shall identify and describe the status quo on ENC activities and what are the problems. The status quo report shall at least contain relevant information about:

- IENC coverage of the national stretch (incl. reasons and solution if this is not achieved so far)
- Availability of depth information within the Inland ENCs
- The IENC production process from raw GIS data into IENC objects, involved persons or organisations, used equipment and software tools
- IENC publication process (distribution of updates and new releases)
- Sources (data basis) and accuracy for IENC charts
- Create and maintain Inland ENCs according to the Inland ECDIS Standard
- Cooperations
- Updates, updating circle
3 IENC COVERAGE

In Austria national Inland Electronic Navigational Charts (IENCs) are provided for the river Danube and the Danube Canal in Vienna. The total length of the Austrian Danube is 350.5 river kilometres (2223.2 km – 1872.7).

The coverage of the Austrian Inland ENC is from river km 2201.5 – 1872.7. The common border section between Germany and Austria (2223.2 km – 2201.5 km, in total 21.7 km) is developed and provided in Germany. The common border section between Austria and Slovakia (1880.0 km – 1872.7 km, in total 7.3 km) are developed and provided in Austria.

The content of the Austrian Inland ENCs are in accordance with the European Inland ECDIS Standard, Edition 2.0. Edition 2.0 is the current version of the recommendations and regulations of the Central Commission for Navigation on the Rhine (CCNR), the European Commission (EC) and the Danube Commission (DC).

The Inland ENCs are produced by the Inland ECDIS Encoding Guide Edition 1, Version 2.2 (November 2007) and the Feature Catalogue Edition 2.0 (2006-10-24). The Encoding Guide provides detailed guidance on what is required to produce objects, attributes and attribute values that are suitable for any Inland ENC application.

In Austria all objects included in an Inland ENC are regarding the Minimum Contents of Inland ECDIS Standard, Edition 2.0:

- Bank of wareway/river bank
- Shoreline construction (e.g. dam, groin)
- Contours of locks and dams
- Boundaries of the navigation channel/fairway (if defined)
- Isolated dangers in the fairway below and above the water level, such as bridges, overhead cables and obstructions
- Shipping police regulations (e.g. buoys, beacons, lights, notice marks)
- Waterway axis with kilometres/hectometres or river mile indications

The UN/ECE classification of the Austrian Danube is VIa. There is a full coverage without any gaps.

The Inland ENCs are available and can be downloaded from DoRIS website free of charge (http://www.doris.bmvit.gv.at/inland_ecdis/downloads/inland_ecdis_standard_20/).
- Austrian section of the Danube, river km 2201.5 – 1872.7

- Danube Canal in Vienna, river km 0 – 17.0
Charts with detailed information about the infrastructure in ports were developed in cooperation with the port operators, as illustrated in the next figure (e.g. port of Lobau).

Port Lobau
4 COVERAGE OF DEPTH INFORMATION

Depths values are based on RNW 96 (low water level according to the recommendations of the Danube Commissions). They represent the situation at the time of measurement. As the riverbed is subjected to ongoing natural changes especially in the free flowing sections of the Danube, liability for the depths values cannot be assumed; depth data are intended for information purposes only.

In Austria the following sections are covered with detailed depth information. In total 335.2 km of 350.2 km are covered with depth data. There is only one section where no depth data are provided. This section concerns Ottensheim from km 2162.6 to km 2147.3 (15.3 km). This section was measured by our hydrographic department and will be integrated into the final Inland ENC soon.

In the following figure there is an overview where detailed depth information along the Austrian Danube based on following dates of surveys are provided:

<table>
<thead>
<tr>
<th>Section Details</th>
<th>Survey Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1072.7 - 1920.0</td>
<td>East of Vienna</td>
</tr>
<tr>
<td>1920.0 - 1921.0</td>
<td></td>
</tr>
<tr>
<td>0.1 - 16.45</td>
<td>Donaukanal</td>
</tr>
<tr>
<td>1921.4 - 1949.0</td>
<td>Backwater section Freudenau</td>
</tr>
<tr>
<td>1949.6 - 1979.3</td>
<td>Backwater section Greifenstein</td>
</tr>
<tr>
<td>1960.7 - 1990.0</td>
<td>Backwater section Altenwörth</td>
</tr>
<tr>
<td>1990.0 - 1995.0</td>
<td></td>
</tr>
<tr>
<td>1998.0 - 2038.0</td>
<td>Wachau</td>
</tr>
<tr>
<td>2038.3 - 2060.1</td>
<td>Backwater section Melk</td>
</tr>
<tr>
<td>2060.5 - 2094.4</td>
<td>Backwater section Ybbs</td>
</tr>
<tr>
<td>2095.9 - 2119.4</td>
<td>Backwater section Wallsee</td>
</tr>
<tr>
<td>2120.2 - 2146.7</td>
<td>Backwater section Abwinden</td>
</tr>
<tr>
<td>2147.3 - 2162.6</td>
<td>Backwater section Ottensheim</td>
</tr>
<tr>
<td>2163.0 - 2201.5</td>
<td>Backwater section Aschach</td>
</tr>
<tr>
<td>2201.5 - 2223.2</td>
<td>Backwater section Jochenstein</td>
</tr>
</tbody>
</table>

In Austria there are two critical sections, where the depth information can change constantly on the account of morphologic conditions in rivers and due to dredging operations:

- Wachau, km 2038.0 – 1998.0
- East of Vienna, km 1921.0 - 1872.7
5 IENC PRODUCTION PROCESS

In Austria the software tools from CARIS, Microstation V8 (Bentley) and SevenCs are used for production of geographical data, bathymetric data and Notice marks & buoys.

5.1. Used Software

5.1.1. Bathymetric Data

For the post processing of surveyed soundings and the conversion into Inland ENCs (S-57 format) the hydrographic department of via donau use the following software:

- Hydrographic Information Processing System HIPS (CARIS)
  the HIPS product is a comprehensive bathymetric data cleaning and validation tool integrated with powerful vector product creation.
- CARIS GIS Professional (CARIS)
  With CARIS GIS the density and distribution of soundings are controlled, a digital 3D terrain model and depth contours are calculated.
- CARIS HOM
  For the transformation into WGS 84 and conversion to the final S-57 format the CARIS HOM is used for S-57 production.

The bathymetric surveys (sounding data) are collected in a database based on ORACLE.

5.1.2. Geographical Data and Notice Marks

For the production of geographical data and notice marks the ENC software tools from SevenCs are used. The hydrographic department prepare the geographical data in Microstation (dgn format). Therefore the first step is to convert the dgn files into dxf format. The conversion from dgn to dxf is done inside of Microstation V8. Then the dxf files are converted into S-57 data format for further processing.

The following versions of SevenCs ENC tools are available in Austria:

- ENC Manager
  → Version 2.3.4
  → is used for ENC data maintenance and production of S-57 update files as well as complete exchange sets which comply with the IHO S-57 Standard.
- ENC Designer
  - Version 4.4.4
  - for creating and editing digital hydrographic chart data based on S-57
- ENC Optimizer
  - Version 2.4.1
  - to minimise data storage and maximise display performance
- ENC Analyzer
  - Version 2.7.0.19
  - is a quality assurance tool for S-57 (Version 2.7 for ENC Edition 2.0)
  - to check accuracy and encoding consistency
- ENC Referencer
  - Version 1.10
  - for geographic referencing of raster data (image) files
- DXF Converter
  - Version 3.5.15
  - to convert DXF (AutoCAD) files into the S-57 data format for further processing
- NTX Converter
  - Version 2.1.11
  - to convert NTX (CARIS) data format files into the S-57 data format for further processing

### 5.2. Production and maintenance process

The Inland ENCs are usually produced by the national hydrographic authorities. In Austria, these are the Supreme Navigation Authority (Oberste Schifffahrtsbehörde, OSB) and via donau. The basis for the production of charts are images taken of the areas concerned by aerial surveys, surveys or other measurement procedures. For the production of ENCs all objects have to be available in WGS 84 format (World Geodetic System).

In Austria, there are two files or layers for each waterway section (in Austria every 10 kilometres):

- the files "2W......" contain all geographical and bathymetric information (charts of via donau),
- the files "1S......" contain data relevant to shipping police regulations (charts of OSB).

#### Geographical data (Topographical information)

Information obtained from orthophoto images (or high-resolution satellite images). The general area data are considering the information about all fixed objects. Based on the hi-resolution geo-referenced terrain images, the
digital vectorized dataset can be easily produced by means of ENC tools and used further in ENC production process.

What are the steps for producing and encoding all objects and attributes regarding Inland ECDIS Standard Edition 2.0:

1. **Raw GIS data from different sources**

   ![Data basis for ENC – Aerial photo](image)
2. **Conversion into the S-57 format (with DXF Converter)**

Data basis for ENC – Microstation (dgn) data out of flight surveys

Conversion into S-57 format
3. Encoding of objects and attributes regarding the Inland ECDIS Standard

4. Check the accuracy and encoding consistency with SevenCs ENC Analyzer
**Bathymetric data (Depth information)**

The post processing of the surveyed data is quite complicated and time consuming from survey up to integration of depth information into IENC publishing. In order to provide actual depth data to fairway users, it is necessary to include actual depth information into IENCs whereas the following steps are necessary:

- A bathymetric survey has to be carried out. One of the first decisions is whether to use multi-beam or single-beam echo sounders for surveying depth information.
- The recorded bathymetric data have to be cleaned and processed due to the high amount of data.
- The surveyed data have to be transformed into the desired projection and exported to the final Inland ENC S-57 format.
- The old depth information is substituted and integrated into the official Inland ENCs with the actual depth data. Objects are formed new, attributes are adapted and the depth areas are cleaned by editing other geometry errors. This process is quite complicated and time consuming. At the end the cell is checked to a quality test and further errors are repaired regarding the Inland ECDIS Standard.

Depth information is extremely important on critical sections, because there the depth is changing rapidly. Therefore it is necessary to update the depth information much more frequently than the rest of the Inland ENC. In Austria the depth information for the free-flowing sections in the Inland ENCs will be updated twice a year.

For the production of the depth information survey data from hydrographic survey department are needed as sources. With adequate conversion tools the survey source data (depth contours, depth areas) then is converted into the S-57 format regarding the Inland ECDIS Standard.

To reduce the data volume of Inland ENCs the isobaths are reduced. The following contour intervals are produced in Austria:

- less than 1m of depth there are no isobaths
- from 1m and 2.5 m of depth there are 10 cm spacing between isobaths
- more than 2.5 m of depth there are 1m spacing between isobaths
Notice marks

In Austria the Supreme Navigation Authority (Oberste Schifffahrtsbehörde, OSB) is responsible for the notice marks, including the data related to the fairway, buoys, mooring places, etc.

What are the steps for producing and encode all objects and attributes regarding Inland ECDIS Standard Edition 2.0:

1. Data about Notice Marks
2. Check the accuracy and encoding consistency with SevenCs ENC Analyzer
The diagram below describes the whole ENC production process for the Austrian Danube:
6 IENC PUBLICATION PROCESS

In Austria Inland Electronic Navigational Charts (Inland ENCs) are provided and updated at a regular basis and published in S-57 format by the Federal Ministry of Transport, Innovation and Technology (Austrian Supreme Navigation Authority) and by via donau – Österreichische Wasserstraßengesellschaft mbH conforming the Inland ECDIS Standard Edition 2.0.

Updates are published on the DoRIS website, where interested parties can also register for a free Inland ENC newsletter service via e-mail. The publication of new updates for Inland ENCs is announced on the DoRIS Website. All available Inland ENCs with the related edition and update numbers and the date of the publication is published for free on the website

http://www.doris.bmvit.gv.at/inland_ecdis/downloads/inland_ecdis_standard_20/.

This list is updated regularly for fairway users and software companies when there are changes within the Inland ECDIS Standard or modifications inside the data.

These published Inland ENCs are appropriate for navigation. The electronic charts are stored graphic data in vector format allowing a detailed and correct display independent of resolution. When geographic data, bathymetric data and notice marks are modified, only the relevant changes are saved in an update file. These files are small and can be easily updated aboard the vessels via wireless communication.
7 IENC SOURCES AND ACCURACY

The charts were produced on the basis of the information available at the time of generation and are updated when new data become available (e.g. on water engineering work carried out in the meantime or changes to the riverbed due to flooding).

The source data for the ENC product are provided out of surveys. The surveying department (hydrographical) are equipped with tools and technologies to assess the sources to meet the minimum requirement for ENC production.

Depths information are based on RNW96 (low water level according to the recommendations of the Danube Commission). The data provided can only be regarded as information, and authorities do not assume any official liability for the accuracy of the data provided (chart information).

At the moment the accuracy of the IENC objects is as following:

- **Topographical information**: Basic information are out of flight surveys (from aerial photographs). Accuracy +/- 20 cm, at least less than 50 cm (depending on the quality of the aerial photo).

- **Notice Marks**: The position accuracy of notice marks are generally under 1m, position accuracy of boys +/- 5 m.

- **Bathymetric information**: Accuracy of +/- 20 cm (depending on multibeam or singlebeam measurements). Multi-beam measurements provide a complete coverage of the river bed with soundings. The results of single-beam measurements are cross profiles and it is necessary to interpolate soundings between the profiles.
8 INLAND ECDIS STANDARD

In Austria the Inland ENCs are produced according Edition 2.0 of the Inland ECDIS Standard. The Austrian Inland ENCs consist of digitised data conforming to the IHO (International Hydrographic Organization) S-57 ENC Product Specification that records all relevant charted features for safe navigation, such as coastlines, bathymetry, buoys, lights, etc. The IHO S-57 standard is based on the „IHO Transfer Standard for Digital Hydrographic Data“ (Edition 3.1, November 2000), which defines the format for exchanging information, the object catalogue and the product specification. The IHO also published the so-called S-52 standard for standardizing how vessels, bridges, locks, buoys, notice marks, waterway signs, signs and markings and other objects are displayed on the charts.

Soon we will produce the version 2.2 of the Inland ECDIS Standard. But this is depending on the availability of ENC production tools in accordance with the new version 2.2.

The IENC quality control checks according the current Inland ECDIS Standard is done with SevenCs ENC Analyzer.
9 UTILISATION OF LOCATION CODES AND RIS INDEX

The **RIS Index** is a list of location codes with additional information on the objects and is available at [http://www.risexpertgroups.org/index3.html](http://www.risexpertgroups.org/index3.html). In 2009, activities to improve the workflow for the production of the RIS Index started.

In Austria we are providing a RIS Index according to the RIS Index Encoding Guide, which is available on the website of the NtS Expert Group.

The following IENC objects on the Danube are encoded with the 20 digit ISRS location Code:

- Waterway gauges (used for Notices to Skippers)
- Locks (Lock basin. Lock basin part)
- Bridges
- Ports and terminals
- Anchorage areas, berths (pontoons)
- Junctions (end of waterway)
- Bunker facility/Fuelling Station
- Turning Basins

The following objects will be encoded soon:

- Distance marks
- Cities
- Others

The national RIS Index is maintained manually within an Excel file so far. There is no software module used to extract the ISRS location Codes from the IENC objects to the RIS index. In the future a converter will be implemented that automatically generates the national RIS Index out of the national IENCs based on RIS Index Encoding Guide. The reason is that all information provided by the RIS Index should be contained within IENCs. So the Inland ENCs will be the basis for maintenance process of the RIS Index table and not vice versa.

The objective of the IENC-RIS Index Converter is to export the objects with the location codes (ISRS) from the Inland ENCs. The table is in accordance with the RIS Index Encoding Guide.

In addition functionality with quality check will be integrated. This means that the data within Inland ENCs are compared to a set of rules which is provided for the first time on the basis of the definition of the IENC 2.0 Feature catalogue, IENC 2.0 Encoding guide and the current RIS Index Encoding Guide.
After the implementation of this converter tool we will be able to fulfill the provision of all the minimum content as prescribed in the Annex I of the RIS Directive 2005/44/EC.

At the moment in Austria there is no regularly update of the RIS Index. During the implementation and the first trials of the IENC-RIS Index converter a lot of manual quality checks and resulting manual updates within the IENCs are expected. Once the system is running updates only need to be done within the IENCs and then the new national RIS Index has to be generated including the respective automatic quality check.
10 COOPERATIONS

The Inland ENCs of the common border section between Germany (river km 2223.2, Passau) and Austria (river km 2201.5, Engelhartszell) are developed and provided in Germany. At the moment there are no Inland ENCs for the common border section provided by via donau.

The Inland ENCs of the common border section between Slovakia (river km 1872.7, east of Bratislava) and Austria (river km 1880.0, west of Hainburg) are developed and provided in Austria and Slovakia too. So these part is twice covered.
Austrian Inland ENC
There is no special agreement with Germany and Slovakia concerning ‘area of responsibility’. There will be a coordination meeting in 2010 where a bilateral solution in the border sections will be discussed and defined.

The following questions have to be solved on a bilateral basis:

- Who is producing IENCs for which part of the border section?
- What are the procedures for updating of the IENCs (who is providing information to whom)?
- Who is assigning Location Codes for pieces of infrastructure in border sections?
- Between Austria and Slovakia we will have to decide which language should be used for Object Names according Inland ECDIS Standard.
- If one country is providing IENCs for free and the other is selling them, we have to agree on a mode of distribution for the border sections.
11 CHART UPDATES, UPDATING CIRCLE

When there are a lot of updates we provide a new Edition of all IENC cells. So for about every year we publish a new complete Edition of all 34 Austrian cells.

Inland waterways are dynamic systems. If the depth of a water area changes (in case of flood), if there is a new bridge, or a new transhipment installation then updates are provided and published.

In general, the process starts when the hydrographic department provides new surveying data out of aerial orthophotos. The hydrographic department that produce the geographical and bathymetrical information out of surveys is responsible for the accurate and the up-to-date information. Computer software is used to compare the difference between the two versions and then to update the changes.

We get feedback only of our Supreme Navigation Authority (Oberste Schifffahrtsbehörde, OSB).

- End of document -