



# Economic and Social Council

Distr.: General  
1 October 2015  
English  
Original: English, French and  
Russian

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## Economic Commission for Europe

### Inland Transport Committee

#### Working Party on Inland Water Transport

##### Fifty-ninth session

Geneva, 9–11 November 2015

Item 9 (c) of the provisional agenda

**Promotion of River Information Services (RIS) as well as other  
Information and Communication Technologies (ICT) in inland navigation:  
Recommendation on Electronic Chart Display and Information System  
for Inland Navigation (Inland ECDIS) (Resolution No. 48)**

### **Amendment proposals to the Recommendation on Electronic Chart Display and Information System for Inland Navigation (Inland ECDIS) (Resolution No. 48)**

#### Note by the secretariat

## I. Mandate

1. This document is submitted in line with cluster 5: Inland Waterway Transport, paragraph 5.1 of the programme of work 2014–2015 (ECE/TRANS/2014/23) adopted by the Inland Transport Committee on 27 February 2014.
2. The secretariat recalls that the Working Party on the Standardization of Technical and Safety Requirements in Inland Navigation (SC.3/WP.3) at its forty-seventh session approved amendments to Resolution No. 48 transmitted by the Inland ECDIS Expert Group (ECE/TRANS/SC.3/WP.3/2015/5) as amended (ECE/TRANS/SC.3/WP.3/94, para. 50).
3. The Inland ECDIS Expert Group has also proposed new technical appendices to Resolution No. 48 to replace the existing ones to Resolution No. 48 which are available on the UNECE website at [www.unece.org/trans/main/sc3/sc3res.html](http://www.unece.org/trans/main/sc3/sc3res.html) in English only:
  - (a) Appendix 1, “Product Specification for Inland ECDIS”:
    - Appendix 1.0, “Product Specification for Inland ENC’s Edition 2.4 1.0”
    - Appendix 1.1, “Inland ENC Feature Catalogue Edition 2.4.0”
    - Appendix 1.2, “Encoding Guide for Inland ENC’s Edition 2.4.0”

- (b) Appendix 2, “Presentation Library for Inland ECDIS”:
    - Appendix 2.0, “Presentation Library for Inland ECDIS 2.4”
    - Appendix 2.1, “Look Up Tables 2.4”
    - Appendix 2.2, “IES Symbols 2.4”.
  - (c) Appendix 3, “Product Specification for Bathymetric Inland ENC’s”:
    - Appendix 3.0, “Product Specification for Bathymetric Inland ENC’s”
    - Appendix 3.1, “Feature Catalogue for Bathymetric Inland ENC’s Edition 1.0”.
4. The secretariat recalls that amendments to technical appendices proposed by the Inland ECDIS Expert Group are presented for consideration and approval by member Governments at the fifty-ninth session of the Working Party on Inland Water Transport according to the procedure adopted by Resolution No. 77.
5. The Working Party on Inland Water Transport may wish to consider and adopt a draft resolution on amendment of Resolution No. 48 (Chapter II) and its annex (Chapter III) as approved by SC.3/WP.3.
6. The Working Party on Inland Water Transport may wish also to consider and approve the technical appendices proposed by the Inland ECDIS Expert Group.

## **II. Draft resolution on amendment of Resolution No. 48, revised**

### **Resolution No. ...**

#### **(adopted by the Working Party on Inland Water Transport on ...)**

*The Working Party on Inland Water Transport,*

*Noting* the development of electronic charts for inland navigation and the necessity to have a harmonized standard for these charts in Europe to enable international transport to use charts of different countries with the same equipment of hardware and software,

*Responding* to the Policy Recommendation No. 3 of the UNECE White Paper on Efficient and Sustainable Inland Water Transport in Europe (ECE/TRANS/SC.3/189),

*Bearing in mind* the existing standard of IHO and IMO for Electronic Chart Display and Information Systems (S-52 and S-57) for maritime navigation and the desirability of compatibility in areas of mixed traffic, where inland navigation as well as seagoing vessels are navigating,

*Taking into account* Resolution No. 48, revision 2, “Recommendation on Electronic Chart Display and Information System for Inland Navigation (Inland ECDIS)”, of 12 October 2012 (ECE/TRANS/SC.3/156/Rev.2),

*Taking into account also* the report of the Working Party on the Standardization of Technical and Safety Requirements in Inland Navigation of its forty-seventh session (ECE/TRANS/SC.3/WP.3/94, para. 50),

*Recalling* the procedure of any further amendment of Resolution No. 48 and its technical appendices established by Resolution No. 77 and adopted by the Working Party on Inland Water Transport on 12 October 2012,

1. *Decides* to replace the text of the annex to Resolution No. 48, revision 2, with the text contained in the annex to this resolution;

2. *Recommends* Governments, intergovernmental organizations, regional economic integration organizations, river commissions and private entities to apply the Inland ECDIS Standard reproduced in the annex to this resolution for the production of electronic charts for inland navigation,
3. *Recommends* Governments to bring their national legislation concerning navigation by inland waterway in accordance with the Inland ECDIS Standard,
4. *Invites* Governments to keep the secretariat informed of the measures taken with a view to the introduction of the Inland ECDIS Standard, specifying the inland waterways concerned,
5. *Requests* the Executive Secretary of the Economic Commission for Europe to periodically include the question of application of this resolution in the agenda of the Working Party on Inland Water Transport.

### **III. Draft of the third revised edition of the Recommendation on Electronic Chart Display and Information System for Inland Navigation (Inland ECDIS)\***

#### **Annex**

### **Recommendation on Electronic Chart Display and Information System for Inland Navigation (Inland ECDIS)**

#### **A. Preface**

1. Since the late 1990s, reflections and experiments using telematics for the support of inland navigation have been made in several member States of the United Nations Economic Commission for Europe (UNECE). In different research and development projects the radar image on the display in the skipper's wheelhouse was underlaid by an electronic chart. This is a safer and more efficient approach of inland navigation.
2. The discussions established that only an internationally agreed upon procedure would be successful, since a skipper could not be expected to employ different equipment in each country. Thus, the internationally introduced and very mature Electronic Chart Display and Information System (ECDIS) – originally developed for maritime navigation – was also considered for inland navigation. The idea was to adopt ECDIS for inland navigation and to supplement some distinct inland features, but not to change the original ECDIS standard. In this way, compatibility was possible between the original – Maritime – ECDIS and Inland ECDIS. This is important for the estuaries of the rivers, where sea vessels as well as inland vessels navigate.
3. In 1998 the European Union (EU) appointed an Inland ECDIS Expert Group (Expert Group) for the development of an Inland ECDIS Standard. The Expert Group submitted its first proposal on 1 January 1999.

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\* Some minor editorial changes are made by the secretariat in Chapter 4 of Section 2, Chapter 3.1 of Section 4 and numbering of footnotes in the document.

4. In the year 2000, the competent committees of the Central Commission for the Navigation of the Rhine (CCNR) in Strasbourg installed an Ad-hoc Working Group for Inland ECDIS with the order to draft the Inland ECDIS Standard of CCNR.

5. The Ad-hoc Working Group took the results of the Expert Group as the basis for their further work and developed edition 1.0 of the Inland ECDIS Standard. The Inland ECDIS Standard has been adopted not only by CCNR, but also by the Danube Commission, the UNECE and International Navigation Association (PIANC). The standard has become the first in inland navigation to have been recognized by all these organizations.

6. For the UNECE, the Inland ECDIS Standard was adopted by Resolution No. 48, "Recommendation on Electronic Chart Display and Information System for Inland Navigation (Inland ECDIS)" (TRANS/SC.3/156), approved by the UNECE Working Party on Inland Water Transport (SC.3) on 25 October 2001. In this Resolution SC.3 recommended that Governments, intergovernmental organizations, regional economic integration organizations, river commissions and private entities apply the Inland ECDIS Standard for producing electronic charts for inland navigation. It also recommended Governments to bring their national inland waterway navigation legislation in accordance with the standard.

7. Further development by the Expert Group of the standard into edition 2.0 was driven by several aspects:

(a) The research and development EU project COMPRIS (Consortium Operational Management Platform River Information Services) further developed the Inland ECDIS Standard its applications. These developments have been focused on the information side of Inland ECDIS with special regard to voyage planning;

(b) As the Inland ECDIS Standard had not been officially recognized by the International Hydrographic Organization (IHO) in the beginning, there were some incompatibilities between edition 3.1 of S-57 and the first Inland ECDIS Standard. In order to ensure the future compatibility of Inland ECDIS and S-57 and its foreseen successors S-100 and S-101, it was necessary to obtain recognition by IHO. Therefore an international harmonization group with the participation of the Russian Federation, the United States of America (US) and several countries from South America and Asia was set up to get a better basis for a worldwide recognition of Inland ECDIS. The Inland ENC Harmonization Group (IEHG) was mandated as a task force of the Expert Group. IEHG developed an Inland ENC Encoding Guide on the basis of a similar document of the US Army Corps of Engineers (USACE). This document was amended with the additional features and attributes of the European approach after a thorough check on which features and attributes to introduce. Whenever possible, the American approach of using pure S-57 to encode the same real world entities was applied. All the amendments of COMPRIS and the harmonization process were introduced in the documents of the Inland ECDIS standard by the Expert Group. IEHG has been recognized as a Non-Governmental International Organization (NGIO) by IHO in 2009. An Inland ENC Domain has been implemented by IEHG within the S-100 registry of IHO;

(c) The European Directive 2005/44/EC of 7 September 2005 "on harmonized river information services (RIS) on inland waterways in the Community" required the adoption of a technical specification in the area of Inland ECDIS.

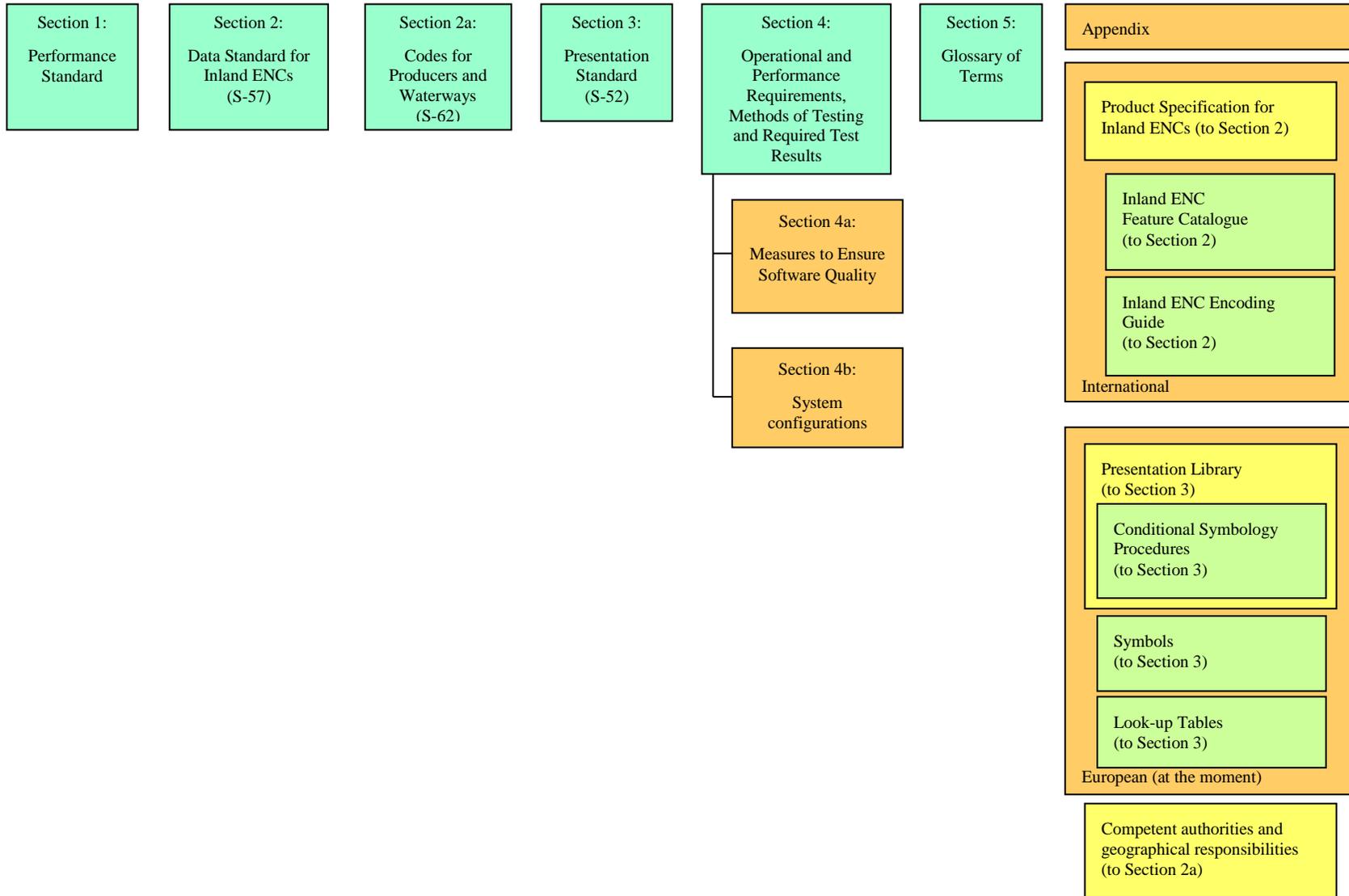
8. The Expert Group had delivered its proposal for edition 2.0 in June 2006 to the relevant international organizations for adoption. Based on this proposal from the Expert Group, SC.3, at its fiftieth session, decided to update its Resolution No. 48 accordingly (ECE/TRANS/SC.3/174, para. 50). The first revised edition of the Resolution was issued by the UNECE in 2007 (ECE/TRANS/SC.3/156/Rev.1).

9. In February 2011, the Chair of the Expert Group informed SC.3 about an updated edition of the Inland ECDIS Standard (Edition 2.3). Edition 2.3 was also transmitted by the Expert Group to the River Information Services (RIS) Committee of the EU, which approved the proposal to use it for the Commission Regulation on Inland ECDIS within the framework of the Directive 2005/44/EC. The work on the second revised edition of Resolution No. 48 was, thus, initiated by UNECE in 2011. During this revision the term “Inland ECDIS Standard” was replaced by “Technical specifications for Inland ECDIS”. The revised Resolution was approved by the fifty-sixth session of SC.3 on 12 October 2012 as resolution No. 77.

10. The following diagram and table show the structure of the Inland ECDIS and the mapping between (maritime) ECDIS and the technical specifications for Inland ECDIS, Edition 2.3.

11. Technical appendices established by the Expert Group can be consulted in English at the website of SC.3: [www.unece.org/trans/main/sc3/sc3res.html](http://www.unece.org/trans/main/sc3/sc3res.html).

### B. Structure of the technical specifications for Inland ECDIS



## C. Comparison of the structures of the standard for (Maritime) ECDIS and of the technical specifications for Inland ECDIS

<i>(Maritime) ECDIS</i>	<i>Inland ECDIS</i>	<i>OPEN ECDIS FORUM</i> <a href="http://ienc.openecdis.org">http://ienc.openecdis.org</a>
IMO MSC.232(82) revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS), December 2006	Section 1: Performance Standard	
<ul style="list-style-type: none"> <li>Appendix 1: Reference Documents</li> <li>Appendix 2: SENC Information available for display during route planning and route monitoring</li> <li>Appendix 3: Navigational Elements and Parameters</li> <li>Appendix 4: Areas for which special conditions exist</li> <li>Appendix 5: Alarms and Indicators</li> <li>Appendix 6: Back-up requirements</li> <li>Appendix 7: RCDS mode of operation</li> </ul>		
IHO S-57: Transfer Standard for Digital Hydrographic Data, Edition 3.1 (including Supplement No. 2, June 2009)	Section 2: Data Standard for Inland ENC's	
<ul style="list-style-type: none"> <li>Part 1: General Introduction</li> <li>Part 2: Theoretical Data Model</li> <li>Part 3: Data Structure</li> <li>Appendix A: IHO Object Catalogue</li> </ul>		Inland ENC Feature Catalogue
<ul style="list-style-type: none"> <li>Chapter 1: Object Classes</li> <li>Chapter 2: Attributes</li> <li>Annex B: Attributes/Object Classes Cross Reference</li> <li>Appendix B: Product Specifications</li> <li>Appendix B.1: ENC Product Specification</li> <li>Annex A: Use of the Object Catalogue for ENC</li> <li>Annex B: Example of CRC Coding</li> <li>Appendix B.2: IHO Object Catalogue Data Dictionary Product Specification</li> </ul>		<ul style="list-style-type: none"> <li>Bathymetric Inland ENC Feature Catalogue</li> <li>Product Specification for Inland ENC's</li> <li>Product Specification for bathymetric Inland ENC's</li> </ul>
IHO S-62 ENC Producer Codes, Edition 2.5, December 2009	Section 2a: Codes for Producers and Waterways	OEF ( <a href="http://www.openecdis.org">www.openecdis.org</a> ): Codes for Producers and Waterways (not part of the Inland ECDIS technical specifications)
IHO S-52 Specification for Chart Content and Display Aspects of ECDIS, Edition 6, March 2010	Section 3: Presentation Standard	Presentation Library for Inland ECDIS
<ul style="list-style-type: none"> <li>Annex A: IHO ECDIS Presentation Library</li> <li>Annex B: Procedure for initial calibration of colour displays</li> <li>Annex C: Procedure for maintaining the calibration of displays</li> </ul>		<ul style="list-style-type: none"> <li>Look-up Tables</li> <li>Symbols</li> <li>Conditional</li> <li>Symbology Procedures</li> </ul>

<i>(Maritime) ECDIS</i>	<i>Inland ECDIS</i>	<i>OPEN ECDIS FORUM</i> <i><a href="http://ienc.openecdis.org">http://ienc.openecdis.org</a></i>
Appendix 1:	Guidance on Updating the Electronic Chart	
Annex A:	Definitions and Acronyms	
Annex B:	Current Updating Practice for Paper Charts	
Annex C:	Estimate of Data Volume	
	IEC 61174 Edition 3.0: ECDIS – Operational and Performance Requirements, Methods of Testing and Required Test Results, 2008	Section 4: Operational and Performance Requirements, Methods of Testing and Required Test Results  Section 4a: Measures to Ensure Software Quality  Section 4b: System Configurations
IHO S-32 Appendix 1: Hydrographic Dictionary – Glossary of ECDIS-Related Terms		Section 5: Glossary of Terms

## **D. Technical Specifications for Electronic Chart Display and Information System for Inland Navigation (Inland ECDIS) (Edition 2.4)**

### **Section 1: Performance Standard for Inland ECDIS**

#### **1. Introduction**

(a) Inland ECDIS contributes to safety and efficiency of inland shipping and thereby to the protection of the environment;

(b) Inland ECDIS reduces the navigational workload as compared to traditional navigation and information methods;

(c) Inland ECDIS can be designed for both information mode and navigation mode<sup>1</sup> or for information mode only;

(d) For the navigation mode as specified in Section 4 of these technical specifications, Inland ECDIS (Operating System Software, Application Software and Hardware) must have a high level of reliability and availability; at least of the same level as other means of navigation;

<sup>1</sup> On wide inland waterways, Basin Administration may waive the requirement concerning the differentiation between the “navigation mode” and “information mode” of usage of Inland ECDIS, just as it is the case in the IHO Standard S-52.

- (e) Inland ECDIS must use chart information as specified in Sections 2 and 3 of these technical specifications;
- (f) Inland ECDIS must facilitate simple and reliable updating of the Inland Electronic Navigational Chart;
- (g) Inland ECDIS must provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment;
- (h) Inland ECDIS must meet the requirements of this performance standard.

## 2. References

- (a) IHO Special Publication S-57, "IHO Transfer Standard for Digital Hydrographic Data", Edition 3.1, including Supplement No. 2, June 2009;
- (b) IHO Special Publication S-62, "ENC Producer Codes", Edition 2.5, December 2009;
- (c) IHO Special Publication S-52, "Specifications for Chart Content and Display Aspects of ECDIS", Edition 6, March 2010, including S-52 Appendix 1 "Guidance on Updating the Electronic Navigational Chart", Edition 4.0, April 2012;
- (d) IMO Resolution MSC.232(82) "Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS)", December 2006;
- (e) International Standard IEC 61174, edition 3.0 "Maritime navigation and radiocommunication equipment and systems – Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results", 2008;
- (f) EU Directive 2006/87/EC as amended by 2013/49/EU and Article 7.06 and Annex M of the Rhine Vessel Inspection Regulation laying down technical requirements for inland waterway vessels, Annex IX, Parts III to VI, "Requirements applicable to signal lights, radar installations and rate-of-turn indicators";
- (g) IHO Special Publication S-32, Appendix 1 "Hydrographic Dictionary – Glossary of ECDIS-related Terms";
- (h) EN 60945 (2002) and Corr.1 (2010): Marine navigational equipment; General requirements – Methods of testing and required test results;
- (i) DC Recommendations on the main technical and operational parameters for the radar installations used for the navigation on the Danube, CD/SES 60/10, Budapest, 2003;
- (j) UNECE Resolution No. 61, revised, "Recommendations on Harmonized Europe-Wide Technical Requirements for Inland Navigation Vessels", Appendix 7, Part III "General technical specifications applicable to radar equipment" (ECE/TRANS/SC.3/172/Rev.1 and Amends. 1 and 2);
- (k) UNECE Resolution No. 57, revised, "Guidelines and Recommendations for River Information Services" (ECE/TRANS/SC.3/165/Rev.1).

### 3. Contents, Provision and Updating of Chart Information

#### 3.1 Contents and Provision of Inland ENC and Bathymetric Inland ENC

- (a) The chart information to be used in Inland ECDIS must be the latest edition of information;
- (b) Provisions must be made to prevent the user from altering the contents of original Inland ENC and bathymetric Inland ENC editions;
- (c) At least the following features must be included in the Inland ENC:
- bank of waterway (at mean water level)
  - shoreline construction (e.g. groyne, longitudinal control dam, training wall – any facility that is considered a hazard to navigation)
  - contours of locks and dams
  - boundaries of the fairway/navigation channel (if defined)
  - isolated dangers in the fairway/navigation channel under water
  - isolated dangers in the fairway/navigation channel above water level, such as bridges, overhead cables, etc.
  - official aids-to-navigation (e.g. buoys, beacons, lights, notice marks)
  - waterway axis with kilometres and hectometres or miles
  - location of ports and transshipment sites
  - reference data for water level gauges relevant to navigation
  - links to the external xml-files with operation times of restricting structures, in particular locks and bridges.

If the chart producer is using overlay files or bathymetric Inland ENCs the features can be included in different cells, but the whole package has to fulfil the minimum requirements;

(d) If the chart is intended to be used for navigation mode, the respective competent authority decides for each waterway or harbour within its geographical area of responsibility which of the above named features are to be verified. The respective competent authority must declare which Inland ENCs and bathymetric Inland ENCs are approved for navigation mode within its geographical area of responsibility;<sup>2</sup>

- (e) The SENC shall be stored in the Inland ECDIS.

#### 3.2 Updates

(a) Inland ECDIS shall be capable of accepting updates to the Inland ENC data provided in conformity with the Product Specification for Inland ENCs and updates of the depth information provided in conformity with the Product Specification for bathymetric Inland ENCs. These updates must be applied to the Inland SENC automatically. The implementation procedure must not interfere with the display in use;

(b) Inland ECDIS must allow display of updates, so that the skipper may review their contents and ascertain that they have been included in the Inland SENC;

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<sup>2</sup> For further details see Section 2a of these technical specifications.

- (c) Inland ECDIS must be capable of revoking automatically applied updates of the Inland ENC data;
- (d) Original Inland ENC editions and later updates must never be merged;
- (e) The Inland ENC and all updates to it must be displayed without any degradation of their information content;
- (f) The Inland ENC data and updates to it must be clearly distinguishable from other information;
- (g) Inland ECDIS must ensure that the Inland ENC and all updates to it have been correctly loaded into the Inland SENC;
- (h) Inland ECDIS must keep a record of updates, including the time of application to the Inland SENC;
- (i) The contents of the Inland SENC to be used must be adequate and up-to-date for the intended voyage.

## **4. Presentation of Information**

### **4.1 Display Requirements and Recommendations**

- (a) The display method must ensure that the displayed information is clearly visible to more than one observer in the typical conditions of light experienced in the wheelhouse of a vessel by day and night;
- (b) The display size of the chart presentation must be at least 270 mm by 270 mm for equipment designed and admitted for the navigation mode. In information mode ergonomic aspects must determine the size. The information displayed must be readily visible from the conning position:
- alphanumeric data and text should be presented using a clearly legible non-italic, sans-serif font
  - the font size shall be appropriate for the viewing distance from user positions (i.e. with respect to reading distance and viewing angles) likely to be experienced in the wheelhouse of a vessel
  - the character height and the size of AIS symbols in millimetres shall not be less than 3.5 times the nominal viewing distance in metres
  - the minimum size of AIS symbols and the minimum character height of AIS information should be 3.5 mm
  - the manufacturer's documentation shall identify the nominal viewing distance for the display equipment
  - for the size of the display it is recommended to use the size as specified for navigation mode in this standard. In case space for the installation of the display is an issue the display size might be reduced taking into account the nominal viewing distance for the display. In any case, the display diagonal may not be smaller than 199 mm (7.85 inch). Under all conditions the shipmaster must be capable to perceive the displayed information sufficiently
  - if the software is sold without display the manufacturer's documentation shall include the information that it may only be used as Inland ECDIS in Information mode if the display fulfils the requirements of this chapter 4.1.

(c) The display requirements must be met whether in landscape or in portrait format.

#### 4.2 Display Ranges (Scales)

(a) In information mode,<sup>3</sup> it is recommended to use the same ranges as specified in navigation mode. All scales and ranges are allowed;

(b) In navigation mode,<sup>4</sup> only the successive switchable ranges (scales) specified in Section 4, Chapter 4.7 of these technical specifications are allowed.

#### 4.3 Image Positioning and Orientation

(a) In information mode all kinds of chart orientation are allowed;<sup>3</sup>

(b) In navigation mode the chart must be automatically positioned and oriented in the relative motion, head-up orientation with the own vessel's position in the screen centre or off-centred.<sup>4, 5</sup>

#### 4.4 Display of Inland SENC Information

(a) The display of Inland SENC information must be divided into the following three display categories:

- display Base
- standard Display
- all Display.

The allocation of the feature classes to the display categories is given in detail in the "Look-up Tables" of Appendix 2, "Presentation Library for Inland ECDIS", of these technical specifications.

(b) The Display Base category must contain at least the following features:

- bank of waterway (at mean water level)
- shoreline construction (e.g. groyne, longitudinal control dam, training wall – any facility that is considered a hazard to navigation)
- contours of locks and dams
- boundaries of the fairway/navigation channel (if defined)
- isolated dangers in the fairway/navigation channel under water
- isolated dangers in the fairway/navigation channel above water level, such as bridges, overhead wires, etc.
- official aids-to-navigation (e.g. buoys, lights and beacons).

(c) The Standard Display category must contain at least the following features:

- the objects of Display Base category
- prohibited and restricted areas

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<sup>3</sup> See Chapter 5.1 of this Section.

<sup>4</sup> See Chapter 5.2 of this Section.

<sup>5</sup> On wide inland waterways, Basin Administration may allow the true motion and north-up orientation of the picture.

- piers for commercial vessels (cargo and passenger)
- kilometre and hectometre or mile marks on the banks.

(d) The All Display category must display all features that are contained in the Inland SENC, individually on demand;

(e) When invoking the Inland ECDIS, it must come up with the Standard Information Density at an appropriate range available in the Inland SENC for the displayed area;

(f) Inland ECDIS must be switchable to the Standard Information Density at any time by a single operator action;

(g) Inland ECDIS must clearly indicate the information density currently in use at all times;

(h) Time variable depth information in the Inland ENC must be displayed independently of the above named three display categories.

#### **4.5 Display of Radar Information**

(a) In navigation mode, the radar image must have the highest display priority and it is only allowed to be presented in the relative motion, head-up mode. If the system is also type approved for maritime ECDIS, true motion and north-up mode may be implemented. If such a system is used in true motion and/or north-up mode on European inland waterways, it is considered to be working in information mode;

(b) The under laid Inland SENC must match in position, range and orientation. The radar image and the position from the position sensor must both be adjustable for the antenna offset to the conning position;

(c) The overlaid radar image must conform to the minimum requirements as specified in Section 4, Chapter 4.14 of these technical specifications;

(d) The overlaid radar image may contain additional navigational information. Any additional navigational information and tracking and tracing symbols must however in no way degrade the display of the original radar content.

#### **4.6 Display of Other Navigational Information**

(a) Inland ECDIS and additional navigational information must use a common reference system;

(b) It must be possible to display the skipper's own vessel's position on the screen;

(c) It must be possible for the skipper to select safety limits;

(d) Inland ECDIS must indicate the falling short of the safety limits.

#### **4.7 Colours and Symbols**

(a) The display of colours and symbols to represent Inland SENC information must comply, at least, with the regulations of Section 3 of these technical specifications. Other user-selectable symbol sets are also allowed;

(b) To present navigational elements and parameters as listed in the IMO Resolution MSC.232(82), Appendix 3, other colours and symbols than those mentioned in 4.7 (a) must be used;

#### **4.8 Data and Display Accuracy**

(a) The accuracy of the calculated data that are presented must be independent of the display characteristics and must be consistent with the Inland SENC accuracy;

(b) The Inland ECDIS in navigation mode shall provide an indication whether the display uses a smaller display range than the accuracy of the Inland ENC data offers (over-scale indication);

(c) The accuracy of all calculations performed by Inland ECDIS must be independent of the characteristics of the output device and must be consistent with the Inland SENC accuracy;

(d) Bearings and distances drawn on the display or those measured between features already drawn on the display must have accuracy no less than that afforded by the resolution of the display.

### **5. Operation**

#### **5.1 Information Mode**

(a) Information mode must be used for information only and not for navigation;

(b) In information mode all kinds of chart orientation, rotation, zooming and panning are allowed. However, it is recommended to use the same fixed ranges as in navigation mode and the chart orientation either:

- to north, or
- to the fairway axis at the actual position, or
- to the actual vessels-heading.

(c) It should be possible to scroll the chart manually on the screen with the fairway axis in line with the vertical screen axis;

(d) Inland ECDIS may be connected to a positioning sensor to scroll the chart picture automatically and to display the section of the chart matching the actual surrounding, namely in the operator-selected range;

(e) Information regarding the position and orientation of other vessels, gathered by communication links like AIS, must be displayed only if they are up-to-date (nearly real-time) and accurate. The position and the orientation of other vessels by:

- a directed triangle, or
- a true outline (to scale)

must not be presented if the heading of these other vessels is not available. A generic symbol is recommended.

The following time out values are recommended:<sup>6</sup>

<i>Category of vessel</i>	<i>Nominal reporting interval class A</i>	<i>Maximum time out value class A</i>	<i>Nominal reporting interval class B</i>	<i>Maximum time out value class B</i>
Vessel at anchor or moored and not moving faster than 3 knots (class B not moving faster than 2 knots)	3 min	18 min	3 min	18 min
Vessel at anchor or moored and moving at more than 3 knots	10 s	60 s	3 min	18 min
Vessel operating in SOLAS mode, moving at 0 to 14 knots	10 s	60 s	30 s	180 s
Vessel operating in SOLAS mode, moving at 0 to 14 knots and changing course	3 1/3 s	60 s	30 s	180 s
Vessel operating in SOLAS mode, moving at 14 to 23 knots	6 s	36 s	30 s	180 s
Vessel operating in SOLAS mode, moving at 14 to 23 knots and changing course	2 s	36 s	30 s	180 s
Vessel operating in SOLAS mode, moving faster than 23 knots	2 s	30 s	30 s	180 s
Vessel operating in SOLAS mode, moving faster than 23 knots and changing course	2 s	30 s	30 s	180 s
Vessel operating in inland waterway mode	2–10 s	60 s	–	–

The AIS targets must be marked as outdated if the position information of moving vessels is older than 30 seconds.

Information on the intention (blue sign) or the number of blue cones of other vessels, the status of signals, weather warnings (EMMA) and the water level received via Inland AIS may be displayed. The information on the intention (blue sign) must only be displayed on the right side of the symbol, if the heading of the vessel is available. If no heading information is available the information must only be displayed in a direction independent form. The following table is providing an example for the display:

<sup>6</sup> Values taken from IEC 62388.

Visualisation of Blue Sign status 0 to 2 and dangerous goods							
Blue Sign		Not connected or not available		Not set		Set	
Blue cones		no	1 to 3	no	1 to 3	no	1 to 3
Heading	No						
	Symbol						
	True shape						
Yes	True shape						

(f) Information regarding AIS base stations, AIS Aids to Navigation (ATON) and AIS Search and Rescue Transmitters (SART) may be displayed, if the symbols can be distinguished from other symbols (e.g. symbols 2.10 and 2.11 of IEC 62288 Ed. 2, Table A.2);

(g) Information received by an AIS device and required by local police regulations shall be displayed;

(h) It shall be possible to display all information transmitted by an AIS on user request.

**5.2 Navigation Mode**

(a) In navigation mode, the Inland ECDIS display must be integrated with the vessel’s own radar information. The radar information must be clearly distinguishable from the SENC information;

(b) The Integrated Display must be in accordance with the requirements for radar on inland waterways as specified in Section 4, Chapter 4.14 of these technical specifications;

(c) The chart and the radar image must match in size, position and orientation within the limits as specified in Section 4, Chapter 3.4 and 8.3.2 of these technical specifications;

(d) The Integrated Display must only be presented in the head-up orientation. Other orientations are permitted in systems with an additional maritime ECDIS type approval. If such a system is used in true motion and/or north-up mode on European inland waterways, it is considered to be working in information mode;<sup>7</sup>

(e) It must be possible for the operator to adjust the off-set values between the positions of the position sensor and the radar antenna of the vessel so that the SENC display matches the radar image;

(f) It must be possible to remove either the ECDIS or the radar information by a single operator action temporarily;

<sup>7</sup> On wide inland waterways, Basin Administration may allow the true motion and north-up orientation of the picture.

(g) The vessel's position must be derived from a continuous positioning system of which the accuracy is consistent with the requirements of safe navigation;

(h) Navigation mode must provide an indication when the input from the position-fixing system is lost. Navigation Mode must also repeat, but only as an indication, any alarm or indication passed to it from a position fixing system;

(i) The positioning system and the SENC must be based on the same geodetic datum;

(j) In navigation mode the data according to Chapter 3.1 (c), first to seventh indent, of this Section shall always be visible and shall not be obscured by other objects. The transparency of the radar overlay shall, therefore, be user defined;

(k) Information regarding the position and orientation of other vessels, gathered by other communication links than the vessel's own radar, are permitted to be displayed only if they are up-to-date (nearly real-time) and meet the accuracy that is required for the support of tactical and operational navigation. Position information of the own vessel that is received from a repeater station must not be displayed;

(l) As tracking and tracing information (for example AIS) of other vessels is useful for the planning of the passing, but of no use during passing itself, tracking and tracing (AIS) symbols must not disturb the radar image during passing and must be faded out therefore. Preferably the application must allow the skipper to define the area where the symbol is faded out;

(m) The presentation of the position and the orientation of other vessels by:

- a directed triangle, or
- a true outline (to scale)

are permitted only if the heading of these other vessels is available. In all other cases a generic symbol must be used (an octagon is recommended, a circle must not be used for applications which are certified according to maritime standards);

(n) Information that another vessel is carrying blue cones or lights may be displayed by a different color of the vessel symbol. The number of the blue cones/lights must only be displayed in the pick report;

(o) Information on the intention of another vessel to pass on starboard (blue sign) may only be displayed on the right side of the directed triangle symbol or of the scaled shape if the heading of this vessel is available. If no heading information is available, the information must only be displayed in a direction independent form;

(p) Information regarding the position of AIS base stations, AIS Aids to Navigation (ATON) and AIS Search and Rescue Transmitters (SART) may be displayed, if the symbols can be distinguished from other symbols (e.g. symbols 2.10 and 2.11 of IEC 62288 Ed. 2, Table A.1).

### 5.3 Operation and Control Elements

(a) Inland ECDIS must be designed following ergonomic principles for user-friendly operation;

(b) The Inland ECDIS equipment must have a minimum of operation and control elements in accordance with Section 4 of these technical specifications;

(c) Operation and control elements, and indicators for connected sensors, may be integrated in Inland ECDIS;

- (d) Standard settings and user-defined settings must be easily retrievable.

## **6. Connections with other Equipment**

- (a) Inland ECDIS must not affect the performance of any connected equipment adversely. Similarly the connection of optional equipment must not degrade the performance of Inland ECDIS;
- (b) Inland ECDIS must be capable of generating information to other systems, e.g. for the purpose of electronic reporting;
- (c) The relevant requirements of controls and indicators to connected equipment must be fulfilled.

## **7. Indications and Alarms**

### **7.1 Built-in Test Equipment (BITE)**

Inland ECDIS in navigation mode shall be provided with means for carrying out on board tests of major functions either automatically or manually. In case of a failure, the module at fault must be shown.

### **7.2 Malfunctions**

- (a) Inland ECDIS in navigation mode shall provide a suitable alarm or indication of system malfunctions;<sup>8</sup>
- (b) Inland ECDIS in information mode shall provide a suitable alarm or indication of missing input from – if connected – GPS, AIS and heading device.

## **8. Fallback Arrangements**

### **8.1 Insufficient Accuracy of the SENC Positioning**

In navigation mode, the SENC must be automatically switched off, if the SENC positioning does not match the radar picture within the limits of Section 4, Chapter 5.1 and 5.2 of these technical specifications.<sup>9</sup>

### **8.2 Defects**

- (a) If the Inland ECDIS system in navigation mode has an evident defect, it shall provide a suitable alarm;<sup>10</sup>
- (b) Facilities enabling a safe take-over of the functions of the Inland ECDIS in navigation mode shall be provided in order to ensure that an Inland ECDIS failure does not result in a critical situation.

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<sup>8</sup> See Section 4, Chapter 9 of these technical specifications.

<sup>9</sup> On wide inland waterways, Basin Administration may prescribe that Inland ECDIS must provide a suitable alarm and/or indication, if the SENC positioning does not match the radar picture within the limits of Section 4, Chapters 5.1 and 5.2.

<sup>10</sup> See Section 4, Chapters 4.16 and 9 of these technical specifications.

## 9. Power Supply in Navigation Mode

Inland ECDIS must have its own separate, fused power supply.

## Section 2: Data Standard for Inland ENCs

### 1. Introduction

(a) This “Data Standard for Inland ENCs” describes the technical specifications to be used:

- for the exchange of digital hydrographic data between national inland waterway authorities, and
- or its distribution to manufacturers, skippers and other users.

(b) This Data Standard must be used for the production of Inland ENCs and bathymetric Inland ENCs. The transfer and distribution must take place in such a way that none of the information is lost;

(c) This Data Standard is based on the “IHO Transfer Standard for Digital Hydrographic Data”, Special Publication No. 57, Edition 3.1, Supplement 2, with all Appendices and Annexes (see comparison table in the preface of these technical specifications), hereafter S-57;

(d) This Data Standard describes the necessary additions and clarifications to S-57 and the application of S-57 for the purpose of use in Inland ECDIS applications;

(e) This Data Standard comprises:

- this Section 2;
- Appendix 1.0, “Product Specification for Inland ENCs”, Appendix 1.1, “Inland ENC Feature Catalogue”, and Appendix 1.2, “Encoding Guide for Inland ENCs”; and
- Appendix 3.0, “Product Specification for Bathymetric Inland ENCs”, and Appendix 3.1, “Feature Catalogue for Bathymetric Inland ENCs”.

### 2. Theoretical Data Model

The description of the theoretical data model in S-57, Part 2 must apply to the theoretical data model of Inland ENCs and bathymetric Inland ENCs.

### 3. Data Structure

The description of the data structure in S-57, Part 3 must apply to the data structure of Inland ENCs and bathymetric Inland ENCs.

#### 4. Product Specification for Inland ENC<sup>s</sup> and bathymetric Inland ENC<sup>s</sup>

(a) The Product Specification for Inland ENC<sup>s</sup><sup>11</sup> and for bathymetric Inland ENC<sup>s</sup><sup>12</sup> are sets of specifications intended to enable chart producers to produce a consistent Inland ENC or bathymetric Inland ENC, and manufacturers to use that data efficiently in an Inland ECDIS that satisfies the Performance Standard for Inland ECDIS.<sup>13</sup>

(b) Data for ENC<sup>s</sup> shall be made available to all manufacturers of applications.

An Inland ENC shall be produced in accordance with the rules defined in these technical specifications and shall be encoded using:

- the Inland ENC Feature Catalogue;<sup>14</sup> and
- the rules described in the Inland ENC Encoding Guide.<sup>15</sup>

A bathymetric Inland ENC shall be produced in accordance with the rules defined in these specifications and shall be encoded using:

- the bathymetric Inland ENC Feature Catalogue;<sup>16</sup> and
- the rules described in the Inland ENC Encoding Guide.<sup>17</sup>

(c) Official Inland ENC<sup>s</sup> and bathymetric Inland ENC<sup>s</sup> shall be produced in accordance with the latest version of the “Data Standard” including the “Product Specification”. Official Inland ENC<sup>s</sup>, which have been produced in accordance with earlier editions of the Inland ECDIS Standard and before the entry into force of these technical specifications remain valid until new editions of Official Inland ENC<sup>s</sup> are published in accordance with these technical specifications.

#### 5. Definitions

Definitions of terms may be found in:

- S-57, part 1, clause 5
- “Glossary of ECDIS Related Terms”, S-52, Appendix 1
- “Glossary of Terms”, Section 5 of these technical specifications.

#### Section 2a: Codes for Producers and Waterways<sup>18</sup>

(a) Codes for producers of Inland ENC<sup>s</sup> as well as the registration procedure are those mentioned in IHO S-62.

(b) Administrations or private companies which produce Inland ENC<sup>s</sup> and which are not already mentioned in IHO-S-62 and administrations or private companies decide to

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<sup>11</sup> See Appendix 1.0.

<sup>12</sup> See Appendix 3.0.

<sup>13</sup> See Section 1.

<sup>14</sup> See Appendix 1.1.

<sup>15</sup> See Appendix 1.2.

<sup>16</sup> See Appendix 3.1.

<sup>17</sup> See Appendix 1.2.

<sup>18</sup> The codes provided in this section are in addition to those listed in the IHO S-62 ENC Producer Codes.

produce Inland ENC's shall register a producer code at the S-100 registry of IHO at <https://registry.iho.int/navbar.html>;

(c) Since a producer code alone is not sufficient to judge whether an Inland ENC is appropriate for navigation mode, the following declaration process is applicable:

1. The competent authority for a waterway or a harbour must register itself on the official website of the organizations which have adopted these technical specifications. Details on the name of the authority, its geographical area of responsibility, its official website and other communication possibilities must be given and must be accessible on this website.

2. The competent authority for a waterway or a harbour must maintain a list of Inland ENC's which are appropriate for navigation mode within its geographical area of responsibility. The list must include the file name of the cell, the stretch of the inland waterway covered, the edition number, the issue date and a list of available updated files to the currently valid edition, with their issue dates. By putting an Inland ENC on that list, the authority declares this cell as verified concerning the minimum content and therefore appropriate for navigation mode.

(d) The lists of competent authorities for waterways or harbours with the above-mentioned details on the official websites of the organizations which have adopted these technical specifications are regarded as digital parts of the Inland ECDIS technical specifications and are named "Competent authorities and geographical responsibilities";

(e) The following codes for waterways are recommended for use in the file name of Inland ENC's:

<i>Waterway Code</i>	<i>Waterway Name</i>	<i>Remark</i>
AK	Albertkanaal/Canal Albert	
AKL	Afleidingskanaal van de Leie	
BA	Balaton	
BCR	Branche de la Croyère	
BED	Benedendijle	
BEN	Beneden-Nete	
BEZ	Beneden-Zeeschelde	
BH	Kanaal Bocholt-Herentals	
BK	Boudewijn Kanaal	
BLO	Branche de La Louvière	
BME	Basse-Meuse	
BN	Kanaal Briegden-Neerharen	
BOS	Bovenschelde	
BOZ	Boven-Zeeschelde	
BSK	Berlin-Spandauer Schiffahrtskanal	including Westhafenkanal and Charlottenburger Verbindungskanal
BZ	Beneden Zeeschelde	

<i>Waterway Code</i>	<i>Waterway Name</i>	<i>Remark</i>
CCB	Canal Charleroi-Bruxelles/Kanaal Brussel -Charleroi	
CCG	Canal du Centre à Grand Gabarit	
CHV	Canal de Haccourt à Visé	
CLA	Canal de Lanaye	
CMO	Canal de Monsin	
CPC	Canal Pommeroeul-Conde	
D	Danube	including Sulina branch
DA	Danube Chilia branch	
DB	Dunarea Barcea	
DCC	Danube Cernovoda canal	
DDT	Dijledoortocht	
DE	Dortmund-Ems Kanal	
DEN	Dender	
DHK	Datteln-Hamm Kanal	
DKW	Kanaal Dessel-Kwaadmechelen	
DR	Drava	
DTS	Kanaal Dessel-Turnhout-Schoten	
DUK	Rackevei-Duna	
DUM	Mosoni-Duna	
DUR	Gekanaliseerde Durme (Beneden-Durme)	
DUS	Szenterei-Duna	
DV	Dunarea Veche	
EL	Elbe	
EH	Elbe-Havel-Kanal	
EMS	Ems	
EPP	Embranchement Principal	
ES	Elbe-Seiten-Kanal	
EV	Estuaire Vaart	Estuary shipping between Zeebrugge and Dutch border
GA	St. Gheorghe-Arm	
GMO	Grand Large de Mons	
GPE	Grand Large de Péronnes	
HES	Haut-Escaut	
HO	Havel-Oder-Wasserstraße	including Westoder
IJZ	Ijzer	
KB	Kanaal naar Beverlo	
KBK	Kanaal Bossuit-Kortrijk	
KGO	Kanaal Gent-Oostende	

<i>Waterway Code</i>	<i>Waterway Name</i>	<i>Remark</i>
KGT	Kanaal Gent-Terneuzen	
KK	Küstenkanal	
KLD	Kanaal Leuven-Dijle	
KND	Kanaal Nieuwpoort-Duinkerken	
KPN	Kanaal Plassendale-Nieuwpoort	
KRL	Kanaal Roeselare-Leie	
KVE	Kanaal van Eeklo	
LA	Lahn	
LOK	Lokanaal	
LS	Leie/Lys River	
MA	Main	
MD	Main-Donau-Kanal	
ME	Müritz-Elde-Wasserstraße	
MEU	Meuse/Maas	
ML	Mittelland-Kanal	
MMI	Meuse Mitoyenne Sud	
MO	Mosel	
MOE	Moervaart	
N	Dnipro	
NBP	Canal Nimy-Blaton-Peronnes	
ND	Desna	
NE	Neckar	
NOK	Nord-Ostsee-Kanal	
NPR	Prypiat	
NSU	Sula	
NTK	Netekanaal	
NVO	Vorskla	
OD	Oder	
OL	Olt	
PB	Pivdennyi Buh	
PK	Plassendale Kanaal	
RH	Rhine	
RHK	Rhein-Herne-Kanal	
RL	Nederrijn/Lek	
ROG	Ringvaart om Gent	
RU	Ruhr	
RUP	Rupel	
SA	Sava	
SAM	Sambre	

<i>Waterway Code</i>	<i>Waterway Name</i>	<i>Remark</i>
SE	Schelde	
SI	Sio-chatorna	
SKH	Stichkanal Mittelland-Kanal-Hildes-heim	
SKL	Stichkanal Mittelland-Kanal-Hannover-Linden	
SKO	Stichkanal Mittelland-Kanal-Osnabrück	
SKS	Stichkanal Mittelland-Kanal-Salzgitter	
SL	Saale	
SM	Smeermaas	
SO	Spree-Oder-Wasserstraße	
SPI	Spierekanaal	
SR	Saar	Currently SA is used; this will be changed to SR in the next edition
SRV	Schelde-Rijnverbinding	
TI	Tisza	
TLE	Toeristische Leie (Leie)	
UH	Untere Havel-Wasserstraße	
UWE	Unterweser	from km UWe 0.00
VKN	Verbindingskanaal Nieuwpoort	
WA	Waal	
WDK	Wesel-Datteln-Kanal	
WE	Mittelweser	until km 366.65/UWe 0.00
ZBS	Zeekanaal Brussel-Schelde	
ZUL	Vertakking van Zulte	
ZWV	Zuid-Willemsvaart	

(f) Additional waterway codes can be registered at <http://ienc.openecdis.org>.

## Section 3: Presentation Standard for Inland ECDIS

### 1. Introduction

(a) This “Presentation Standard for Inland ECDIS” describes the technical specifications to be used for presenting Inland ECDIS data. The presentation must take place in such a way that none of the information is lost;

(b) This Presentation Standard is based on the IHO document S-52 “Specification for Chart Content and Display Aspects of ECDIS”, Edition 6 of March 2010, with all Appendices and Annexes (see “Comparison of the structures of the standard for (Maritime) ECDIS and of the technical specifications for Inland ECDIS” in the preface of these technical specifications);

(c) This Presentation Standard describes the necessary additions and clarifications to S-52 and the application of S-52 for the purpose of use in Inland ECDIS applications;

- (d) This Presentation Standard comprises:
  - this Section 3
  - Appendix 2, Presentation Library for Inland ECDIS, with additions and clarifications to be applied to S-52, Annex A.
- (e) Definitions of terms may be found in:
  - IHO-S-57, Part 1, clause 5
  - the “Glossary of ECDIS-Related Terms” in S-32 Appendix 1
  - the “Glossary for Inland ECDIS” in Section 5 of these technical specifications.

## 2. Presentation Library for Inland ECDIS

S-57 data sets do not contain any information about how the data will be presented. The chart presentation is generated online in the Inland ECDIS application. For that purpose, the Inland ECDIS application uses machine-readable symbolization instructions for each feature, which is drawn on the screen. For the presentation of ENC, the IHO S-52 standard is mandatory. The S-52 standard contains all rules which are necessary for the symbolization and presentation of ENC on the screen.

Since the features, attributes and attribute values for ENC were extended for Inland ENC and bathymetric Inland ENC, an extension of the S-52 standard is necessary in order to also display the features specific to inland navigation. All extensions apply to Edition 3.4 of the IHO ECDIS Presentation Library (Annex A of S-52).

### 2.1 Components of S-52 and Inland ECDIS Presentation Library

2.1.1 The major components of the S-52 presentation library are:

- a library of symbols, line styles and fill styles
- a colour coding scheme which includes the IHO colour tables for day, dusk and night time
- a set of symbology command words from which machine readable instructions can be assembled. The result is a symbology instruction, which is processed to symbolise ENC features in turn
- a set of conditional symbology procedures to decide the appropriate symbolisation in cases determined by the mariner’s selection (e.g. safety contour) or for complex symbols (e. g. top marks on buoys and beacons)
- a set of look-up tables that link feature descriptions from the SENC database to the appropriate symbology instructions depending on whether:
  - (a) The link is straight forward, i.e. a direct relationship between a feature’s description and its presentation such as a buoy or a land area. In this case, the look-up table provides the symbology instruction to show a symbol, an area fill, or a line style;
  - (b) The link is conditional, i.e. depending on circumstances, for example a depth area, whose colour fill depends on the choice of the safety contour. In this case, the look-up table refers the decision to a conditional symbology procedure that selects the appropriate symbology instructions later.

**2.1.2** Inland ECDIS must use all S-52 components plus extensions in:

- look up tables
- symbol library
- conditional symbology procedures.

Only the extensions are described in Appendix 2, “Presentation Library for Inland ECDIS”.

## **2.2 Look-up Tables**

**2.2.1** For each geometry type (point, line, area) there is a separate look-up table. Each entry in a look-up table consists of the following fields:

- (a) 6-character code of the feature class (acronym);
- (b) Attribute combination;
- (c) Symbolization instructions;
- (d) Display priority, 0–9 (comparable with drawing layers);
- (e) Radar code;
- (f) Display category (Display base, standard, all other);
- (g) “Viewing group”, more refined grouping of features than the display categories.

Figure 1

### **Example Entry of a Look-up Table**

«LNDMRK»,«CATLMK17»,«SY(TOWERS01)»,«7»,«O»,«OTHER»,«32250»
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In this case the feature LNDMRK is shown by the symbol TOWERS01 with priority 7, if the attribute CATLMK equals 17. The feature lies over the radar.

The presentation of features in a specific area that are contained in different cells of the same usage follows the entries in the look-up tables.

**2.2.2** The Presentation Library provides five look-up tables:

- paper chart point symbols
- simplified point symbols
- line symbols
- plain area boundary symbols
- symbolized area boundary symbols.

## **2.3 Conditional Symbology Procedures**

Conditional Symbology Procedures (CS) are generated for features of which the symbolization

- depends on application settings, e.g. safety contour
- depends on other features, e.g. top marks and their structure
- is too complex to be defined in a direct look-up table entry.

CS Procedures, which must be modified or implemented in an Inland ECDIS additional to the CS Procedures of S-52 are described in Appendix 2.0, "Presentation Library for Inland ECDIS".

## 2.4 Colours

Colours used in an ECDIS are defined in an absolute, monitor independent way (coordinates of the International Commission on Illumination (CIE)). This ensures that ECDIS charts look similar on monitors of different suppliers. CIE values are converted into RGB values by means of a colour calibration software which must be used by the manufacturer.

Commercial displays usual in the trade are seen as matching these requirements.

Because of the different lighting conditions on the bridge of a vessel, it is necessary to offer presentations with different brightness. For each level, a separate colour table exists.

The represented colour scheme must be chosen on the basis of ergonomic and physiological factors and the representation of indications in different colours must not result in mixed colours by overlaying.

## 2.5 Representation of Signs

Signs which are located on the river banks are represented in the chart displayed by generic symbols (notmrk01, notmrk02 and notmrk03). This must not apply to signs on bridges.

Additional applications are required to be able to display the detailed symbol, which is similar to the real world indication, and the full set of object information of a user-selected sign.

Signs that are located on the bridges, must be symbolized according to the orientation of the bridge.

Signs which specify distances or a velocity will not be symbolized with the number itself, but only with that symbol which gives the general regulation or information.

# Section 4: Operational and Performance Requirements, Methods of Testing and Required Test Results

## 1. Introduction

This section specifies the minimum requirements contained in Section 1 of these technical specifications and describes the test procedures and the required results concerning the hardware, the software, the functions, the operation, the display and the interfaces to other equipment on board of vessels.

## 2. Operating Modes and System Configuration

### 2.1 Operating Modes

(a) The Inland ECDIS technical specifications distinguish two operating modes: navigation mode and information mode;

(b) Inland ECDIS equipment designed for operating in navigation mode must fulfil the requirements of these technical specifications and the standards for navigational radar equipment and rate-of-turn indicators to be proven by conformity tests;

(c) For Inland ECDIS equipment designed for information mode only, the requirements of this section are to be understood as technical (operational and performance) requirements. The producer has to declare the conformity with these technical requirements. A type approval is not required for Inland ECDIS in information mode. The documentation of the conformity tests shall be made available to competent authorities and users on request.

## **2.2 System Configurations**

### *2.2.1 Inland ECDIS equipment, stand-alone-system without connection to radar*

In this configuration only operation in information mode is possible (Section 4b, Fig. 1).

### *2.2.2 Inland ECDIS equipment, parallel installation and connection to radar*

This configuration allows operation in information mode as well as in navigation mode (Section 4b, Fig. 2).

### *2.2.3 Inland ECDIS equipment, monitor shared with connected radar equipment*

In this case, the monitor of the radar equipment is shared with the Inland ECDIS equipment. Prerequisite for this mode are matching graphic parameters for both video signals and a video switch, which allows a fast switchover of the video sources (see Section 4b, Fig. 3).

This configuration allows operation in information mode as well as in navigation mode.

### *2.2.4 Radar equipment with integrated Inland ECDIS functionality*

This is a radar installation with integrated Inland ECDIS functionality that can be operated in information mode as well as in navigation mode (see Section 4b, Fig. 4).

## **3. Performance Requirements**

### **3.1 Hardware Performance**

(a) Inland ECDIS equipment for operating in navigation mode must be designed and manufactured to withstand typical environmental conditions prevailing on board of a vessel without any degradation in quality and reliability. Furthermore, it must not disturb other communication and navigation equipment.

(b) In the configuration as described in Chapter 2.2.4 of this Section all components of Inland ECDIS equipment installed inside the wheelhouse must fulfil the requirements of the class (b) “protected from weather” equipment as specified in the standard IEC 60945 with the exception that the test temperature range is limited to 0° C to + 40° C (whereas the test temperature range in IEC 60945 is specified from - 15° C to + 55° C) unless specified differently in these technical specifications. For the configurations described in paragraphs 2.2.2 and 2.2.3 of this Section CE conformity is sufficient.

### 3.2 Software Performance

Software for the operation, visualization and functionality of Inland ECDIS equipment must be designed, developed, implemented, and tested in accordance with the software requirements described in Section 4a of these technical specifications.

### 3.3 Performance of Operation Controls

(a) The operation of the system must be simple, appropriate and conform to common human interface standards;

(b) The number of operational controls must be as low as possible and restricted to the required number;

(c) Wireless remote controls are not permitted;

(d) The ON/OFF switch must perform and must be arranged in such a way that inadvertent operation is not possible;

(e) The symbols of the operating controls must have a minimum character height of 4 mm and must be readable under all conditions that may exist in a wheelhouse;

(f) The brilliance and the illumination of the operating controls must be adjustable to the required value.

### 3.4 Display Performance

For Inland ECDIS in information mode the requirements of 3.4.2 to 3.4.7 are recommendations only.

#### 3.4.1 *Display dimensions*

(a) In navigation mode the minimum chart and radar display area have to be at least 270 mm x 270 mm.

(b) In information mode the requirements of Section 1 4.1 (b) shall be fulfilled.

#### 3.4.2 *Display orientation*

(a) A rectangular display may be mounted in landscape or in portrait orientation under the prerequisite that the above-mentioned minimum dimensions are fulfilled;

(b) Because of the limited space available in the typical wheelhouse of an inland vessel and the fact that a vessel usually follows the fairway-axis, the display must be installed preferably in the portrait orientation.

#### 3.4.3 *Display resolution*

A display resolution of 5 m in the 1,200 m range is required. This leads to a maximum pixel dimension of 2.5 m x 2.5 m, i.e. about 1,000 pixels at the short edge of the display.

#### 3.4.4 *Display colours*

The system must be able to display ergonomically proven colour combinations for day and night.

#### 3.4.5 *Display brilliance*

The brilliance of the display must be adjustable to every operational required value. This is especially valid for the lowest value during operation in darkness.

#### 3.4.6 *Picture renewal*

- (a) The picture renewal rate must not be shorter than that of the radar picture ( $\geq 24$  pictures per minute);
- (b) Between two consecutive renewals no fluctuations of brilliance must occur;
- (c) On raster scan displays, the frame repetition rate must not be lower than 60 Hz.

#### 3.4.7 *Display technology*

Preferably, display systems must be used that are insensitive to the magnetic fields that may occur in the wheelhouse of an inland vessel.

## **4. Operational Functions**

### **4.1 Operating Mode**

- (a) If the equipment is able to work in both operation modes, it must provide the possibility to switch between navigation mode and information mode;
- (b) The operation mode in use must be displayed;
- (c) Suitable measures are required to prevent inadvertent switching off of the navigation mode.

### **4.2 Equipment Pre-sets (Store/Recall) in Navigation Mode**

- (a) After invoking, the Inland ECDIS equipment must emit a moderate brilliance pre-set which neither blinds in a dark environment nor makes the picture invisible in a bright environment;
- (b) Other parameters may come up with their values at the time before switching off or from stored settings.

### **4.3 Presentation of SENC Information in Navigation Mode**

- (a) The radar picture must be clearly distinguishable from the chart independently of the chosen colour table;
- (b) Only a monochrome presentation of the actual radar picture is permitted;
- (c) The presentation of chart information must not mask or degrade important parts of the radar picture. This must be ensured by appropriate entries into the look-up tables (refer to Section 3 of these technical specifications, Chapter 2.2, field "Radar code"). The transparency of the radar overlay shall, therefore, be user defined;
- (d) In navigation mode, chart and radar picture presentation must have the same scale;
- (e) The heading line must be always visible;
- (f) Additionally, the mariner's own vessel's contour and the safety contours may be inserted.

### **4.4 Chart Orientation, Positioning and Shifting**

- (a) In navigation mode, only the chart orientation "relative motion, head up" and the "centred" or "off-centred" presentations, as required for the radar picture, are permitted;

(b) In information mode, at least the chart orientations “north” and “parallel to the waterway axis” as well as positioning are recommended. With a positioning sensor, the displayed part of the chart can automatically follow the mariner’s own vessel position.

#### 4.5 Own Vessel’s Position and Bearing

(a) In navigation mode, the own vessel's position must always be visible in the display area, whether “centred” or “off-centred” as specified in the radar requirements of appendix 7 to the annex to Resolution No. 61, revised, “Recommendations on Harmonized Europe-Wide Technical Requirements for Inland Navigation Vessels”;

(b) In navigation mode, the heading line which runs from the display centre to the top and which must always be visible, must represent the heading of the mariner’s own vessel.

#### 4.6 Information Density

The information density must be at least adjustable to the three switch steps: “Base”, “Standard” and “All Information”. The latter displays all other features in addition to the “Standard” display, individually on demand. All corresponding visible features are defined in the “Performance Standard” and the “Presentation Standard” (including “Presentation Library for Inland ECDIS”) (Sections 1 and 3 of these technical specifications).

#### 4.7 Ranges/range Rings

(a) In navigation mode the following fixed ranges and range rings are prescribed according to the radar regulations:

<i>Range</i>	<i>Range rings</i>
500 m	100 m
800 m	200 m
1 200 m	200 m
1 600 m	400 m
2 000 m	400 m
4 000 m	800 m

(b) Smaller and larger ranges with a minimum of four and a maximum of six range rings are permitted;

(c) Inland ECDIS equipment in navigation mode must have fixed range rings with the above-mentioned intervals and at least one variable range marker (VRM);

(d) Switching on/off of fixed and variable range markers must be independent of each other and their display must be clearly distinguishable;

(e) The position of the VRM and the corresponding displayed distance must use the same increments and resolution;

(f) The functions of the VRM and the electronic bearing line (EBL) may additionally be realised by a cursor and by a corresponding numerical display, showing the range and bearing of the cursor position.

#### 4.8 Picture Brilliance in Navigation Mode

(a) The brilliance of the display must be adjustable to the operationally necessary value. This applies in particular to operation in darkness;

- (b) The chart and the radar picture must have separate brilliance controls;
- (c) Because of the strongly different environment brightness by day and night, another control for the basic brilliance of the display must be available additionally to the colour tables in the menu.

#### **4.9 Picture Colours**

At least the colour combinations included in the IHO S-52 Presentation Library,6.0 (colour tables) for day, dusk and night shall be supported.

#### **4.10 Pick report**

- (a) It shall be possible to get all underlying textual and/or graphical information concerning user selections of the features that are displayed in the chart;
- (b) This additional textual and/or graphical information must not hamper the view of the waterway in the navigational chart.

#### **4.11 Measurement Features**

- (a) Measurement features for distances and bearings are required;
- (b) Resolution and accuracy must at least be the same as those of the display, but may not suggest better values than those of the chart data.

#### **4.12 Input and Editing of Skippers' Own Chart Entries**

- (a) Inland ECDIS equipment must allow input, storing, modification and deletion of additional chart information by the skipper (skippers' own features);
- (b) These own chart entries must be distinguishable from the SENC data, and must not overlay or degrade the radar picture.

#### **4.13 Loading and Updating of SENCs**

- (a) All manual activities concerning loading or updating of charts must be possible only outside of navigation mode;
- (b) Automatic updating must not degrade the performance of the navigation display;
- (c) A roll-back function must be implemented to allow restoring to the last working combination.

#### **4.14 Radar Picture Presentation and Overlay**

- (a) The radar image representation is mandatory for operation in navigation mode;<sup>19</sup>
- (b) The dimensions, resolution and attributes of the radar presentation must fulfil the relevant radar requirements;
- (c) The radar picture must not be degraded by other contents of the picture (see also Chapter 4.3 (c) of this section);

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<sup>19</sup> On wide inland waterways, Basin Administration may, where appropriate, consider this mandatory requirement as a recommendation.

(d) Provided the performance requirements are fulfilled, overlaying of different information layers is permitted;

(e) The overlay of information regarding the position and orientation of other vessels is only allowed when:

- the information is up-to-date (nearly real-time) and
- the age of information does not exceed the maximum time out values provided in table in 5.1 (e) of Section 1, Performance Standard for Inland ECDIS. For moving vessels the symbols must be marked as outdated if the age of information exceeds 30 seconds. The vessel's own position information must not be displayed if it is received from a repeater station.

(f) The overlaid information derived from tracking and tracing devices regarding the position and orientation of other vessels must be faded out at a user-definable range;

(g) The presentation of the position and the orientation of other vessels by:

- a directed triangle, or
- a true outline (to scale)

are permitted only if the heading of these other vessels is available. In all other cases a generic symbol must be used (an octagon is recommended, a circle must be used for inland applications only);

(h) It must be possible to switch off the chart and any other information layer and to display only the radar picture by one easily accessible control element or menu area;

(i) If the quality and plausibility monitoring of the Inland ECDIS equipment detects that the chart cannot be oriented and/or positioned with the accuracy required by these technical specifications, an alarm must be presented on the display and the chart must be switched off automatically.

#### **4.15 Inland ECDIS Functions with Immediate Access**

(a) The following operational functions require direct access:

- RANGE
- BRILLIANCE
- COLOURS
- INFORMATION DENSITY.

(b) These functions must either have their own control elements or their own menu areas, which are arranged in the highest menu level and are permanently visible.

#### **4.16 Permanently Visible Function Parameters**

The following function parameters must always be visible:

- actual RANGE
- sensor STATUS (in navigation mode radar tuning, position quality, alarms; in information mode: if connected, GPS, AIS and heading)
- selected WATER LEVEL (if available)
- selected SAFETY DEPTH (if available)
- selected INFORMATION DENSITY.

## 5. Service Functions

Service functions shall be protected by password or other suitable measures against unauthorized access. They shall not be selectable in navigation mode.

The requirements of 5.1 to 5.3 are only applicable to navigation mode.

### 5.1 Static Correction of the Chart Position

(a) The position of the mariner's own vessel must be presented "centred" or "off-centred" on the display in accordance with the radar requirements. The chart position must match the radar image. Assuming an absolute position's input the permissible static difference between the actual radar position and the displayed radar centre must not exceed 1 m;

(b) It must be possible to correct an offset error (distance between the positions of the position sensor and the radar sensor).

### 5.2 Static Correction of the Chart Orientation

(a) The difference between the heading line orientation and the vessel's axis must not be greater than  $\pm 1.0$  degree;

(b) The chart and the radar image must have the same orientation. The static directional error between heading line and chart orientation must be less than  $\pm 0.5$  degree.

### 5.3 Configuration of Interfaces

(a) It must be possible to configure interfaces for connected sensors, actors and signals;<sup>20</sup>

(b) Interfaces must comply with existing interface specifications like the IEC 61162-1 standard and the interface specifications for rate of turn indicators (20 mV/deg/min).

## 6. Hardware test and Required Certificates

In navigation mode:

(a) The test must consist of a comparison between the equipment under test (EUT) and the requirements of these technical specifications;

(b) Proved equivalent tests, and proved and documented test results must be accepted without renewed tests.

### 6.1 Compatibility with the Environmental Conditions in Navigation Mode

(a) Inland ECDIS equipment, as described in paragraph 2.2.4 of this Section, must fulfil the requirements of IEC 60945 for environmental conditions (humidity, vibration and temperature; the latter reduced according to Chapter 3.1 of this Section) and electromagnetic compatibility;

(b) The provider or their representative must submit a relevant conformity declaration by an accredited laboratory.

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<sup>20</sup> An actor transforms an electrical quantity into another physical quantity (e.g. optical). An actor is the opposite of a sensor.

## **6.2 Equipment Documentation**

The technical documentation must be checked to be complete, appropriate, and understandable, and to be sufficient for unproblematic installation, configuration and operation of the equipment.

## **6.3 Interfaces**

- (a) All interfaces must be correctly and completely documented;
- (b) Electronic circuits must be of failsafe design, mechanically and electronically, and must not have degrading repercussions on connected equipment.

## **6.4 Characteristic of Operation Controls**

All operation controls must be checked regarding the ergonomic and functional mode of operation and must fulfil the requirements of these technical specifications.

## **6.5 Characteristic of the Display in Navigation Mode**

The display must fulfil all these technical specifications concerning dimension, displayable colours, resolution, and variation of brilliance.

# **7. Test of the Chart Presentation, Operation and Functionality**

## **7.1 Preparation of the Equipment Under Test (EUT)**

The EUT must be installed, assembled and connected according to the installation manual. After switching on, the test SENC must be loaded.

## **7.2 Test of the Operation Modes**

All operating modes as described in the operating manual will be successively invoked and tested. The requirements of chapter 4 of this section must be met.

## **7.3 Test of the Displayed Features**

All features included in the test SENC will be tested for visibility and correct display. For this test, the information density must be switched to “all features”. The system must be capable of at least displaying all features according to “Presentation Standard for Inland ECDIS” (Section 3 of these technical specifications). Additionally other user-selectable symbol sets are allowed.

If symbols that deviate from Appendix 2.0, “Presentation Library for Inland ECDIS”, are used for the presentation of any chart information, they must:

- be legible
- be certain and unambiguous in their meaning
- be of sufficient size to support the nominal viewing distance.

Symbols added to the ECDIS Presentation Library must be clearly distinguishable from Presentation Library symbols.

## **7.4 Test of the Scale Dependent Information Density (SCAMIN)**

- (a) The SCAMIN functionality (the minimum scale at which the feature may be used for ECDIS presentation) must be tested for correct installation;

(b) For this test, the range at which the feature is visible according to its SCAMIN enumeration (refer to Appendix 1.1, “Inland ENC Feature Catalogue”, and S-52, Annex A, IHO ECDIS Presentation Library, Appendix 2, Part I, Users' Manual, Section 8.4) must be used.

#### **7.5 Test of Brilliance Variation in Navigation Mode**

The Inland ECDIS equipment must be operated in a dark room with the brilliance at its lowest level. The brilliance of the features must not exceed a value of 15 cd/m<sup>2</sup>, and the background, a value of 0,5 cd/m<sup>2</sup>.

#### **7.6 Test of the Colours**

All user selectable S-52 colour tables must be sequentially tested to conform to these technical specifications.

#### **7.7 Test of the Measurement Functions**

(a) All numeric display values of the electronic bearing line (EBL) and the variable range marker (VRM) must exactly match with the analogue positions of the EBL and the VRM (or correspond with the cursor coordinates);

(b) The resolution and increments of the numerical display must be identical to the analogue values of EBL and VRM.

#### **7.8 Test of the Chart Update Function**

Before and after each test step the version numbers of the loaded SENCs and updates must be recalled as described in the operation manual and showed on the display.

- Step 1: Loading of the test SENC
- Step 2: Update of the test SENC
- Step 3: Test of the roll-back function
- Step 4: Loading of a new SENC.

After an update it must be possible to recall and display all concerned features.

#### **7.9 Test of Displayed Features in More than One Cell for the Same Area**

(a) All features included in the test SENC and in the additional overlay test SENC must be tested for visibility and correct display. For this test, the information density will be switched to “all display”;

(b) The possibility to select one or more specific cells for presentation if there are several cells from different producers for the same area with the same usage must be tested;

(c) It shall be tested whether the test bathymetric Inland ENC is displayed correctly together with the base SENC in accordance with chapter 6 of the Presentation Library for Inland ENCs.

### **8. Test of Radar Picture Presentation and Operation in Navigation Mode**

#### **8.1 Preparations**

(a) For the test purposes, the manufacturer or provider must provide a serial interface at the system to be approved (equipment under test – EUT) which delivers the

same actual values (i.e. IEC 61162-1strings) of position and heading that are used to position and orient the chart;

(b) During the test, a reference system must be used of which position and heading values are compared with those of the EUT;

(c) The EUT must be connected to any type approved radar equipment (provider's choice);

(d) The radar picture must be adjusted in range and bearing with reference to the heading line.

## 8.2 Test of the Radar Picture without Underlaid Chart

(a) If the Inland ECDIS equipment displays the radar picture but the radar operation control remains at the radar equipment (Section 4b, figures 2 and 3), the radar picture of the inland ECDIS equipment must be considered as the “daughter display” of an item of radar equipment. In that case, the radar picture must fulfil the display and picture-relevant requirements of the requirements for radar and rate-of-turn indicators;

(b) If the EUT is a radar installation with integrated Inland ECDIS functionality (Section 4b, figure 4), all requirements of the standards for radar equipment and rate-of-turn indicators must be fulfilled.

## 8.3 Test of the Radar Picture, Overlaid Information from Other Vessels and the Underlying Chart

The Inland ECDIS equipment must be installed in a reference environment. This can be real (on a vessel) or simulated. Position and orientation information of other vessels (according to the Inland AIS technical specifications) must be applied with several information ages.

### 8.3.1 Test of the radar overlay

(a) The radar image must not be degraded by the chart picture (Chapter 4.3 (c) of this Section);

(b) The overlay of information regarding the position and orientation of other vessels must be displayed only when:

- information is up-to-date (nearly real-time); and
- the age of information does not exceed the maximum time out values provided in the table in 5.1 (e) of Section 1, Performance Standard for Inland ECDIS. The symbols must be marked as outdated if the age of information exceeds 30 seconds for moving vessels. The position information of the own vessel must not be displayed if it is received from a repeater station.

(c) The overlay of information derived from tracking and tracing devices on the position and orientation of other vessels must be faded out at a user-definable range;

(d) The position and the orientation of other vessels by:

- a directed triangle; or
- a true outline (to scale)

must be displayed only when the heading of these other vessels is available. For all other vessels a generic symbol must be used (a square is recommended, a circle may be used for inland applications only);

- (e) It must be possible to switch off the chart and any other information layer and to display only the radar picture by one easily accessible control element or menu area;
- (f) The chart picture must be renewed not later than the radar picture.

#### 8.3.2 *Test of the chart positioning and orientation*

- (a) The static offset of the chart position must be less than  $\pm 5$  m in all ranges up to 2,000 m;
- (b) The static azimuth orientation offset error between radar and chart image must be less than  $\pm 0,5$  degree;
- (c) The correction of these parameters must be demonstrated in the service mode;
- (d) The dynamic deviation of the chart orientation at rates of turn less than  $\pm 60$  deg./min must be less than  $\pm 3$  degrees;
- (e) These tests must be performed visually or by evaluation of measured data.

#### 8.3.3 *Test of scale conformity*

The chart's information must be compared with well-known reference points contained in the radar picture in order to test whether the chart scale sufficiently conforms to the radar scale.

### **9. Test of Alarms and Indications**

- (a) The alarms generated from Inland ECDIS equipment itself as well as the passed alarms delivered by the connected sensors to the ECDIS must be tested;
- (b) The test procedure in navigation mode must comprise the following situations:
  - any error in the Inland ECDIS equipment (built-in test equipment – bite)
  - missing positioning signal
  - missing radar signal
  - missing rate of turn signal
  - missing heading signal
  - radar map matching not possible.
- (c) The test procedure in information mode shall comprise the following situations:
  - any error in the Inland ECDIS equipment (built-in test equipment – bite)
  - missing positioning signal
  - missing heading signal
  - missing AIS signal.

## 10. Test of Fall-back Arrangements in Navigation Mode

(a) This test must demonstrate the reaction of Inland ECDIS equipment to a failure of any internal or external component and the possible and required actions by the operator.

(b) In addition, the operating manual must be checked to determine whether the measures required by the operator are described adequately and appropriately.

## Section 4a: Measures to ensure Software Quality

### 1. General Requirements

Software used in navigation mode is a safety-relevant part of a navigation system. Providers of navigation systems must make sure that all software components used in navigation mode allow safe navigation in every situation.

The requirements of 1.1 to 1.5 are only applicable to navigation mode.

#### 1.1 Software Design Requirements

Software components must be clearly designed by means of established software design methods. The design specification must indicate how safety requirements are addressed in the software design.

A software style guide must be provided that specifies code writing style, documentation style, modularization, conflict analyses and testing of software components. For every software component documents describing specification and design are required.

#### 1.2 Implementation Requirements

Implementation of software modules must be done by qualified developers who fully understand the design and safety requirements.

If more than one developer is working on the navigation system software, a version control system must be used that guarantees conflict-free development.

The implementation must be according to the design specification and must reflect the software style guide. Moreover, well known implementation problems (depending on the language used) must be addressed in the implementation. This includes, but is not restricted to:

- null pointer handling
- uninitialized variables
- range checking
- array size verification
- memory allocation and de-allocation
- exception handling.

If parallel processing is used (e.g. multiple threads, tasks or processes) problems of conflict-free processing must be addressed in the implementation. This includes but is not restricted to:

- race conditions

- re-entrance problems
- priority inversion
- deadlocks.

### **1.3 Test Requirements**

In accordance with the design specification, software modules have to be tested. The test results have to be compared with the design guidelines and documented in test reports.

Tests must incorporate module as well as system tests. Providers of a navigation system must use extensive simulator-based tests to ensure stability of their system. The simulator must allow the simulation of a complete navigation environment including all required external sensors.

### **1.4 Third Party Components Requirements**

Third party components (Original Equipment Manufacturer (OEM) products) include software not developed by the navigation system provider. This includes but is not restricted to:

- static or dynamic linked libraries
- computer aided design and engineering tools producing source or object code
- operating systems.

Third party software components must be chosen according to the general safety requirements. The navigation system provider must prove that third party components meet the high standards necessary for safe navigation either by providing acceptable quality certificates or by extensive and provable testing of the components.

### **1.5 Requirements for Additional Services in Navigation Mode**

Navigation systems may support additional services in navigation mode if they are useful. These services must not interfere with navigation mode.

The navigation system provider is responsible for additional test equipment, necessary to verify interface specification, protocol specification and compliance tests with the Inland ECDIS technical specifications.

### **1.6 Language**

National versions of a type-approved Inland ECDIS must reapply for type approval which will check for the translation of the user interface.

### **1.7 Documentation Requirements for Users**

The documentation (manuals) must contain comprehensive information on installation, operation and service of the navigation system. The presentation of user-relevant information must be made clear, understandable and without unnecessary technical terms. The user manual must be available in English, French, German and Dutch. The technical documentation may be made available in English only.

## 2. Methods of Testing and Required Test Results

### 2.1 Navigation Mode Operation Test

#### 2.1.1 Performance Requirements

The navigation systems must make reliable estimations of position and heading. Moreover, the estimations of position and heading must be checked by the system for conformity with the required accuracy.

Position and heading information must be calculated and displayed for the same reference position. This should normally be the centre of the radar antenna. A new position estimate must, at least, be available with every revolution of the radar antenna.

##### 2.1.1.1 Position

The navigation system must estimate and display the position of the vessel. The following minimal requirements must be fulfilled under normal operation conditions:

- (a) The average position estimation must not deviate more than 5 metres from the true position and must cover all systematic errors;
- (b) The standard deviation  $\sigma$  must be less than 5 metres and must be based on random errors only;
- (c) The system must be capable to detect deviations of more than  $3\sigma$  within 30 seconds.

These results must be verified by a realistic test of at least 60 minutes.

##### 2.1.1.2 Heading

The navigation system must estimate and display the heading of the vessel. The following minimal requirements must be fulfilled:

- (a) The average heading angle estimation must not deviate more than 1 degree from the radar heading direction and must cover all systematic errors. The offset between vessel heading direction and radar heading must be less than 1 degree;
- (b) The standard deviation  $\sigma$  must be less than 2 degrees and must be only based on random errors.

These results must be verified by a realistic test of at least 60 minutes.

#### 2.1.2 Sensor Failure

The navigation systems must check proper operation of the position and heading estimation online. Problems must be detected within 30 seconds. In case of malfunction, the navigation system must inform the user about the problem and its consequence for navigation.

If a critical sensor alarm signalizes that position or heading does not meet the required accuracy the navigation chart must be switched off.

#### 2.1.3 Performance Test Interface

A navigation system provider must equip navigation systems during the compliance test with a standard IEC 61162-1 interface sending the position and heading information used by the navigation system. This information must be encoded by IEC 61162-1

sentences known as GGA and HDT. Additional sentences like RMC, ROT and VTG are accepted.

These strings must be sent preferably every 0.1 second, at least every second. Position and heading must be according to the definitions in Chapter 2.1.1.1 and Chapter 2.1.1.2 of this Section.

## **2.2 General Software Tests**

### **2.2.1 Equipment Documentation**

The following documents must be provided for admittance and must be shipped with every navigation system:

- user manual
- installation manual
- service manual.

The following documents and files must be provided during the admittance procedure and are not required for end users:

- design specification
- software style guide
- certificates of third party software components or test and simulation protocols.

The documents and files provided must allow for a complete verification of compliance with these technical specifications.

A user's manual shall be shipped with every information mode system.

### **2.2.2 Endurance Test**

The navigation system must pass an endurance test of 48 hours of uninterrupted operation under normal operating conditions. The system must provide standard interfaces for performance and resource monitoring during operation. Monitoring the system must show no indication of system instability, memory leaking or any kind of performance loss over time. Navigation systems supporting additional services while running in navigation mode must provide the necessary test equipment including all documents mentioned in Chapter 1.7 of this Section.

## **3. Changes to Certified Systems**

### **3.1 General Requirements**

Navigation systems installed on board must be functionally equivalent to a system certified by authorities. For every system the navigation system provider must ship a statement of compliance with the Inland ECDIS technical specifications and its functional equivalence to the certified system.

The competent authority is entitled to check Inland ECDIS compliance of installed systems at any time.

### **3.2 Hardware and Software Changes**

The navigation system provider may change software or hardware as long as Inland ECDIS compliance is maintained. Changes must be fully documented and submitted to the

competent authority together with an explanation of how the navigation system is affected by these changes. The competent authority may request a partial or complete renewal of certification if considered necessary. The aforementioned also applies to the use of an approved Inland ECDIS with another national version of the operating system.

The following changes do not affect certification of the system and require only a notice to the competent authority:

- minor changes on third party components (e.g. operation system or library updates)
- use of equivalent or better hardware components (e.g. faster microprocessor, newer chip revisions, equivalent graphic card, etc.)
- minor changes in source code or documentation.

### Section 4b: System Configurations (Figures)

Figure 1  
Inland ECDIS equipment, self-sufficient system without connection to radar

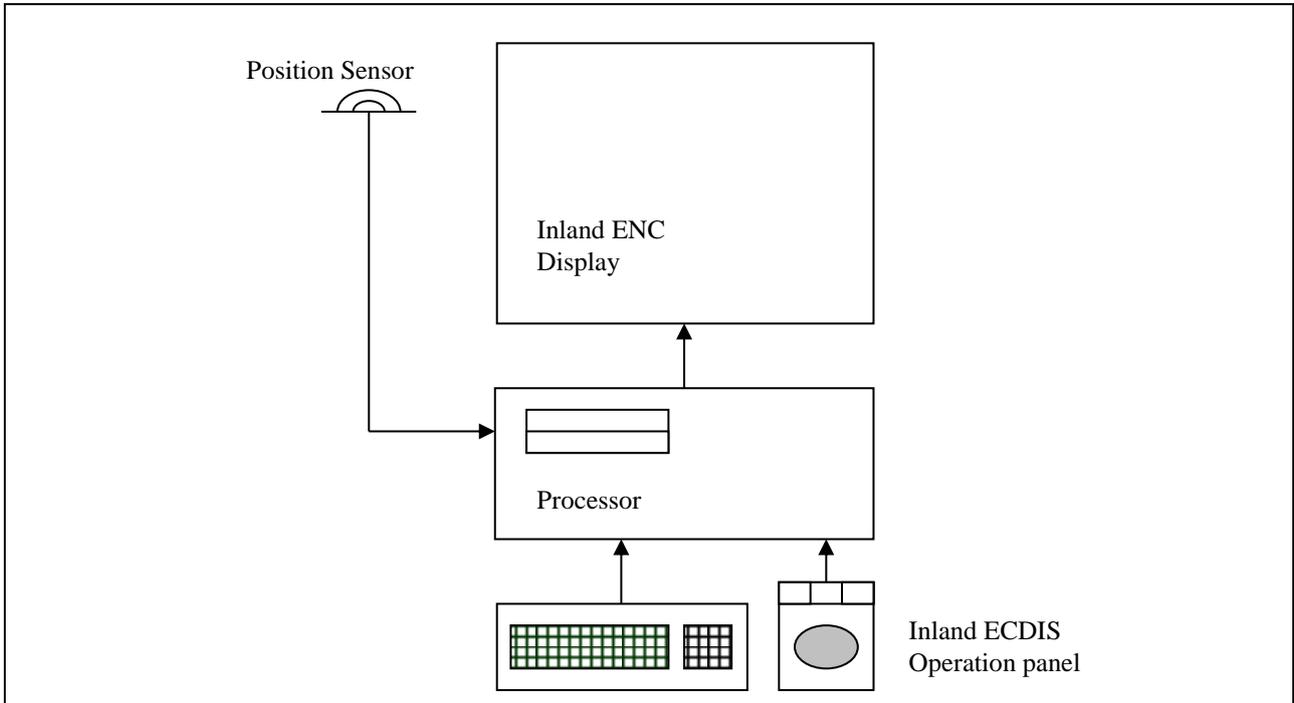


Figure 2  
Inland ECDIS equipment, self-sufficient system with connection to radar

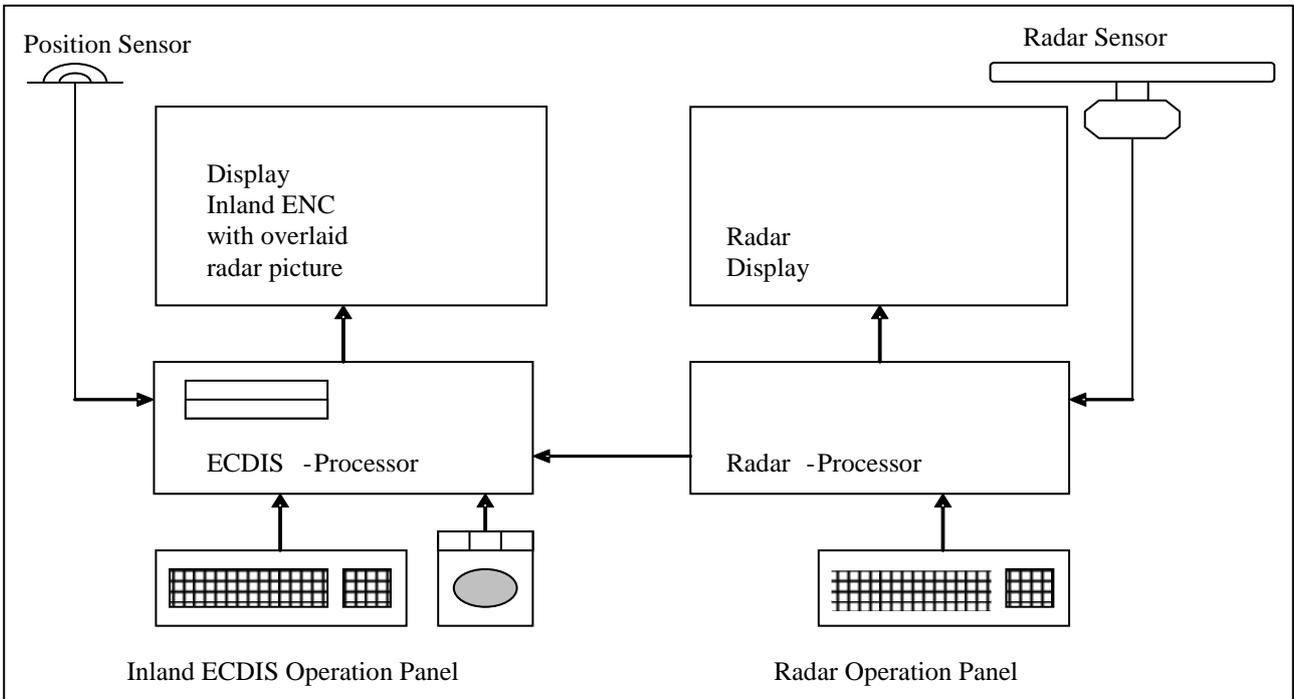


Figure 3  
**Inland ECDIS equipment with connection to radar and shared monitor**

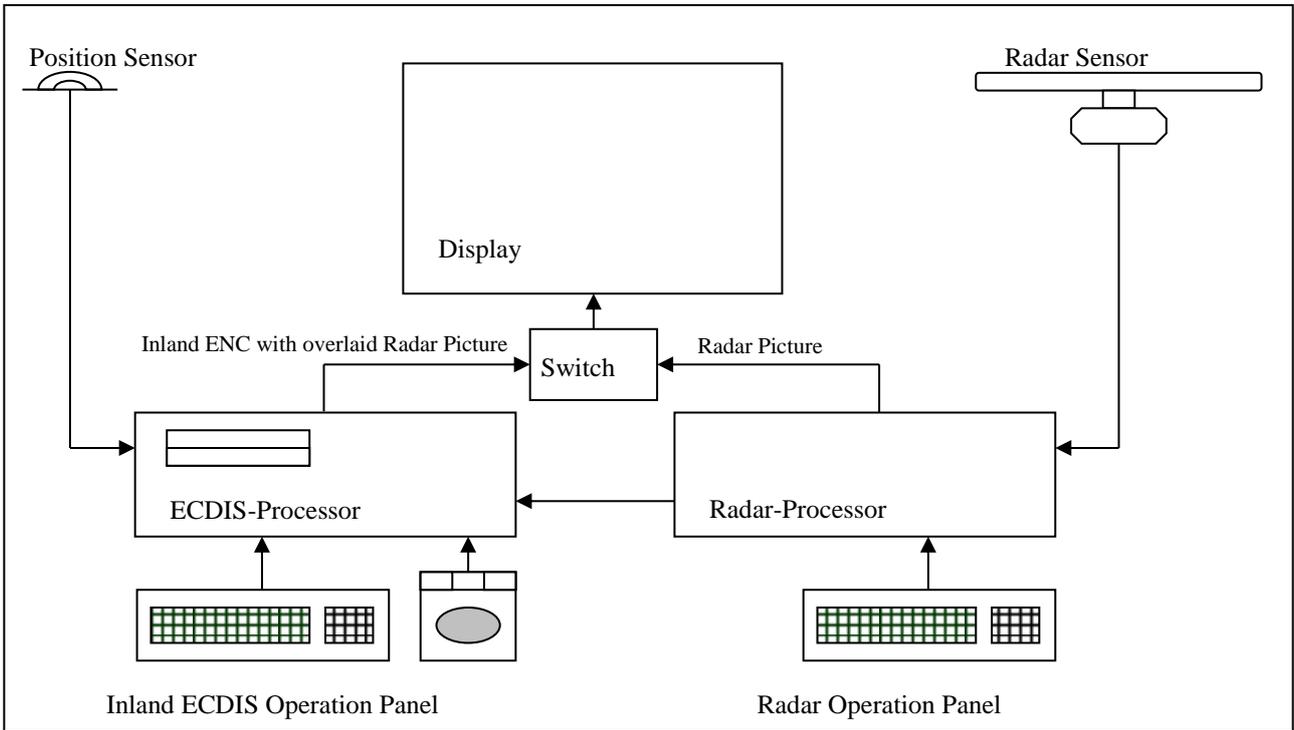
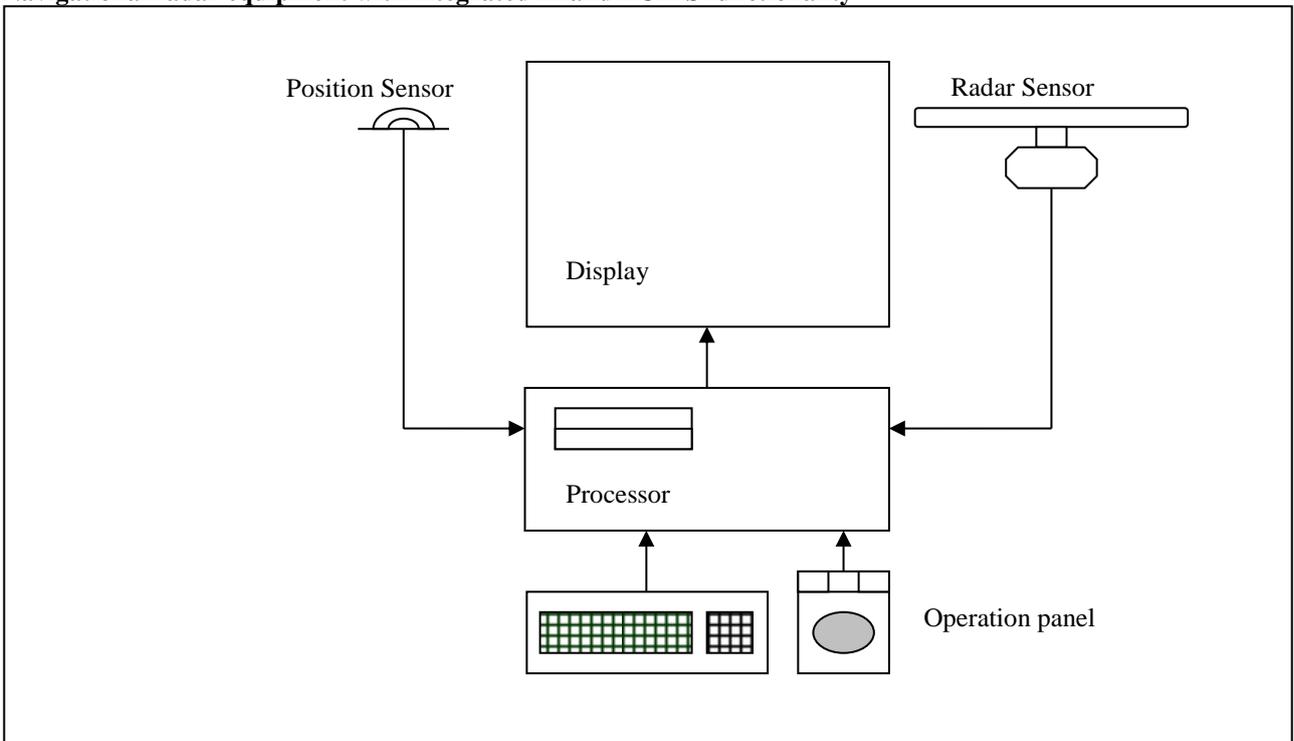


Figure 4  
**Navigational radar equipment with integrated Inland ECDIS functionality**



## Section 5: Glossary of Terms

### 1. Sources used to define the terms and abbreviations provided in the text

1. IMO Resolution MSC.232(82)
2. IHO S-52 and IHO S-32, Appendix 1, “Glossary of ECDIS Related Terms”
3. IHO S-57 (especially Part 1 “General Introduction”, clause 5 “Definitions”)
4. Technical Specifications for Inland ECDIS, Edition 2.3
  - 4.1 Section 1: Performance Standard for Inland ECDIS
  - 4.2 Section 2: Data Standard for Inland ENC’s
  - 4.3 Section 2a: Codes for Producers and Waterways
  - 4.4 Section 3: Presentation Standard for Inland ECDIS
  - 4.5 Section 4: Operational and Performance Requirements, Methods of Testing and Required Test Results including its Sections 4a and 4b
5. Inland ENC Domain in the S-100 Registry
6. IEHG Product Specification for Inland ENC’s
7. IEHG Inland ENC Feature Catalogue
8. IEC Guideline 61174, Edition 3.0
9. Annex IX, Parts III to VI, of the EU Directive 2006/87/EC as amended by 2013/49/EU: Requirements applicable to radar installations and rate-of-turn indicators
10. Commission Regulation (EC) No. 414/2007 concerning the technical guidelines for the planning, implementation and operational use of river information services (RIS)
11. DC Recommendations on the main technical and operational parameters for the radar installations used for the navigation on the Danube, CD/SES 60/10, Budapest, 2003
12. UNECE Resolution No. 61, revised, “Recommendations on Harmonized Europe-Wide Technical Requirements for Inland Navigation Vessels”, Appendix 7, “Requirements concerning lights and the colour of signal lights on vessels, intensity and range of signal lights on vessels and general technical specifications applicable to radar equipment”, ECE/TRANS/SC.3/172/Rev.1
13. UNECE Resolution No. 57, revised, “Guidelines and Recommendations for River Information Services”, ECE/TRANS/SC.3/165/Rev.1

### 2. Definitions of Features and Attributes

Definitions of features and attributes can be derived from the Feature Catalogue for Inland ENC’s (Appendix 1.1 to these technical specifications).

<i>Term or Abbreviation</i>	<i>Definition</i>	<i>Source</i>
Acronym	6-character-code of the feature/attribute	3
AIS	Automatic Identification System: An automatic communication and identification system intended to improve the safety of navigation by assisting in the efficient operation of vessel traffic services (VTS), ship reporting, ship-to-ship and ship-to-shore operations.	2
All information density	All information density (All Display) means the maximum amount of SENC information. Here, in addition to the standard display, all other objects are also displayed, individually on demand.	4.1
Attribute	A defined characteristic of an entity (e.g. the category of a light, the sector limits, the light characteristics, etc.).	3
Attribute copied	S-57/S-100 attributes (with their complete list of attribute values) which were extended according to the requirements of Inland ECDIS. All new attributes have the same name as their source, but written in small case letters.	7
CCNR	Central Commission for Navigation of the Rhine; international commission based on the Mannheim Convention. Current Member States are Belgium, France, Germany, the Netherlands and Switzerland. The most important and permanent objectives of CCNR are: <ul style="list-style-type: none"> <li>• Prosperity of inland navigation on the Rhine and in Europe</li> <li>• Maintenance of a high level of safety in inland navigation and its surroundings.</li> </ul>	
Cell (chart cell)	A cell is a geographical area containing Inland ENC or bathymetric Inland ENC data.	3
CIE colour calibration	Procedure to confirm that the colour specified in IHO S-52 is correctly reproduced on the ECDIS display.	2
Collection feature	Type of feature containing information about the relationships between other features.	3
Compilation scale	The scale with which the chart information meets the IHO requirements for chart accuracy. It is established by the producing hydrographic office and encoded in the ENC.	6
Datum	A set of parameters specifying the reference surface or the reference coordinate system used for geodetic control in the calculation of coordinates of points on the earth. Commonly, datum are defined as separate horizontal and vertical datums. For the practical use of datum, it is necessary to have one or more well distinctive points with coordinates given in that datum.	2
Datum, horizontal	A set of parameters specifying the reference for horizontal geodetic control, commonly the dimensions and the location of a reference ellipsoid. (The horizontal datum must be WGS 84).	6
Datum, vertical	A surface to which elevations and/or depths (soundings and tide heights) are referred. For elevations commonly a level (equipotential) surface, approximately the mean sea level is used, for depths in many cases, low water.	6
DC	Danube Commission; international river commission based on the Belgrade Convention of 1948, currently under revision. Current member States: Austria, Bulgaria, Croatia, Germany, Hungary, Republic of Moldova, Romania, Serbia, Slovakia, Russian Federation and Ukraine. The most important objectives of DC are: <ul style="list-style-type: none"> <li>• Prosperity of the Danube navigation and its full integration into the European system of transport by inland waterway; and</li> <li>• Maintenance of a high level of safety of navigation on the Danube.</li> </ul>	

<i>Term or Abbreviation</i>	<i>Definition</i>	<i>Source</i>
Differential GPS (DGPS)	A form of GPS in which the reliability and accuracy are enhanced by broadcasting a time-varying correction message from a GPS monitoring receiver (differential mode) at a known position on shore. The corrections are fed automatically into the GPS receiver on-board and used to compute an improved position.	4
Display base	Minimum information density (Display Base); means the minimum amount of SENC information that is presented and which cannot be reduced by the operator. Here, information that is required at all times in all geographic areas and under all circumstances is displayed.	1
Display scale	The ratio between a distance on the display and a distance on the ground, normalized and expressed as a ratio, e.g. 1:10 000.	2
EBL	Electronic Bearing Line	4.5
ECDIS	Electronic Chart Display and Information System (ECDIS) means a navigation information system which, with adequate back-up arrangements, can be accepted as complying with the up-to-date chart required by regulation V/19 and V/27 of the 1974 SOLAS Convention, as amended, by displaying selected information from a system electronic navigational chart (SENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and, if required, display additional navigation-related information.	1
Edge	A one-dimensional spatial object, located by two or more coordinate pairs (or two connected nodes) and optional interpolation parameters.	3
Electronic chart	Very broad term to describe the data, the software, and the electronic system, capable of displaying chart information. An electronic chart may or may not be equivalent to the paper chart required by SOLAS.	2
ENC	Electronic Navigational Chart means a data base, standardized as to content, structure and format, issued for use with ECDIS on the authority of government authorized hydrographic offices. The ENC contains all the chart information necessary for safe navigation and may contain supplementary information in addition to that contained in the paper chart (e.g. sailing directions) which may be considered necessary for safe navigation.	1
ENC cell	The geographic division of ENC data for distributing purposes.	8
Enumeration	A specific quality or quantity assigned to an attribute (e.g. "leading light", the limiting angles, the code specifying the light's colour – see attribute).	7
Exchange format	A specification for the structure and organization of data to facilitate exchange between computer systems.	2
Exchange set	Set of files representing a complete, single purpose (i.e. product specific) data transfer. For example, the ENC product specification defines an exchange set which contains one catalogue file and at least one data set file.	2
Feature	An identifiable set of information. A feature may have attributes and may be related to other features.  A digital representation of all or a part of an entity by its characteristics (attributes), its geometry, and (optionally) its relationships to other features (e.g., the digital description of a light sector specifying, in particular, sector limits, the colour of the light, the visibility range, etc., and a link to a light tower, if any).	2
Feature catalogue	The comprehensive list of currently identified features, attributes and enumerations which are allowed for the use in Inland ENCs.	7

<i>Term or Abbreviation</i>	<i>Definition</i>	<i>Source</i>
Feature copied	S-57 features (with their complete set of attributes) which were extended according to the requirements of Inland ECDIS. All new features have the same name as their source, but are written in small case letters.	7
Feature Data Dictionary	A feature data dictionary specifies independent sets of features and attributes that may be used to describe geographic information in a particular context.  A feature data dictionary may be used to develop a feature catalogue.	
File	An identified set of S-57 records collected together for a specific purpose. The file content and structure must be defined by a product specification.	2
Geo Feature	Type of feature containing the descriptive characteristics of a real world entity.	2
Geometric Primitive	One of three basic geometric units of representation: point, line and area.	2
Heading	The direction in which the longitudinal axis of a craft is pointed, usually expressed as an angular distance from north clockwise through 360 degrees (true, magnetic or compass).	2
Head-up display	Information presented on the display (radar or ECDIS) is directed so that the vessel's heading is always pointing upward. This orientation corresponds to the view from the bridge in the direction of the ship's heading. This orientation may require frequent rotations of the display contents. Changing the ship's course, or yawing of the vessel may render this unstabilized orientation mode unreadable.	2
IEC	International Electrotechnical Commission: An international non-governmental organization which produces world standards for electrical and electronical engineering with the objective of facilitating international trade.	2
IHO	International Hydrographic Organization: Coordinates the activities of national hydrographic offices; promotes standards and provides advice to developing countries in the fields of hydrographic surveying and production of nautical charts and publications.	2
IHO registry	IHO Geospatial Information Infrastructure Registry. A registry is an information system on which a register is maintained. In the case of S-100 IHO hosts a registry that provides a facility to store various registers of hydrographic-related information.	
(IHO-) S-32 App.1	Hydrographic Dictionary – Glossary of ECDIS Related Terms.	
(IHO-) S-52	Specifications for Chart Content and Display Aspects of ECDIS.	2
(IHO-) S-52 App. 1	Guidance on Updating the Electronic Navigational Chart.	2
(IHO-) S-57	IHO Transfer standard for Digital Hydrographic Data.	3
(IHO-) S-57 App. A	IHO Object Catalogue.	3
(IHO-) S-57 App. B	ENC Product Specifications.	3
(IHO-) S-62	ENC Producer Codes.	
IMO	International Maritime Organization: Formerly called IMCO, IMO is a specialized agency of the United Nations responsible for maritime safety, efficiency of navigation and prevention of marine pollution from ships.	2
Information Mode	Means the use of the Inland ECDIS for information purposes only without overlaid radar image.	4.1
Inland AIS	AIS for the use in inland navigation and interoperable with (maritime) AIS – technically enabled by amendments and extensions to the (maritime) AIS.	

<i>Term or Abbreviation</i>	<i>Definition</i>	<i>Source</i>
Inland ECDIS	An Electronic Chart Display and Information System for inland navigation, displaying selected information from an Inland System Electronic Navigational Chart (Inland SENC) and optionally, information from other navigation sensors.	4.1
Inland ENC	Inland Electronic Navigational Chart (Inland ENC) means a database, standardized as to content, structure and format, for use with inland electronic chart display and/or information systems operated on-board of vessels transiting inland waterways. An Inland ENC 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 Inland ENC 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.	4.1
Inland ENC domain	Domain within the IHO Geospatial Information Infrastructure Registry dedicated for Inland ENC – related entries.	
Inland SENC	Inland System Electronic Navigational Chart (Inland SENC) means a database resulting from the transformation of the Inland ENC by Inland ECDIS for appropriate use, updates to the Inland ENC by appropriate means and other data added by the mariner. It is this database that is actually accessed by the Inland ECDIS for the display generation and other navigational functions. The Inland SENC may also contain information from other sources.	4.1
INT 1	International chart 1 (INT 1) means a specification of symbols, abbreviations and terms to be used in the International Chart Series of IHO. It provides the chart user with a key to symbols, abbreviations and terms used on charts compiled in accordance with the “Chart Specifications of the IHO”.  INT 1 contains description entries for features and attributes. It can be seen as the reference to the legend of paper charts.	2
Integrated Display	Integrated Display means a head-up, relative-motion picture consisting of the Inland SENC overlaid with the radar-image with matching scale, offset and orientation.	4.1
Look-up table	A table giving symbology instructions to link SENC objects to point, line or area symbolization and providing display priority, radar priority, IMO category and optional viewing group.	2
M-4	Chart specifications of the IHO (M-4) gives chart specifications for compiling nautical charts, together with agreed symbols and abbreviations adopted for general use by Member States. M-4 also provides regulations for INT Charts.  M-4 contains description entries for features and attributes.	3
Meta object	A feature which contains information about other features.	2
Navigation Mode	Means the use of the Inland ECDIS for conning the vessel with overlaid radar image.	4.1
North-up display	Information shown on the display (radar or ECDIS) with the north direction upward.	2
Other navigational information	Navigational Information not contained in the SENC that may be displayed by an ECDIS, such as radar information.	2
Overscale	Displaying data at a larger scale than it was compiled for.	2
Own-vessel	The term which identifies the vessel upon which an ECDIS is operating.	2
Own vessel’s safety contour	The contour related to the own vessel selected by the mariner from the contours provided for in the SENC, to be used by ECDIS to distinguish on the display between the safe and the unsafe water, and for generating anti-grounding alarms.	2

<i>Term or Abbreviation</i>	<i>Definition</i>	<i>Source</i>
Performance standard for ECDIS	Standard developed under the authority of IMO to describe the minimum performance requirements for navigational devices and other fittings required by the SOLAS Convention.  Adopted by IMO on 5 December 2006 and published as MSC.232(82).	2
Pick report (feature report)	The result of querying a displayed point-symbol, line or area for further information from the data base which is not represented by the symbol.	2
Presentation library for ECDIS	A set of mostly digital specifications, composed of symbol libraries, colour schemes, look-up tables and rules, linking every feature and attribute of the SENC to the appropriate presentation of the ECDIS display. Published by IHO as Annex A of its Special Publication No. 52 (S-52).	2
Product specification	A defined subset of the entire specification combined with rules, tailored to the intended usage of the transfer data. (The ENC Product specification provides the content, structure and other mandatory aspects of an ENC)	2
(Radar) range	Distance from the radar antenna. For inland navigation the radar range has to be sequential switchable according to the CCNR Radar Regulations.	9
Relative motion display	A relative motion display shows the chart information, and radar targets, moving relative to the vessel position fixed on the screen.	2
Route planning	An ECDIS function in which the area is displayed which is needed to study the intended route, to select the intended track, and to mark the track, its way points and navigational notes.	1
SCAMIN	The minimum scale at which the feature may be used e.g. for ECDIS presentation.	3
SENC	System Electronic Navigational Chart: A data base resulting from the transformation of the ENC by ECDIS for appropriate use, updates to the ENC by appropriate means and other data added by the mariner. It is this data base that is actually accessed by the ECDIS for the display generation and other navigational functions. The SENC may also contain information from other sources.	2
Spatial object	An object which contains location information about real world entities.	2
Standard display	Standard Information Density means the default amount of SENC information that must be visible when the chart is first displayed on ECDIS.	4.1
UNECE	United Nations Economic Commission for Europe organizes cooperation on economic and sectoral issues between its 56 member countries including all EU and non EU European States, Commonwealth of Independent States and North America. In the transport area, UNECE promotes the facilitation of international road, rail, inland waterway and combined transport, particularly through the improvement of transport infrastructure, simplification and harmonization of administrative border crossing procedures and through the harmonization of technical requirements.	
Vessel Tracking and Tracing	The function of maintaining status information of the vessel and – if needed – combined with information on cargo and consignments [tracking] and retrieving of information concerning the whereabouts of the vessel and – if needed – combined with information on cargo, consignments and equipment [tracing].	10
True motion display	A display in which the own vessel and each radar target moves with its own true motion, while the position of all charted information remains fixed.	2
User-defined settings	Means the possibility to use and store a profile of display and operation controls/settings.	4.1
VRM	Variable Range Marker.	4.5

<i>Term or Abbreviation</i>	<i>Definition</i>	<i>Source</i>
WGS 84	World Geodetic System: The geodetic basis for the “Navigational Satellite Timing and Ranging – Global Positioning System” (NAVSTAR-GPS), which enables the surveying of the earth and its entities and was developed by the United States Department of Defense. This global geodetic reference system is recommended by IHO for hydrographic and cartographic use.	6

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