Evaluation IENC Usages RWS

Ordered by Rijkswaterstaat DVS

Author: P.A. Kluytenaar

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Serendipity UnLtd, Veerkade 15, Rotterdam

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Summary

The concept of Usage of the S-57 standard corresponds to paper charts with different charts for ocean passages, charts for coastal navigation and for entering a port. An ENC is produced with a certain usage. Maritime ENCs with different usages normally exist for one region. For example, the entrance of Hook of Holland is covered by a UKHO Usage 2 ENC and furthermore by ENCs with usages 3 to 6 of the Dutch Hydrographic Office. The distinction between them is the decline in area covered by the ENC and the growing detailing with the rise of the usage number. The difference in detail in the example means that the usage 2 ENC contains only the most important buoys for orientation purposes: the ENC is not suitable to actually navigate into Hook of Holland.

When developing the Inland ECDIS Standard it soon became clear that many of the Inland ENCs contained much more detail than the maritime usage 6 ENCs. For this reason the range of usages was expanded in the Inland ECDIS Standard.

The usage of an ENC indicates the level of detail of the information that is contained in the ENC. However, the information that is displayed in the Inland ECDIS application also depends on the SCAMIN value of the individual features. The SCAMIN value decides at which user selected scale or range a feature is being displayed. SCAMIN aims to prevent too much 'clutter' that would render the display useless when a larger range is selected.

Considering interviews with skippers, desktop 'simulations' and the author's own experience on board of vessels, it becomes clear that there is a need to differentiate between open waters, like the IJsselmeer, rivers and harbour basins with regard to the navigational purpose (usage) of the IENCs that are produced by RWS. The SCAMIN values for buoys and beacons that are recommended by the IENC Encoding Guide in general need to be increased significantly for the Dutch open waters. Additionally the SCAMIN values of lateral buoys and beacons need further detailing to avoid clutter when zooming out. It was also found that the SCAMIN values that are recommended by the IENC Encoding Guide are inconsistent and/or too low for some features. Finally there are indications that the sluggishness of quite a few of the onboard systems stands in the way of an active user-interaction with the application.

1. Introduction

The concept of Usage of the S-57 standard corresponds to paper charts with different charts for ocean passages, charts for coastal navigation and for entering a port. An ENC is produced with a certain usage. Maritime ENCs with different usages normally exist for one region. For example, the entrance of Hook of Holland is covered by a UKHO Usage 2 ENC and furthermore by ENCs with usages 3 to 6 of the Dutch Hydrographic Office. The distinction between them is the decline in area covered by the ENC and the growing detailing with the rise of the usage number. The difference in detail in the example means that the usage 2 ENC contains only the most important buoys for orientation purposes: the ENC is not suitable to actually navigate into Hook of Holland.

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The Dutch IENCs presently have a usage 5[1]. Since the level of detail of these IENCs in most cases is considerably higher than the usual level of detail of a maritime usage 5 ENC is should be considered to use the additional Inland ECDIS usages. However, presently buoys on the IJsselmeer are not being displayed by the Inland ECDIS applications at the ranges that are normally being used by the skippers on the IJsselmeer as a result of the presently fixed relation between the SCAMIN values of individual features and the usage of an IENC. It will be clear that this is an unsafe situation.

The following document describes the aforementioned effects of the present use of usage and SCAMIN for the different types of waterways in the Netherlands. The document also contains proposals for improvement based on desktop 'simulations'.

[1] With the exemption of the IENCs that are being produced by RWS Zeeland which have usage 4.

2. Approach

When drafting this document used was made of both the maritime experience and the experience on board of mv Zwerver during voyages on the Dutch inland waterways. Incidentally when preparing the document the Rhine cruise vessel Zonnebloem was joined for a five-day trip Tiel – Schoonhoven – Dordrecht – Rotterdam – Hellevoetsluis – Gorinchem – Tiel. Last but not least use was made of the extensive experience with Inland ECDIS of Mr. Rinus van der Jagt as relieve skipper on board of a variety of inland vessels with different Inland ECDIS applications.

The following list gives an overview of the various applications and IENCs that were considered during the study.

Vessel	Software	Manufacturer	IENCs
Zwerver	ORCA Master	SevenCs GmbH	RWS/ RWS Zld
	PC Navigo 2008/2009	Noordersoft	RWS/ RWS Zld
	Tresco Viewer	Persikal	Persikal SENC
Zonnebloem	RadarPilot 720	Innovative Navigation	Persikal SENC
Van der Jagt	Tresco Viewer	Periskal	Periskal SENC
	RadarPilot 720	Innovative Navigation	Persikal SENC
	Tresco Navigis	Tresco Engineering	Tresco Eng SENC

The study initially focussed on an inventory of the ranges or scales that are generally being used on board of inland vessels.

The captain and mate of the Zonnebloem were interviewed extensively regarding their use of and experience with the Inland ECDIS installation and the IENCs. Again much attention was paid to the ranges that were used on the various inland waterways.

Desktop 'simulations' of imaginary voyages over different types of inland waterways were carried out together with Mr Rinus van der Jagt looking at the range or scale that would typically be used on board of an inland vessel given certain navigational situations like open waters like the Markermeer or narrow canals like the Brabant canals.

The previous activities mainly dealt with the use of Inland ECDIS when navigating. The study however also considers the use of Inland ECDIS when planning a voyage.

Finally the study evaluates what is being said about usage and SCAMIN in the EU Inland ECDIS Standard and to what extent this meets the needs on the wider waterways in the Netherlands.

3. Scale/ range in practice

3.1. Application handling

Changes to the display settings of Inland ECDIS applications are mostly avoided when navigating inland vessels for a variety of reasons. This conclusion is based on the own experience of the author, but was also observed during earlier trips on board of different inland vessels. Most likely one of the more important reasons is the fact that the display is controlled by a mouse or standard keyboard as a dedicated hardware control interface with sensory feedback is lacking. Research has demonstrated that mouse control comes with additional mental load when compared with application specific hardware knobs and/or buttons: When manoeuvring the cursor in the right position on the screen there is no mental room for other matters. Since the need for changes to the ECDIS display often corresponds with more 'demanding' navigation situations the conflict is obvious.

Another reason both from own experience and mentioned by Van der Jagt are slow reactions of the Inland ECDIS software to user actions that happen all too often. Partly this may be the result of sometimes relatively old hardware[2].

3.2. Navigation - Information mode

There appears to be a difference between the range/scale selection in case of navigation mode and the range/scale selection in information mode. The selected ranges correspond to the usual ranges for radar navigation when the Inland ECDIS in navigation mode is used as primary radar. The information mode usually is used to get more strategic information like the course of the waterway a bit further ahead and – in case an AIS is connected – the traffic situation further on. This means that generally speaking a larger range is selected in information mode.

The use of the RadarPilot Navigation mode installation on board of the Rhine cruise vessel Zonnebloem by both the captain and the mate was quite interesting. The RadarPilot installation is connected to the ship's radar as a 'slave'. This means that the radar has it's own display that is positioned at the usual location on European inland barges, i.e. right in front of the navigator below the windows. The RadarPilot display is fitted to the ceiling slightly offset to starboard (see Figure 11). Most of the time the radar is not switched on with good visibility and daylight. The RadarPilot, however, normally is switched on also with good visibility and is thus being used in information mode. In the case the radar is switched on the RadarPilot defaults to navigation mode, i.e. it will display the radar overlay. However the use remains similar to information mode, i.e. more strategic and at a larger range setting than the radar, with the radar being used for radar navigation.

Since about five years more and more ships appear to fit their information mode application with a portrait display. The effect is that the selected range is increased by about a factor 2 on northerly and southerly headings compared to the selected ranges on normal (landscape) displays.

2 Most inland vessels have the Inland ECDIS software installed on a dedicated PC that is being purchased at the same time as the Inland ECDIS software. This PC seems only to be replaced when the hardware fails and not or not easily when the extended features of the Inland ECDIS software demands improved hardware.

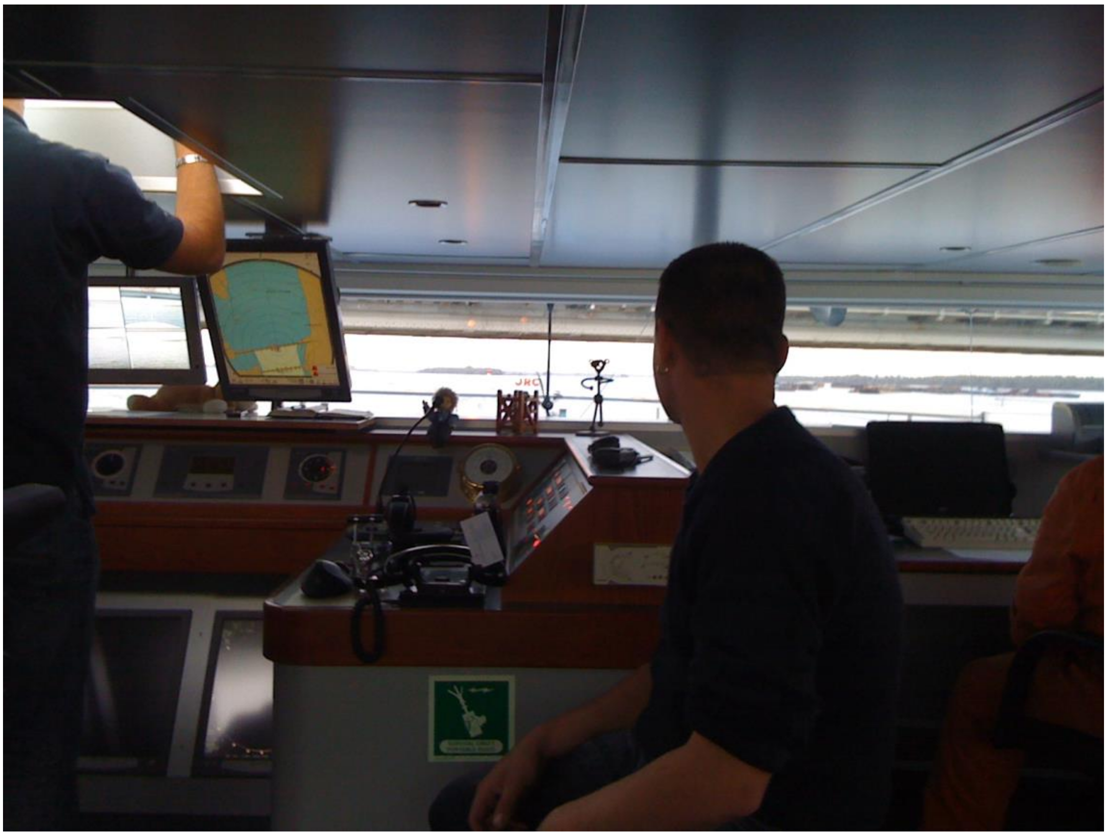

Figure 1 Position of radar and RadarPilot display on board of ms Zonnebloem

3.3. Desktop simulations

3.3.1. Sailing areas

Desktop ‘simulations’ of imaginary voyages over different types of inland waterways were carried out together with Mr Rinus van der Jagt looking at the range or scale that would typically be used on board of an inland vessel given specific navigational situations. In the following overview of navigational situations the selected radar range is given even though in daylight and good visibility the radar is likely to be switched off. This range however is used in case the primary radar is an Inland ECDIS Navigation Mode set-up. Additionally the selected range/scale of an Inland ECDIS Information Mode set-up is given. The later assumes a landscape display (see remark in § 3.2).

3.3.2. Markermeer heading for Houtribsluizen[3]

The Buiten-IJ channel is buoyed with buoy gates. Between the Buiten-IJ fairway and the approach channel to the Houtrib there are mid-fairway buoys. Therefore, when leaving the Buiten-IJ channel, the radar range is adapted to the distance between these buoys, which is 2.5 km. The selected range is 2000 meter, which with a decen-tralized display gives a forward-looking distance of about 3.5 km. The selected scale of an Information Mode set-up would be about 1.5 times the radar range, i.e. about 3.5 km (scale 1:40,000).

[3] Houtrib locks at Lelystad

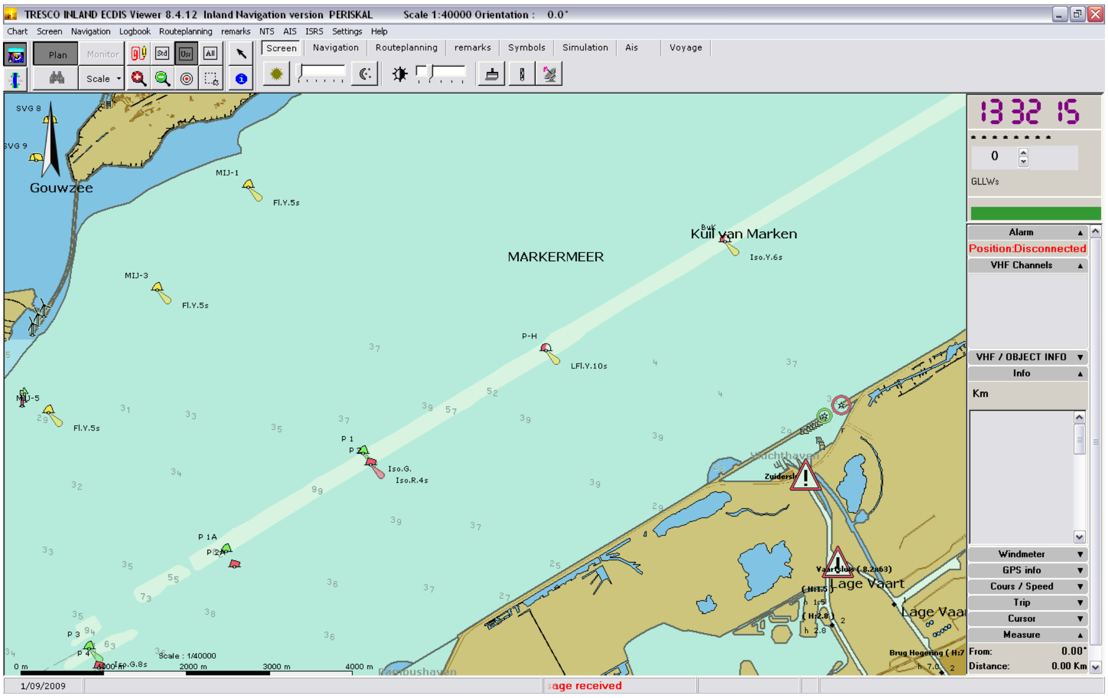

Figure 2 Markermeer scale 1:40.000 (Tresco Viewer, 15' monitor, 1440 x 900 pixels)

Once the buoys (gates) of the Houtrib approach channel show up on the radar the radar range is decreased in steps to 1200 m (in case of heavy traffic 800 m). The scale of the Information Mode is similarly increased, though quite often at a lower pace when the skipper is familiar with the area.

The radar range goes down to 800 m when in between the breakwaters while the Information Mode is switched to 1:10,000. A reason for this scale is that the applications generally display the ship's contour at this scale. The radar range goes down to 250 m near the waiting area (NB the smallest radar range on older radars is 500 m). The Information Mode is switched to 1:500. In the lock the Information Mode is sometimes switched to 1:250 in case there are no other vessels in the lock and the ship is not made fast. This allows monitoring the longitudinal position in the lock and would save the need for the deck hand to go forward.

3.3.3. Terneuzen – Kanaal door Zuid-Beveland - Oosterschelde

The selected radar range on the River Scheldt (Westerschelde) is 2 km, which with a decentralized display gives a forward-looking distance of about 3.5 km. The selected scale of the Information Mode is 1:20,000 or 1:25,000.

Like on the Markermeer the radar range is decreased in steps once the harbour entrance of Hansweert shows up on the radar to be 800 m when in ship is at the entrance. At that moment the scale of the Information Mode has been switched back to 1:10,000. The radar range is 250 m once in between the guide walls of the lock.

The radar range o the canal (Kanaal door Zuid-Beveland) is 1200 m, when passing the bridges or in case of more traffic 800 m.

After having passed Wemeldingen navigating on the Oosterschelde the radar range goes back to 2 km, the Information Mode to a scale of 1:20,000. In the Vlij fairway the radar range is decreased to 1200 m or in case of dense traffic 800 m. The selected scale of the Information Mode is 1:15,000 – 1:10,000.

3.3.4. Amsterdam-Rijnkanaal towards Amsterdam

De radar range on the wider parts of the Amsterdam-Rijnkanaal is 800 m. On the more narrow stretches of the canal like near Maarssen and especially with dense traffic the radar range is 500 m. In both cases the Information Mode is at a scale of 1:10,000.

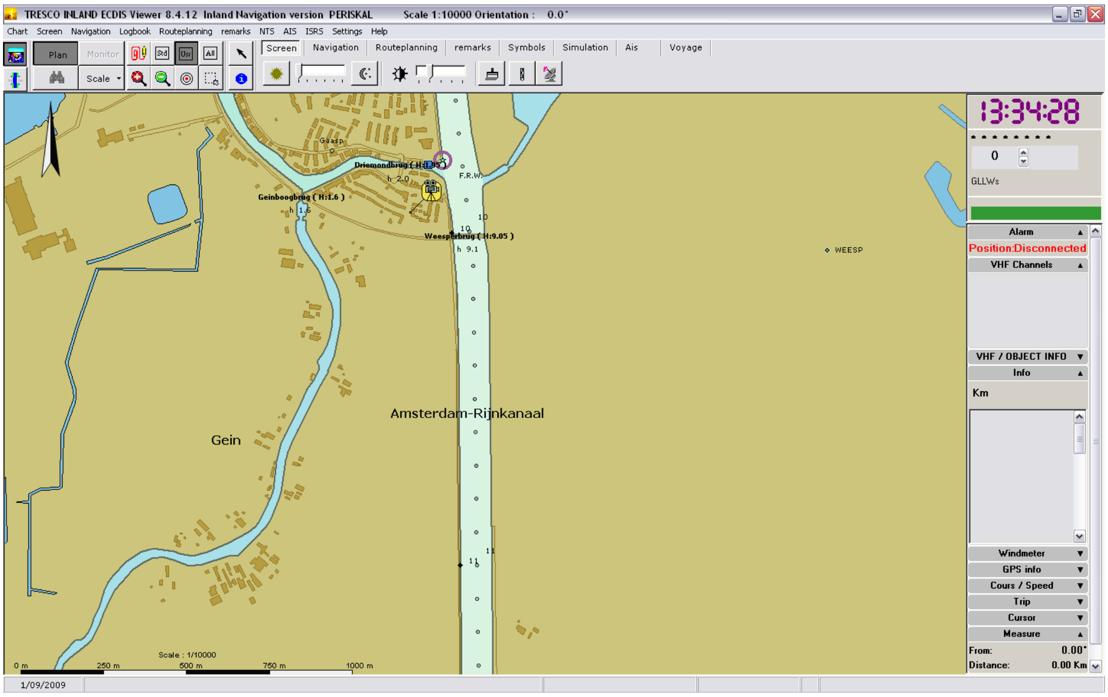

Figure 3 Amsterdam-Rijnkanaal scale 1:10.000
(Tresco Viewer, 15' monitor, 1440 x 900 pixels)

When approaching the junction with the outports of the Prins Alexander and Oranje locks the radar range may be increased to 1200 m to get a better overview of the traffic at hand. The Information Mode remains at 1:10,000.

When continuing in the direction of for example the Amsterdam Westhaven the radar range is back to 800 m and the Information Mode's scale 1:10,000. Due to the 'VTS' VHF channel 68 on which patrol vessels report all movements of seagoing vessels there is no need for a larger range. If this had not been the case the radar range most likely would be temporarily increased to 1200 every now and then.

When entering a harbour basin the radar range is gradually decreased to 250 m when berthing on a jetty or a quay. Depending on the complexity of the navigational situation and the local knowledge of the skipper the Information Mode may be scaled down to 1:500 or even 1:250.

3.3.5. River Maas (River Meuse)

The radar range is 400 – 800 m when sailing downriver on the River Maas in the Province of Limburg. The Information Mode's scale is 1:10,000. Depending on the local knowledge the Information Mode may be used to increase the look-ahead distance at the bends. Usually this is done by either panning ('scrolling') the displayed area or by using the 'look ahead' function if available to circumvent the sluggishness of quite a few of the on-board systems.

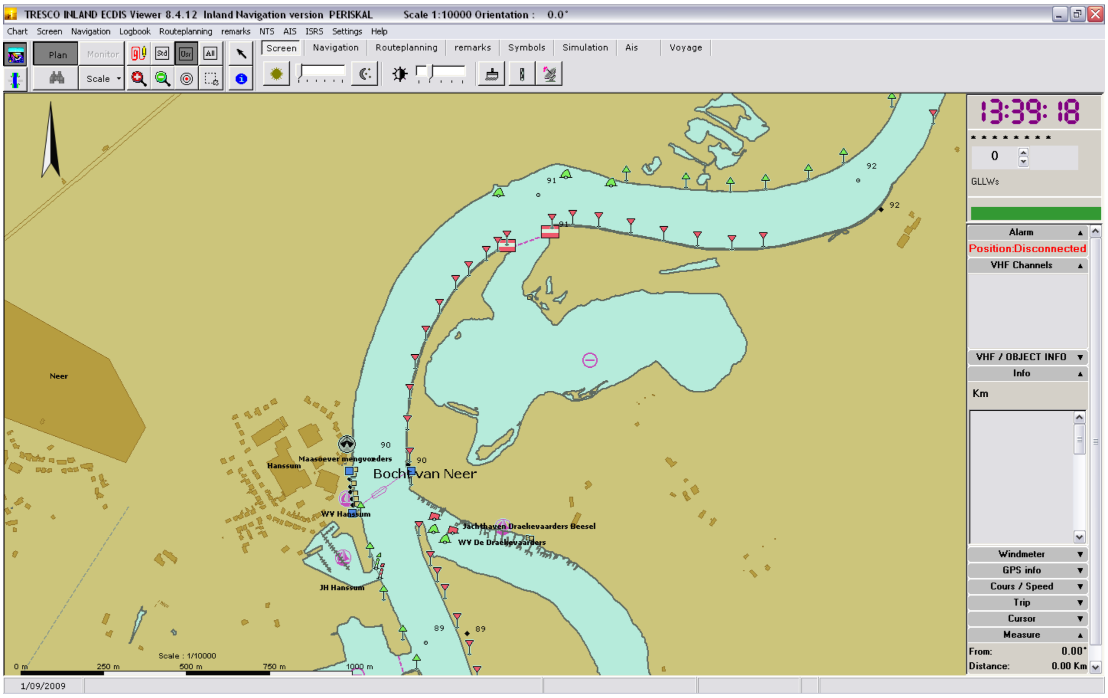

Figure 4 Limburgse Maas scale 1:10.000
(Tresco Viewer, 15' monitor, 1440 x 900 pixels)

3.3.6. Canals

The radar range is 400 m on the narrower canals. The scale of the Information Mode is 1:2500 (see Figure 5). In the case of another vessel reporting itself by VHF the Information Mode is zoomed out to for example 1:20,000 to search for the reported kilometre or other location indication among others to plan the meeting (e.g. not in a bend). NB in this case the Information Mode display is actually zoomed out since panning would be too cumbersome and in this case more time-consuming. Also, most of the IENCs of canals are relatively 'light' and put only limited load on the Information Mode system.

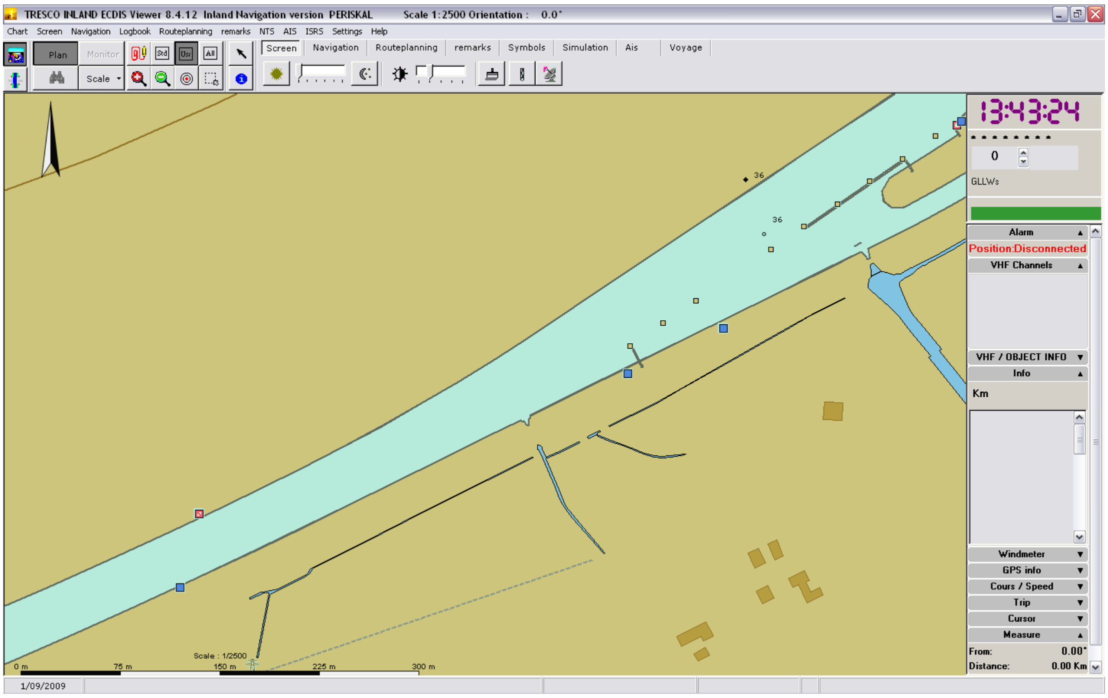

Figure 5 Twentekanaal near Delden scale 1:2.500
(Tresco Viewer, 15' monitor, 1440 x 900 pixels)

3.4. ms Zonnebloem

There appeared to be a distinctive difference in handling the Navigation Mode RadarPilot on board of ms Zonnebloem. The captain generally left the range of the RadarPilot on 1200 m. Quite likely his long experience played a role here. The much younger mate on the other hand interacted much more frequently with the Inland ECDIS equipment, changing the range regularly according to the navigational situation. Interestingly the mate appeared to switch off the radar purposely when navigating on the Haringvliet with stormy weather to have the RadarPilot – now in Information Mode and without 'radar-map-matching' – show the course over ground rather than the true heading, thus allowing him to judge the wind drift.

The mate of the Zonnebloem generally put the RadarPilot – both in Information Mode and in Navigation Mode - one range higher than the radar itself. I.e. on the River Lek, Nieuwe Maas and Oude Maas, Dordtse Kil a range of 1200 m versus a radar range of 800 m. On the more open waterways Haringvliet and Hollands Diep the RadarPilot's range was 2000 m. During the strong wind situation on the Haringvliet the mate put the RadarPilot even on 4000 m to monitor if he would clear specific buoys.

3.5. Voyage planning

As a service Rijkswaterstaat has provided skippers with an option to retrieve Notices to Skippers via the electronic reporting software BICS. A skipper may consult these Notices to Skippers when preparing a voyage using selection criteria like country, province, city, etc. Most of the Inland ECDIS software that is in use in Western Europe offers a similar service. The voyage planning software PC Navigo allows to view these messages in a list, but additionally makes a further step in the sense that it will adjust the planning according to limitations that may be contained in the Notices to Skippers that are received by the software.

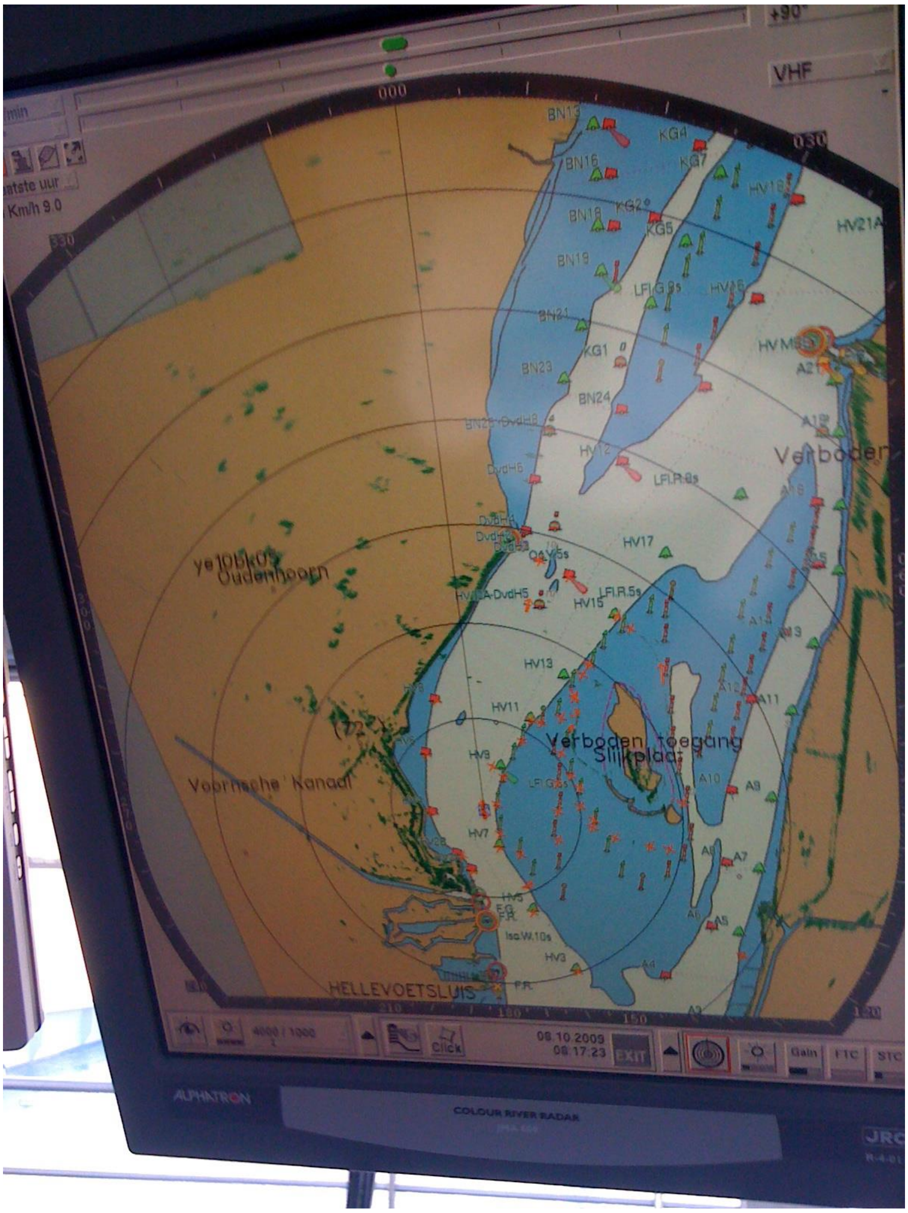

Figure 6 Haringvliet range 4000 m (ms Zonnebloem, RadarPilot 720)

The Periskal Tresco Viewer also offers the option to download Notices to Skippers in this case using selection criteria like provinces (e.g. Zeeland) and waterways (e.g. River Ems). These messages can be viewed in a list, but additionally the messages are indicated at the relevant locations in the chart display (see the triangle icons in Figure 7). This allows getting a quick overview of and selecting the messages that are relevant for the voyage for reading. The necessary zooming and panning however requires a rather powerful PC.

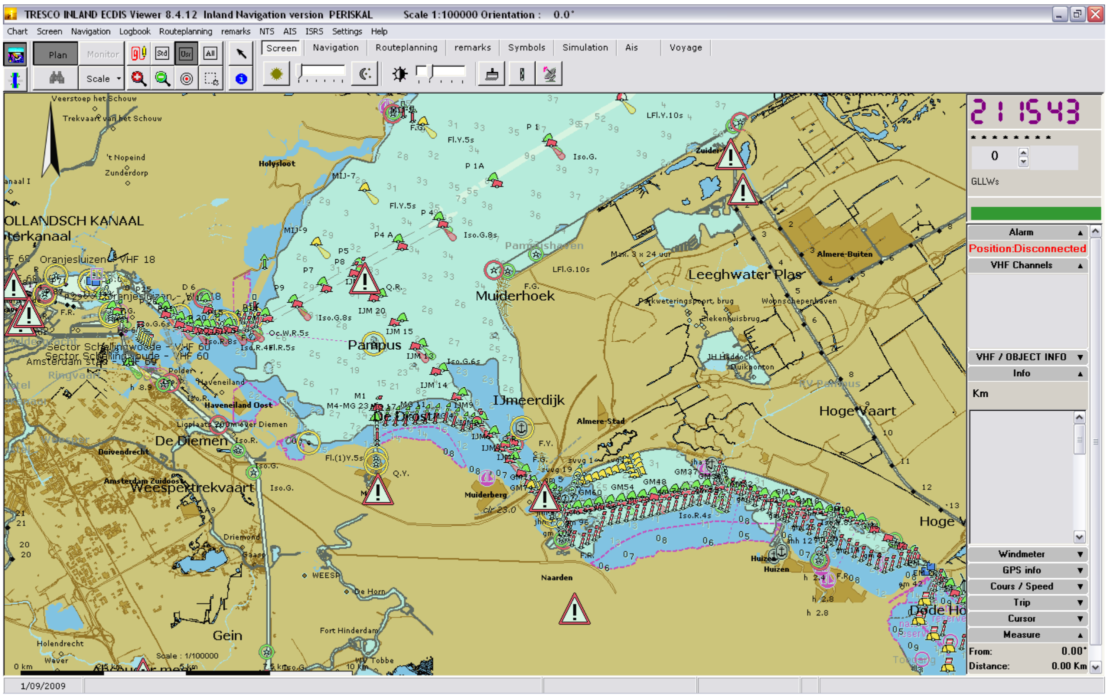

Figure 7 Notices to Skippers scale 1:100.000
(Tresco Viewer, 15' monitor, 1440 x 900 pixels)

4. Usage

4.4. Navigational purpose

The idea of Usage of the S-57 standard corresponds to paper charts with different charts for ocean passages, charts for coastal navigation and for entering a port. An ENC is produced with a certain usage. Maritime ENCs with different usages normally exist for one region. For example, the entrance of Hook of Holland is covered by a UKHO Usage 2 ENC and furthermore by ENCs with usages 3 to 6 of the Dutch Hydrographic Office. The distinction between them is the decline in area covered by the ENC and the growing detailing with the rise of the usage number. The difference in detail in the example means that the usage 2 ENC contains only the most important buoys for orientation purposes: the ENC is not suitable to actually navigate into Hook of Holland.

4.5. IENC Usages

When developing the Inland ECDIS Standard it soon became clear that many of the Inland ENCs contained much more detail than the maritime usage 6 ENCs. For this reason the range of usages was expanded in the Inland ECDIS Standard.

The Inland ECDIS Standard Product Specification [1] contains the following text about Usages:

2.1 Navigational purpose (usage)

IENC data is compiled for a variety of navigational purposes. The navigational purpose for which an individual IENC has been compiled is indicated in the "Data Set Identification" [DSID] field, "Intended Usage" [INTU] subfield and in the name of the data set files. The following codes are used:

Nr.	Navigational purpose **(usage)**	**Intended use**
1 S57	Overview	For route planning and oceanic crossing.
2 S57	General	For navigating oceans, approaching coasts and route planning.
3 S57	Coastal	For navigating along the coastline, either inshore or offshore.
4 S57	Approach	Navigating the approaches to ports or mayor channels or through intricate or congested waters.
5 S57	Harbour	Navigating within ports, harbours, bays, rivers and canals, for anchorages.
6 S57	Berthing	Detailed data to aid berthing.
7 new	***River***	***Navigating the inland waterways (skin cell).***
8 new	***River harbour***	***Navigating within ports and harbours on inland waterways (skin cell).***
9 new	***River berthing***	***Detailed data to aid berthing manoeuvring in inland navigation (skin cell).***
L new	***Overlay***	***Overlay cell to be displayed in conjunction with skin cells***

Authorities as well as private bodies may use the navigational purposes 1 to 8 and L. Navigational purpose 9 should be used by private bodies only.
It is allowed to assign a range of usages to overlay cells (see clause 5.6.3).
Overlay cells may not contain skin-of-the-earth features (see clause 3.10).

The usage of an (I)ENC indicates the level of detail of the information that is contained in the ENC. De information that is actually be shown by the Inland ECDIS application however also depends on the so-called SCAMIN value of the individual features. SCAMIN is discussed in more detail in §5.

The Dutch IENCs presently have a usage 5[4]. However, the level of detail of these IENCs in most cases is considerably higher than the usual level of detail of a maritime usage 5 ENC, see for examples Figures 8 and 9.

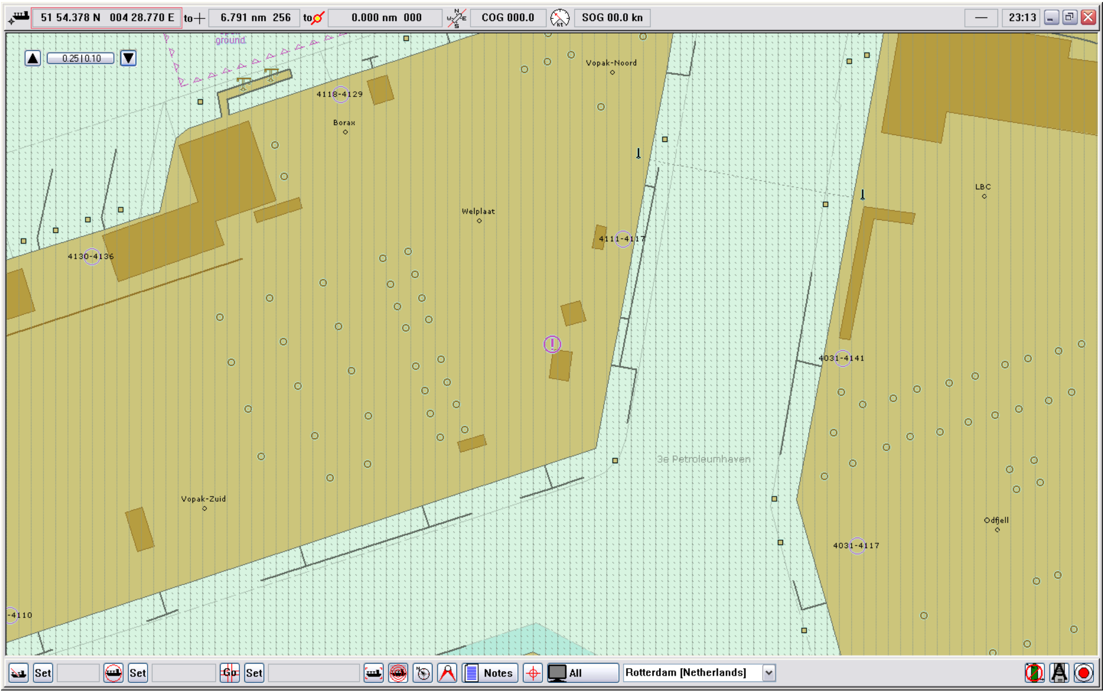

Figure 8 3e Petroleumhaven Rotterdam ENC Dutch Hydrographic Office (Orca Master, 15' monitor, 1440 x 900 pixels)

[4] With the exemption of the IENCs that are being produced by RWS Zeeland which have usage 4.

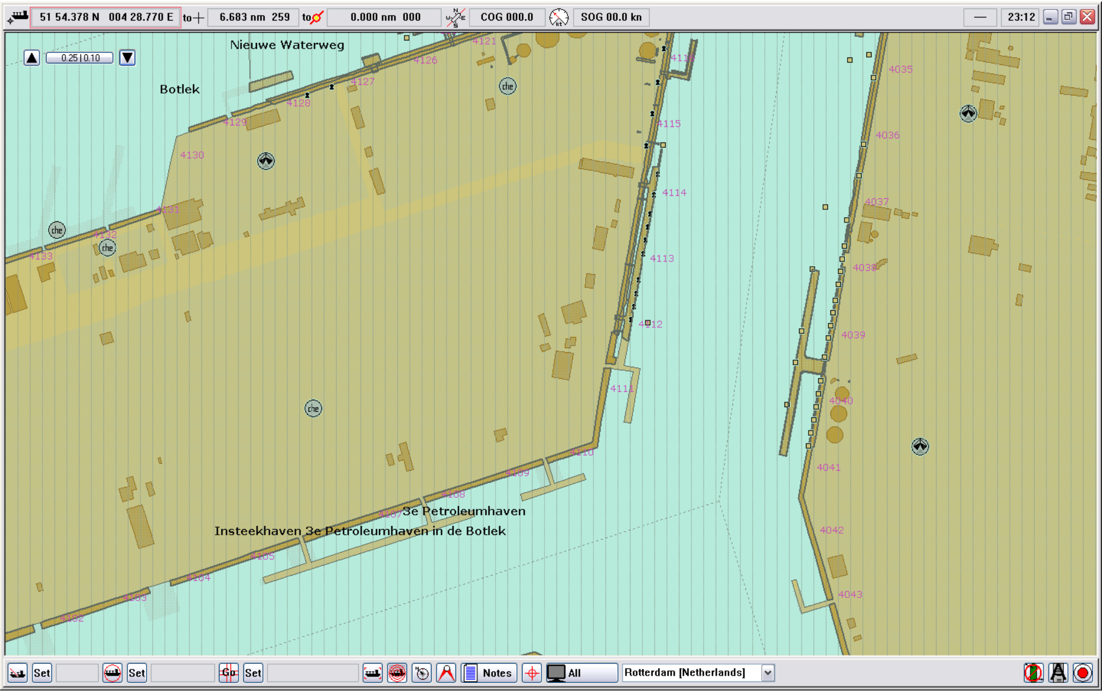

Figure 9 3e Petroleumhaven Rotterdam IENC RWS (Orca Master, 15' monitor, 1440 x 900 pixels)

It seems consistent to use the additional Inland ECDIS usages in those cases where the IENC has more detail than the maritime ENC.

With the choice of usage it is noted that the IENCs that are produced by RWS DID have a compilation scale of 13,333, while the IENCs that are produced by RWS Zeeland have a compilation scale of 5,000.

4.6. Multiple IENCs with different usages

It has been suggested that the Inland ECDIS Standard does not allow making use of multiple IENCs of the same area with different usages if the 'overview' IENC, i.e. the IENC with the lower usage would not contain the complete 'minimum content'. It can however be argued that multiple IENCs of a specific location with a different usage can be seen as a whole in which the most detailed IENC, i.e. the one with the highest usage, must contain the entire minimum content.

§3 demonstrates that the range/scale selection on inland vessels does not vary greatly when underway. This would suggest that there is not that much need to produce IENCs with different usages.

On the other hand also on seagoing vessels many complains are heard about the usability of ECDIS for voyage planning. The main reason for these complaints is the fact that the average display is considerably smaller than the average paper chart. Moreover the average display has a significantly lower resolution than print. As a result voyage planning using ECDIS requires much panning and zooming in and out, which does plea for less detailed, generalised (I)ENCs for smaller scales.

On the one hand the aforementioned panning and zooming in and out does not lead to unacceptable waiting times on the hardware on board of ms Zwerver (MacBook Pro 2.8 GHz Intel Core 2 Duo), not even when the Windows based Inland ECDIS software is run in virtualisation (Parallels) within the Mac OS. Exceptions are IENCs of open waters with detailed depth data and the application set to display everything

(All). Also the recent Windows Vista laptop computer of Van der Jagt has little problems in this area, while the Inland ECDIS software companies Periskal and Tresco Engineering state that they do not receive complains on this subject. On the other hand there is the clear signal from Van der Jagt that there is an issue with the response time of the Inland ECDIS installation on quite a few of the vessels on which he is relieving. The need for multiple IENC with different usages therefore remains unclear.

4.7. Proposal implementation usages

The previous paragraphs lead to the following proposal for the implementation of IENC usages by Rijkswaterstaat:

Usage	Waterway
4	IJsselmeer, Markermeer, Randmeren, Waddenzee, Zeeland waterways, open Zuid-Hollands waterways, all including the harbour approaches
7	Rivers, canals, ports
8	Harbour basins, in case of a greater level of detail

5. SCAMIN

5.4. Discussion

The SCAMIN value decides at which user selected scale or range a feature is being displayed. SCAMIN aims to prevent too much 'clutter' that would render the display useless when a larger range is selected. (For an example of the latter see Figure 8). Using the SCAMIN values a feature is not shown by the display unless the selected display scale is greater than the feature's SCAMIN value. A buoy that has the IENC Encoding Guide's recommended SCAMIN setting of 22,000 will only be shown on the display if the selected display scale is greater than 1:22,000.

The buoys in Figure 8 appear to have a SCAMIN setting of 150,000. The figure, however, demonstrates that there is little added value in showing every single buoy at the selected scale of 1:75,000. It may even result useful information like the name of a waterway becoming invisible.

On the other hand at the selected scale of 1:75,000 not a single buoy would have been displayed if the recommended SCAMIN value of 22,000 had been used. As a result a user would not be aware of the existence of buoyed channels unless he zooms in to a scale greater than 1:22,000. In the example of the crossing of the Markermeer in § 3.3.2 a skipper would not have a single buoy displayed at the customary scale selection of 1:40,000 if the recommended SCAMIN value of 22,000 would be used.

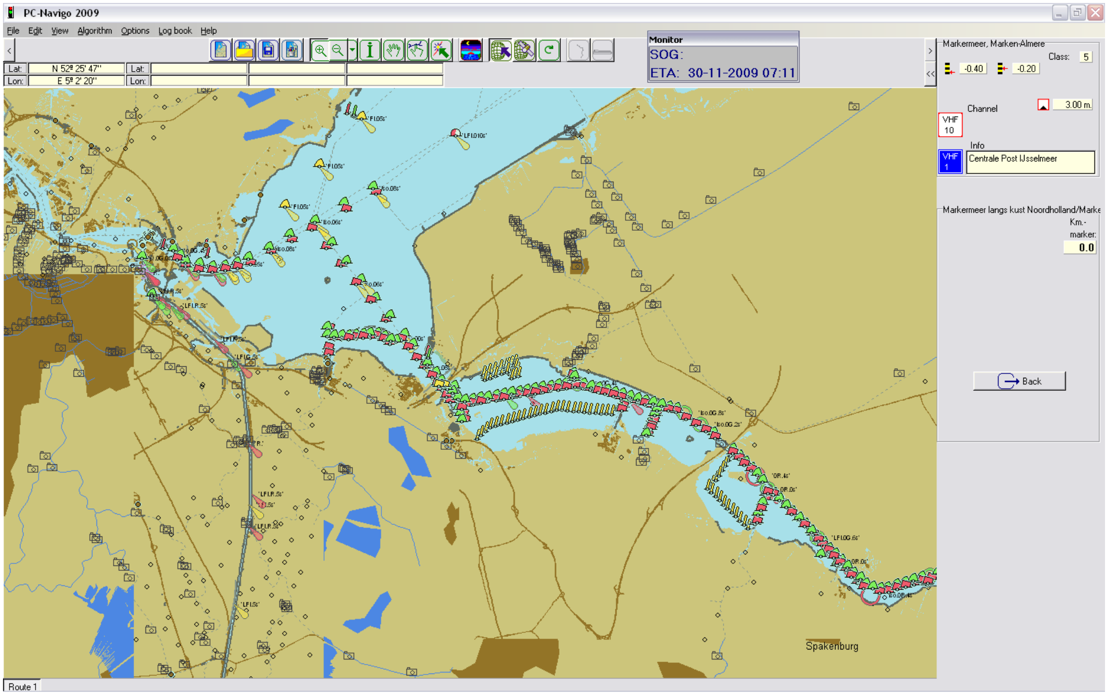

Figure 10 Clutter due to too large SCAMIN values, scale 1:75.000 (PC Navigo, 15' monitor, 1440 x 900 pixels)

5.5. SCAMIN optimization test

Several years ago a trainee at SevenCs, Hamburg, undertook an attempt to optimise the SCAMIN values of ENCs for the IJsselmeer and Markermeer that had been produced by SevenCs[5]. Screen dumps of this - quite successful - attempt are given in

[5] Based on the 1800 series paper charts of the Dutch Hydrographic Office.

Appendix I. Note that the selected range values that show in the upper left corner of the screen dumps are in nautical miles. The examples show that the mid fairway buoys and cardinal buoys stay visible also at larger ranges (small scales). To a certain extent this also applies to the special purpose buoys. On the other hand an ever greater part of the lateral buoys are no longer being displayed when zooming out. However since alternating red and green buoys are being hidden, it remains clear to the users that there is in fact a buoyed channel, while at the same time the amount of clutter is limited.

5.6. SCAMIN proposal

Considering the previous paragraphs it is proposed to use the SCAMIN values that are given in the IENC Encoding Guide for EU IENCs. However in IENCs with usage 4 the Encoding Guide SCAMIN values of the features that are listed in the following table are multiplied with the listed values:

Factor	Features
12	Mid fairway buoys, individual special purpose buoys, cardinal buoys, lights on beacons, leading lights, sector lights
2.5	Lateral recreational buoys ‘behind’ standard lateral buoys

The Encoding Guide SCAMIN values for lateral buoys, lateral recreational buoys not ‘behind’ stand lateral buoys and special purpose buoys that are part of a group for example to mark an area, are multiplied with a factor according to the following pattern:

‘sea’	12	1	8	4	12	1	8	4	…	‘land’
	4	12	1	8	4	12	1	8	…	

Note that it is important that one buoy of the pair of buoys that marks the ‘sea’-ward entrance of a buoyed channel has a SCAMIN x 12 to ensure that the entrance of the channel is displayed also at smaller scales.

5.7. Inconsistencies SCAMIN IENC Encoding Guide

When scanning the SCAMIN recommendations of the IENC Encoding Guide during this study the following inconsistencies were noted:

The EU SCAMIN values in the Encoding Guide for Conveyor (CONVYR) SCAMIN 8000, overhead pipeline (pipohd) SCAMIN 45.000, CRANES and cranes SCAMIN 25.000 seem not consistent since all of them can imply a height limitation for navigation. Taking into account the customary selection of ranges/scales there is a need for a SCAMIN value greater than 10,000 for the aforementioned features. It is proposed to use the EU SCAMIN value for buoys, i.e. 22,000 for all these features.

SLCONS, CATSLC=14 (fender) has a recommended SCAMIN value of 8,000. According to Encoding instruction B fenders need not have depictions of structural pylons behind the fender. Therefore there is a need for a SCAMIN value greater than 10,000 also in this case. It is proposed to use the EU SCAMIN value for buoys, i.e. 22,000. The same applies for the following features:

MORFAC

HULKES

ROCKS

Leading lights,

Directional lights,

Sector lights

NAVLNE,

RCTLNE

6. Conclusions

- There is a need to improve the implementation of the navigational purpose (usage) of the IENCs that are produced by RWS.

- The SCAMIN values that are recommended by the IENC Encoding Guide are not always suitable for the Dutch open waters.

- The SCAMIN values that are recommended by the IENC Encoding Guide are inconsistent and/or too low for some features.

- There are indications that the sluggishness of quite a few of the on-board systems stands in the way of an active user-interaction with the application.

7. Recommendations

- It is recommended to apply the following table when deciding on the usage of the RWS IENCs.

Usage	Waterway
4	IJsselmeer, Markermeer, Randmeren, Waddenzee, Zeeland waterways, open Zuid-Hollands waterways, all including the harbour approaches
7	Rivers, canals, ports
8	Harbour basins, in case of a greater level of detail

- For usage 4 IENCs it is recommended to multiply the IENC Encoding Guide SCAMIN values according to the following table to ensure relevant buoys and beacons on open waters to be displayed also at larger selected ranges:

Factor	Features
12	Mid fairway buoys, individual special purpose buoys, cardinal buoys, lights on beacons, leading lights, sector lights
2.5	Lateral recreational buoys 'behind' standard lateral buoys

The Encoding Guide SCAMIN values for lateral buoys, lateral recreational buoys not 'behind' stand lateral buoys and special purpose buoys that are part of a group for example to mark an area, should be multiplied with a factor according to the following pattern:

'sea'	12	1	8	4	12	1	8	4	…	'land'
	4	12	1	8	4	12	1	8	…	

- It is recommended to formulate proposals to the IENC Harmonisation Group to improve the consistency of the SCAMIN values for a number of features.

References

1 Inland ECDIS Standard version edition 2.1

Appendix I SCAMIN Optimisation test

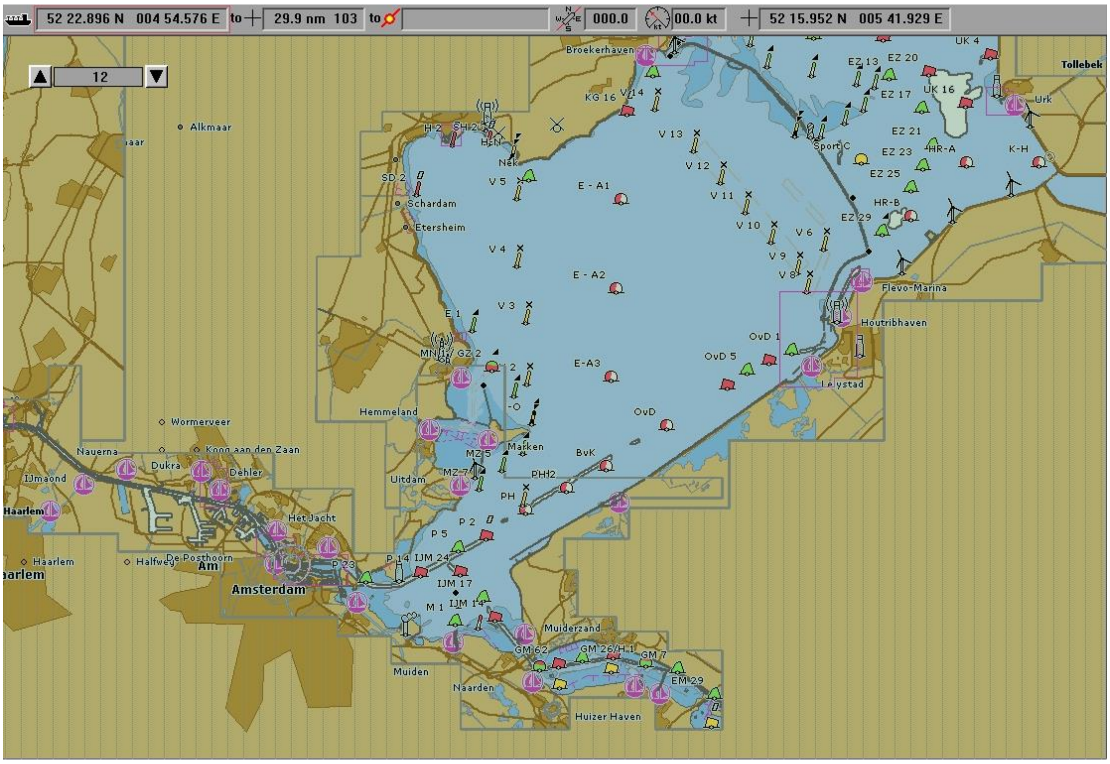

Figure I 1

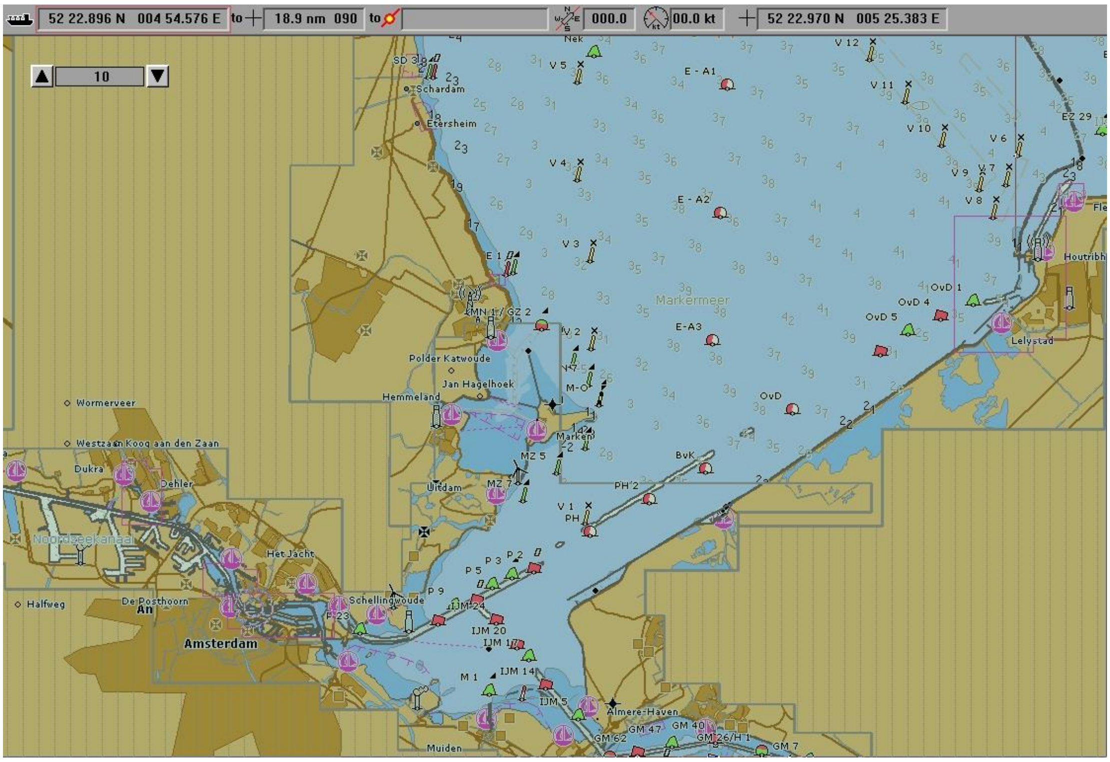

Figure I 2

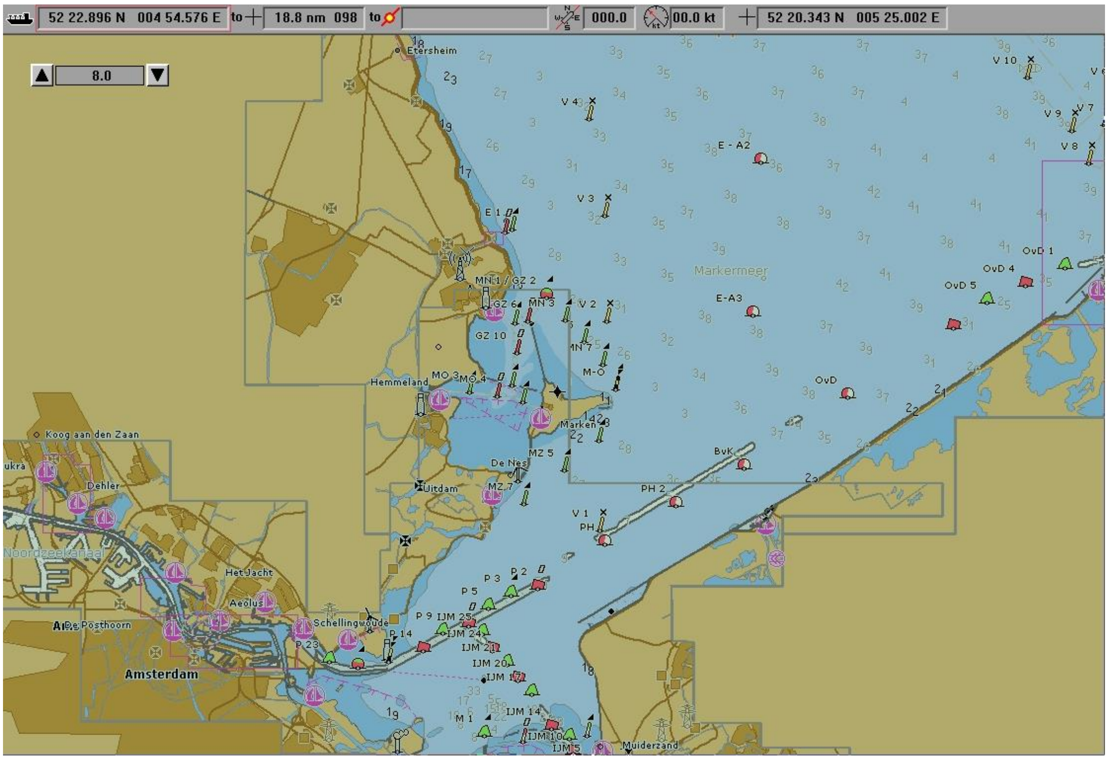

Figure I 3

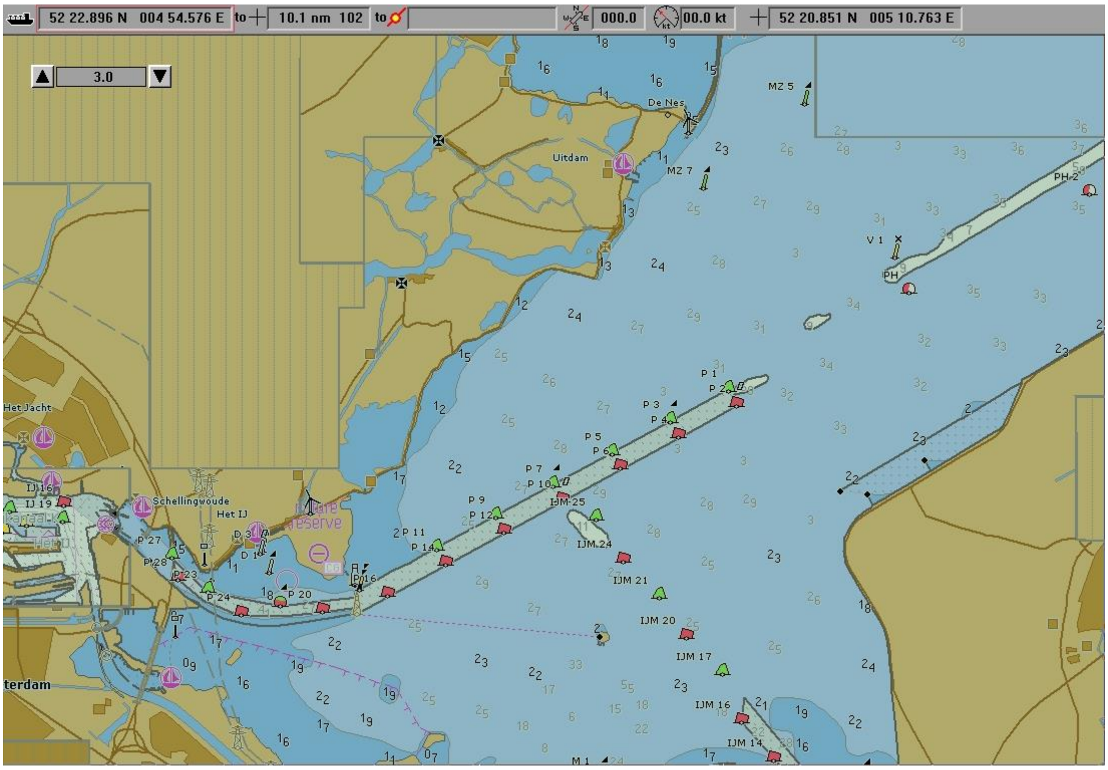

Figure I 4

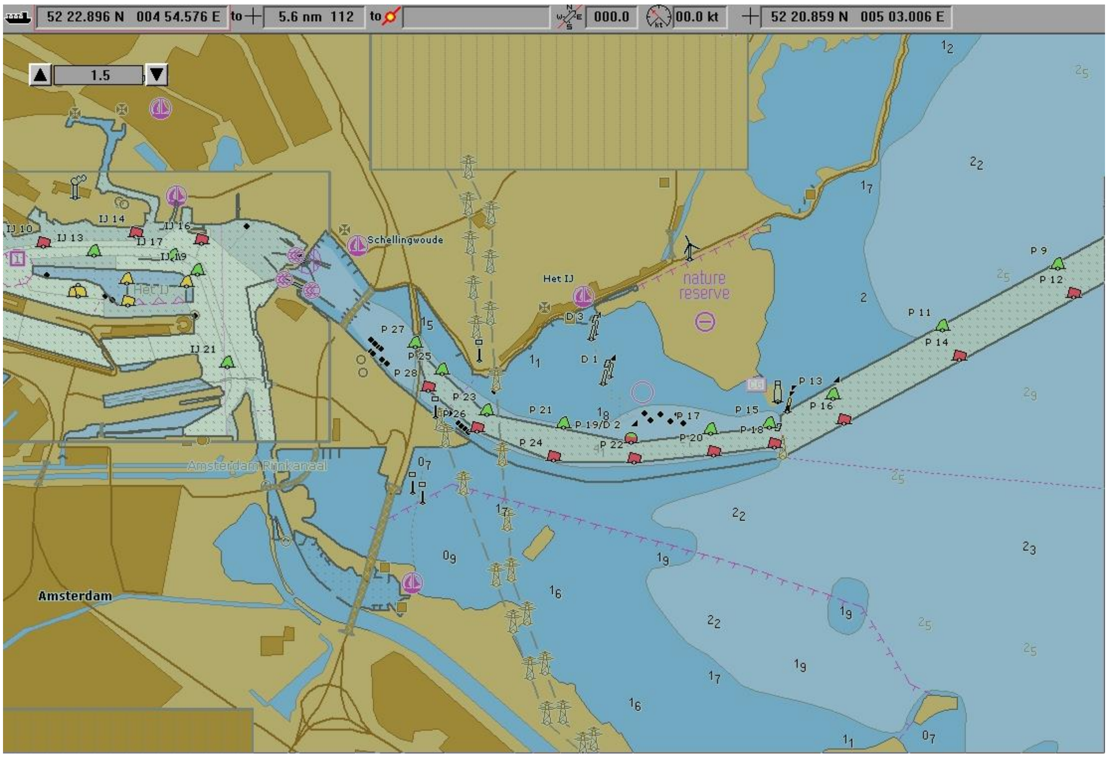

Figure I 5

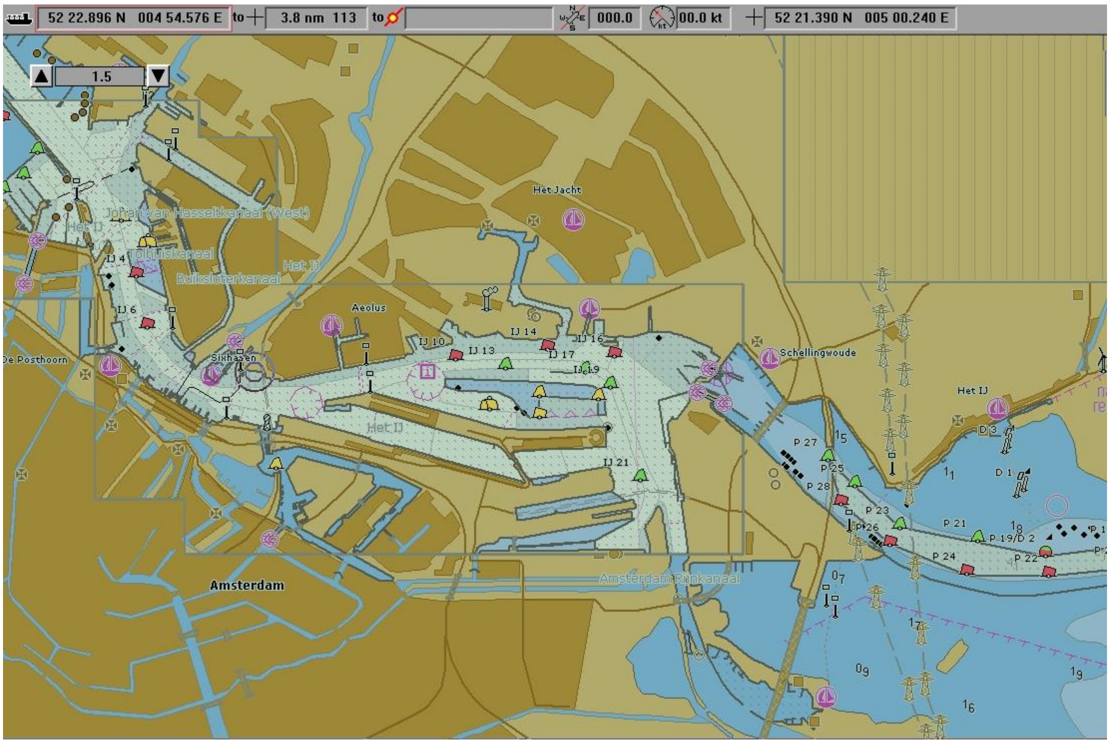

Figure I 6

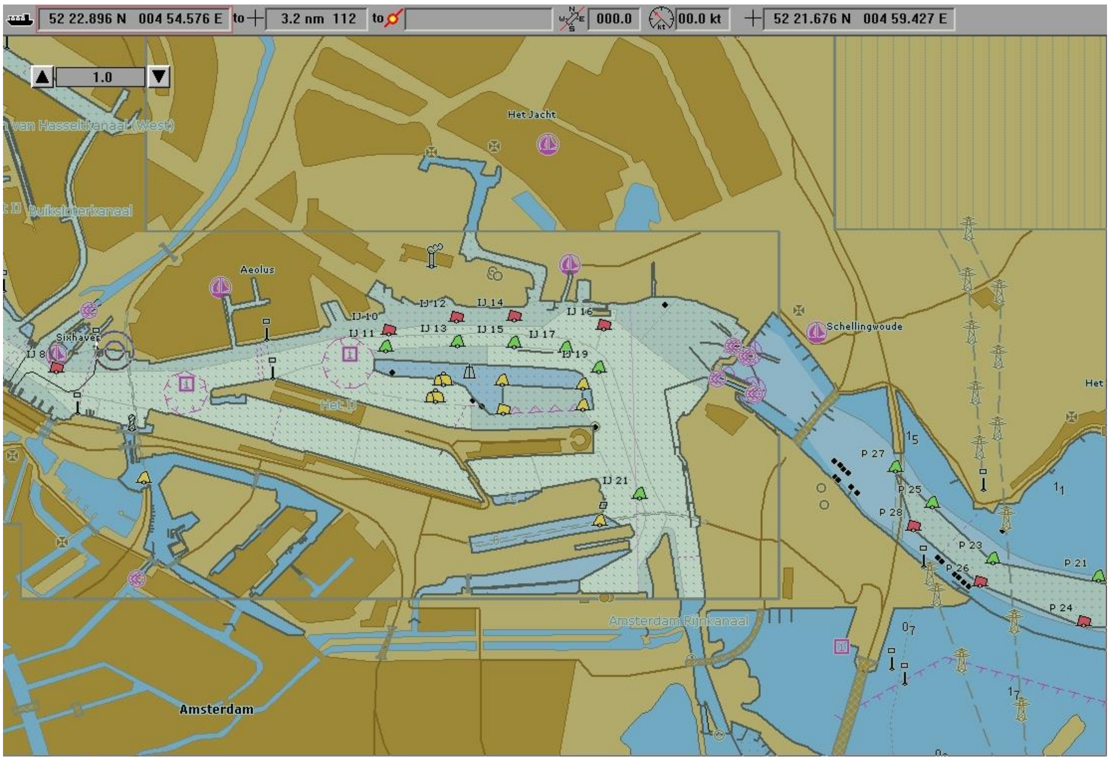

Figure I 7

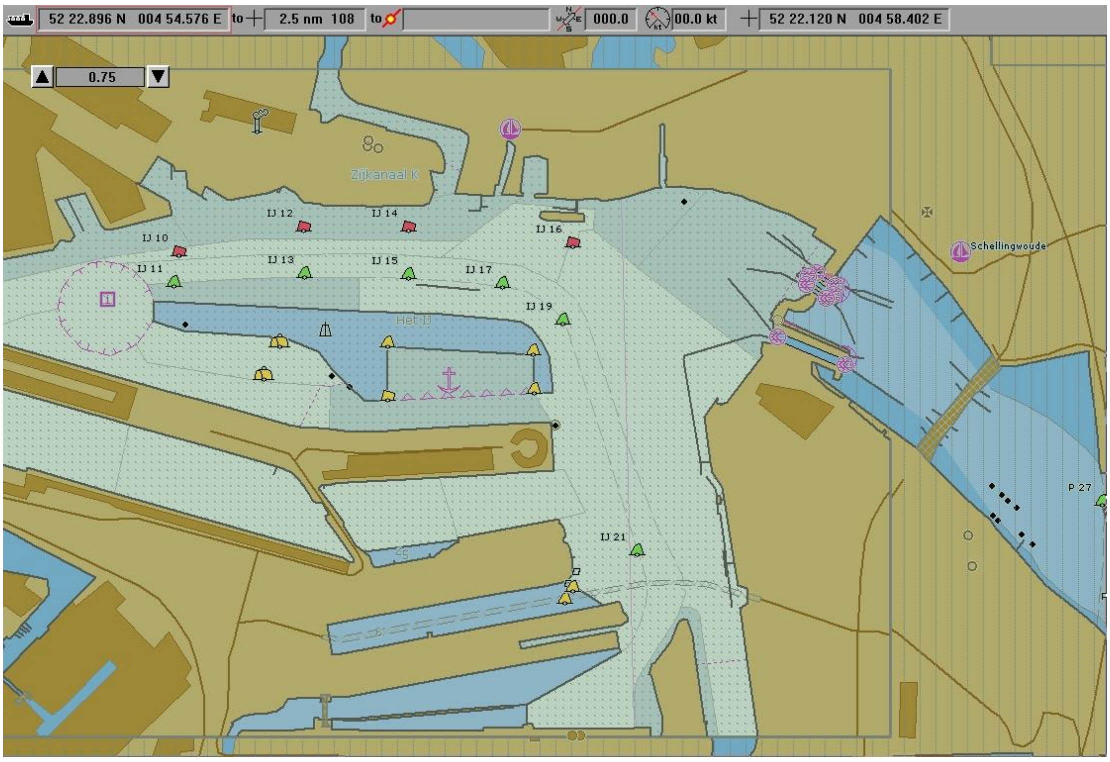

Figure I 8