

IHO Colours & Symbols Maintenance Working Group (C&SMWG)
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*Recommendations for improved ENC consistency
(Future IHB Circular Letter No. 47/2004)*

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Background

With increasing numbers of ENCs now available and in use, it has become apparent that there are problems of inconsistent encoding of data by different national Hydrographic Offices (HOs). Such inconsistencies are particularly noticeable when viewing adjoining data from different HOs at their national boundaries, and are giving ENCs a poor name in the ECDIS environment, a situation the IHO wishes to avoid. It is therefore in the interests of all HOs producing or about to produce ENCs to seriously consider applying the following methods and to ensure that ENCs are consistent to a far greater degree than has been the case in the past.

Although smaller scale official ENC coverage is still lacking in most areas, ECDIS systems must display information at small scales for the purpose of overview/route planning. In order to do this, an ECDIS loads ENCs compiled for larger scales and displays them at much smaller scales, e.g. an ENC compiled at 1:22,000 may be displayed at a scale of 1:90,000 or even smaller. The larger scale ENCs, however, normally contain many details/objects in close proximity which would not usually be portrayed on a small compilation scale ENC of the area. Consequently, those objects will produce much display clutter during zoom out, i.e. the display details may become unreadable. In order to avoid this effect, the S-57 SCAMIN attribute was introduced to be applied to those objects whose visualisation should be suppressed from a particular, pre-determined value of a display scale smaller than the ENC's compilation scale. Unfortunately, the S-57 Object Catalogue, ENC Product Specification, Use of the Object Catalogue (UOC) definitions and rules and the S-57 Maintenance Documents do not provide good advice for the harmonised encoding of compilation scale and the application of SCAMIN attribution in relation to this. The consistent application of compilation scales and SCAMIN value settings throughout all ENCs would have a significant effect on the presentation and usability of ENCs. However, as S-57 Edition 3.1 is frozen, no new clarifications can be issued (via the S-57 Maintenance Document) on how to achieve improved consistency between ENCs produced by different national Hydrographic Offices. Accordingly, this circular letter with its recommendations has been written in order to inform HOs of those areas where consistency **should/must** be addressed, and how SCAMIN in particular should be used.

Based on two documents, "Improving ENC Consistency" and "SCAMIN", written and distributed by IC-ENC in May and August 2003¹, these recommendations have been **discussed and modified by** the TSMAD Working Group of the IHO as "advice for good encoding practice" and will be published as separate ENC Encoding Bulletins on the official IHB web site. The recommendations are listed in order of their anticipated effectiveness. For example, the setting and use of SCAMIN values would have a much greater effect on ENC visualisation improvements than would the standardisation of COMF values for the resolution of coordinates. All of these recommendations will contribute to improving the ENC product and, taken as a whole, will lead to considerable quality improvements and much greater user

¹ The papers can be downloaded from the IHO web-site under the TSMAD sub-group committee site

satisfaction. HO's producing ENC's are therefore recommended to adopt these procedures as early as possible and to grasp opportunities to update all already issued ENC's stepwise. However, the timing of the implementation of the recommendations is left to the discretion of the HO's and some additional practices may have to be applied following agreement between neighbouring members.

Recommendations for consistent ENC data encoding

1. The setting of compilation scales for all ENC's should be based upon the standard radar range scales in the following table:

Selectable Range	Standard scale (rounded)
200 NM	1:3000000
96 NM	1:1500000
48 NM	1:700000
24NM	1:350000
12 NM	1:180000
6 NM	1:90000
3 NM	1:45000
1.5 NM	1:22000
0.75 NM	1:12000
0.5 NM	1:8000
0.25 NM	1:4000

Table 1 Radar range / standard scale table

- Normally, the nearest larger standard scale should be used, e.g. an ENC produced from a 1:25,000 paper chart should have a compilation scale of 22000.
 - Exceptionally, where the density of the data is such that following this rule would result in a particularly cluttered presentation, the next larger scale may be used, but only if this scale is not larger than the scale of the original source survey material. E.g. an ENC produced at 1:25,000 could have a compilation scale of 12,000.
 - Where the source material used to produce the ENC is of a scale larger than 1:4000, then the actual paper chart / source material scale may be used as the compilation scale for the ENC.
 - Where the source material used to produce the ENC is of a scale smaller than 1:3000000, then the actual paper chart / source material scale may be used as the compilation scale for the ENC.
2. SCAMIN values should be determined using a method that reduces the number of individual objects displayed and ensures clarity, using the standard rounded display scales listed in the above table:
 - SCAMIN should be applied to all SCAMIN-attributable objects and also to buoys and beacons which belong to the display category "base display" of the IMO Performance Standards for ECDIS. SCAMIN should not be applied to any other base display objects.

- As a minimum, a single standard value should be applied to all SCAMIN-attributable objects. This single standard value should be set to the compilation scale minus 1 of the next available smaller scale ENC covering the area, e.g. for an ENC with a compilation scale of 12000, where the next available smaller scale ENC has a compilation scale of 90000, this standard SCAMIN value should be set to 89999.
- In order to achieve clarity of display as the user zooms out, intermediate SCAMIN values should be applied to those individual objects in SCAMIN-attributable object classes that the HO considers are less important and that are contributing to clutter. These values should be set to one of the rounded standard scales (minus one) between the compilation scale of the cell and the compilation scale of the next smaller scale ENC available. For instance, for an ENC with a compilation scale of 12000, where the next available smaller scale ENC has a compilation scale of 90000, a SCAMIN value of 44999 could be applied to such objects.
- If it is desired to continue displaying navigationally important objects of the ENC at zoom levels beyond the compilation scale of the next smaller scale ENC available, other smaller scale SCAMIN values should be applied to such individual objects. These values should be set to one of the rounded standard scales (minus one) beyond the compilation scale of the next smaller scale ENC available. For instance, in the example above, a SCAMIN value of 179999 may be applied to such objects. The number of upward steps in rounded standard scales will differ for different objects/object classes of differing importance for navigation, e.g. selected soundings may possibly have SCAMIN values of two steps beyond, whereas aids to navigation (buoys, beacons etc.) may possibly require three or more steps beyond.

For the purposes of consistency, and to support a seamless transition between ENC cells, it makes sense if the objects selected for smaller scale SCAMIN values broadly correlate with the objects which appear on the next smaller scale ENC available.

- If there is currently no smaller scale ENC available, it is recommended that the starting point for use of SCAMIN be set at two steps beyond the compilation scale. The values should be set to one of the rounded standard scales (minus one) beyond the compilation scale of the ENC as described above.
 - If the above recommendations are used to apply SCAMIN values, the last bullet point of UOC clause 2.2.7 recommending the use of the same SCAMIN value for all navigational purposes no longer applies.
 - In order to ensure consistency of display at their boundaries, it is essential that HOs liaise with their neighbouring HOs, RENC and/or Regional Hydrographic Commission when defining these SCAMIN values.
3. HOs may assign each ENC to a navigational purpose based on the ENC's compilation scale. This should be done in consultation with neighbouring HOs or with all nations within a RENC, or with all nations within a Regional Hydrographic Commission, in order to maintain consistency across national or regional boundaries. For instance, the following ranges may be applied:

Navigational Purpose	Name	Scale Range	Available Compilation Scales	Matching Scale Ranges
1	Overview	<1:1499999	3000000 and smaller 1500000	200 NM 96 NM
2	General	1:350000 – 1:1499999	700000 350000	48 NM 24 NM
3	Coastal	1:90000 – 1:349999	180000 90000	12_NM 6_NM
4	Approach	1:22000 – 1:89999	45000 22000	3 NM 1.5 NM
5	Harbour	1:4000 – 1:21999	12000 8000 4000	0.75 NM 0.5 NM 0.25 NM
6	Berthing	> 1:4000	3999 and larger	< 0.25 NM

Table 2 Possible assignment of navigational purposes to scale ranges

Note that this correlation of navigational purposes to compilation scale is intended to give guidance to those HOs about to start ENC production or to those who wish to rescheme their ENC cells.

4. The use of too many M_CSCL objects within the same cell should be avoided. The values of any M_CSCL CSCALE attributes should be set using the same criteria as those used for setting compilation scale described above.
5. Inconsistent depiction of the same localities in different navigational purposes should be avoided. For example, outlines of rivers, ports etc in smaller scale cells should be shown but may be in simplified outline form.
6. In addition to discussing and agreeing the setting of compilation scale and SCAMIN, there should be close liaison between neighbouring HOs when creating ENCs in their border areas, in order to resolve any issues of inconsistent depiction and to avoid gaps in data coverage. In particular, the following issues should be investigated and resolved:
 - common border limits and boundaries
 - COMF value used
 - scales / navigational purposes
 - overlaps / gaps - buffer zone
 - content / data alignment
 - depth contour intervals
 - truncated limits and boundaries (areas that cross the border)
 - SCAMIN rule used.
7. Misalignment and inconsistent depiction of data at cell, source and international boundaries should be investigated and rectified.
8. HOs should, as a minimum, use standardised depth contour intervals (INT1 I130, 31). Additional contours may be added, where required.

9. HOs should not leave holes in smaller scale coverage, assuming that the user will have larger scale data available.
 10. Wherever possible, meaningful and useful values of CATZOC should be used, i.e. values other than CATZOC 6 (data not assessed) for water areas.
 11. Coordinates should be held in ENC production systems at a resolution of 0.0000001 (10^{-7}) and the COMF value should be set to 10000000 (10^7) for all cells.
 12. There must be no gaps in data between adjoining cells of the same navigational purpose.
 13. There must be no overlapping data between cells of the same navigational purpose (see S-57, Appendix B.1 clause 2.2), except at national boundaries, where, if it is difficult to achieve a perfect join, a 5 metre overlapping buffer zone may be used.
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