Paper for Consideration by the ENCWG

Use of Big Monitors for ECDIS

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Executive Summary:	Big monitors are monitors significantly larger than traditional minimum ECDIS monitors just capable to display 270x270 mm minimum chart area. For example, 55 or 60-inch monitors would be such 'big monitors' addressed by this paper. This paper proposes ENCWG to consider minor adjustments in the text of S-64 in order to facilitate use of big monitors.
Related Documents:	S-52 Main document ed 6.0 S-52 Presentation library ed 4.0 S-64 Ed 3.0
Related Projects:	N/A

Introduction / Background

1. Traditionally ECDIS monitors have been as small as possible due to high price of monitors being compliant with IEC 60945 environmental conditions and IHO S-52 & IEC 62288 colour calibration requirements.

2. Recently users have been willing to accept higher price of bigger monitors, as the bigger monitors offer better usability for viewing chart than smaller monitors.

3. Bigger monitors are available in two different resolutions – Full HD (1920x1080) and 4K (3840x2160). For size of about 55 – 60 inch the "picture unit" (pixel) size of Full HD is about 0,6 mm and the "picture unit" (pixel) size of 4K is about 0.3 mm. The Full HD monitors are obviously available at lower price than 4K monitors. Big Full HD monitors would be used for longer viewing distances than traditional ECDIS. 4K monitors suit well "chart table" style table installation.

4. The traditional small monitors have had "picture unit" (pixel) size of about 0.3 mm. The S-52 specify "picture unit" (pixel) size, depending of part text, as 0,3 mm, 0,312 mm or 0,32 mm. Basically, we can say that S-52 specify "picture unit" (pixel) size 0,3 mm.

5. Big monitors based on 4K fit well to the existing S-64 as the "picture unit" (pixel) size is still about 0,3 mm. The CHECKSYM from the S-52 Presentation library would still be 16 "picture units" (pixels) and would be about 5 mm in height. When used as tabletop chart-table such 4K monitor offers large chart area while the nominal viewing distance is still 1.0 m.

6. Big monitors based on Full HD do not fit well the existing S-64. If the height of the CHECKSYM would be kept as 5 mm, the resulting "picture unit" (pixel) count would be only 8 and the loss of resolution would spread all around the presentation resulting same physical size of everything as in 270x270 mm display, but with low "picture unit" (pixel) resolution. The low "picture unit" (pixel) resolution actually causes all text and symbols hard to read and detect.

7. Next aspect is viewing distance. Small monitors are intended to be observed from short distance, for example 1.0 m. IEC 62288 rule for minimum text height is 3,5 mm for viewing distance of 1.0 m. Result of this rule is 7,0 mm for viewing distance of 2.0 m.

8. "S-52 Ed 6.1.0 clause 3.1.5 Size of lines, symbols and text; fonts" specify:
> *Lines and symbols and text should be large enough that they can be easily interpreted at the operational viewing distance. This will be about 70 cm for route planning, but experience to date indicates that the viewing distance for important features during route monitoring may be several metres.*
> *The minimum sizes for all symbols should be as shown in the Presentation Library.*
> *In addition, the symbols should always be drawn with at least the same number of pixels as are required to draw the symbol at the size defined in the Library for the minimum resolution and minimum chart display area (270 x 270 mm). That is, the minimum height in pixels of a symbol is: (symbol height in mm) divided by 0.312 mm (where 0.312 mm is the "pixel size" for the minimum size chart display in Section 5.1 – Physical Display Requirements).*

When the display scale is enlarged by zooming in, it should be possible to hold symbol size constant. The same applies to text. Symbol and text size should never be decreased when zooming out.
The text on the ECDIS should be readable from 1 metre

9. "S-52 Ed 6.1.0 clause 5" contains "specifications for display screen".
Clause "5.1 Physical display requirements" specify
The requirements of S-52 for the main graphic display are:
"Size: minimum effective size of the area for chart display: 270 x 270 mm.
"Resolution: minimum lines per mm (L) given by L=864/s, where s is the smaller dimension of the chart display area. (e.g. for the minimum chart area, s=270 mm and the resolution L=3.20 lines per mm, giving a "picture unit" size of 0.312 mm)
Clause "5.2.1 Reproducing small features and symbols" specify
The specifications above permit a chart display whose minimum resolution (lines/mm) may vary depending on the size of the display. To maintain a clearly readable chart display under this flexibility requires the following constraints to ensure that enough "picture units" (pixels) are always used to draw small features and symbols clearly:
(1) <u>Chart features</u>: Chart features should never be drawn with fewer "picture units" (i.e. lines, pixels, dot-pitch intervals) than when drawn on a 270 x 270 mm chart area at SENC scale.
(2) <u>Symbols</u>: For clear representation, symbols require a minimum number of picture units, depending on their complexity. A simple chart symbol should extend about 12 pixels (that is at least 3.5mm for an IHO standard screen.) See section 3.1.5 for details on the size of symbols.

Analysis/Discussion
10. The requirements of S-52 could be summarized
- Operational viewing distance depends on use case. Route planning might be based on 0.7 m, Route monitoring might be based on several meters (for example 2.0 m).
- Minimum number of "picture units" (pixels) of the symbols in S-52 Presentation library is based on "picture unit" (pixel) size 0,312 mm in S-52 main document (or 0,3 mm if one looks the S-52 Presentation library document). This "picture unit" (pixel) size is used to judge how many "picture units" (pixels) in mm would the symbols need as minimum.
- The special symbol CHKSYM01 to check the size of symbols is defined being 5.0 mm of height at the specified IHO standard screen of 270 x 270 mm. At "picture unit" (pixel) size of 0,312 mm the CHECKSYM would be 16 x 16 "picture units" (pixels).
- Clause 5.2.1 specify "*The specifications above permit a chart display whose minimum resolution (lines/mm) may vary depending on the size of the display.*". This means that in principle the S-52 accepts also other "picture unit" (pixel) size than about 0.3 mm. Basic rule is that whatever is the "picture unit" (pixel) size at least the number of "picture units" (pixels) resulting from the presentation in IHO standard screen of 270 x 270 mm shall be provided.
- This means, for example, that if the "picture unit" (pixel) size is 0,60 mm then the height of CHKSYM01 based on 16 "picture units" (pixels) should be at least 9.6 mm

11. The combination of IHO S-52 minimum count of "picture units" (pixels) and "picture unit" (pixel) size of 0.6 mm causes that text is 7.0 mm high. Based on IEC 62288 this correspondent to viewing distance of 2.0 m which is appropriate value for a monitor located in front of the bridge console.

12. S-52 is clear in requirement – it is possible to use a monitor based on "picture unit" size of 0.3 mm or to use a monitor based on larger "picture unit" size. The "picture unit" size of 0.3 mm is obviously a requirement for an equipment intended to perform route planning. Equipment intended for route monitoring could obviously use "picture unit" size of 0.3 mm or larger as the operative viewing distance could be several meters for the route monitoring task.

13. S-64 is based on assuming that all monitors are based on "picture unit" size of 0.3 mm (or 0.312 mm). This is more limiting than the requirement. Below are principle cases generic to full content of S-64.
- Test 4.7.2 require: "*Confirm that the height of the CHKSYM01 symbol is not less than 5.0mm and not greater than 5.5mm*". For example, if the "picture unit" (pixel) size would be 0.6 mm then the requirement for the size of CHKSYM01 should be not less than 9.0 mm and not more than 10.2 mm (within a tolerance of plus-minus 1 "picture unit" (pixel)).
- Large number of tests specify that "*displayed scale*" is a value given. For example, test 2.1.1 requires: "*After loading of GB4X0000.000, displayed scale 1:50 000*". If the "picture unit" (pixel) size would be

0.6 mm then if the relative size of the symbols against the chart geometry would be same then the effective display scale would be 1:25 000 (same number of "picture units" (pixels) for everything in screen samples would result double size in mm on the screen surface)

- o The "displayed scale" has many implications relative to the size of "picture unit" (pixel). Hydrographic Office (HO) has set CSCL (compilation scale). Amount of details (for example distance between point in contours, distance between obstructions, distance between spot soundings, etc.) has been set by HO so that the chart is not overcrowded at CSCL and SCAMIN has been used so that if the chart is viewed at a smaller scale than the CSCL the number of details is reduced in an appropriate way. All these values: CSCL, SCAMIN and amount of details is set based on the result in IHO standard screen of 270 x 270 mm
- o It is actually important to keep the same relative result i.e. if the "picture unit" (pixel) size is bigger then everything shall be proportionally bigger in order to keep the relative distances between charted symbols etc. The displayed numerical value of the "Scale of display" (see S-52 Presentation Library clause 10.6.2) shall obviously be still true to the physical truth i.e. based on the length measurable by a ruler. But computer processing of the presentation shall be based on CSCL, SCAMIN, overscale indication, etc. internal scale related values multiplied by a coefficient relative to the actual "picture unit" (pixel) vs the nominal IHO "picture unit" (pixel) of 0.3 mm. For example, if the "picture unit" (pixel) size would be 0.6 mm then the coefficient would be 0.3/0.6 = 0.5.

14. This paper addresses bigger monitors with bigger "picture unit" (pixel) size than the nominal size of 0.3 mm of "picture unit" (pixel) for the IHO standard screen of 270 x 270 mm. Bigger monitors with same size of "picture unit" (pixel) as the nominal size of 0.3 mm for the IHO standard screen of 270 x 270 mm are not a problem. Such monitors are just able to show larger geographical area based on same results as expected for the IHO standard screen of 270 x 270 mm.

15. This paper do not address traditional size monitors (for example 19" or 20") capable to show about just 270 x 270 mm of the IHO standard screen. If such monitor is 4K (3840x2160) the expected result is still the same as documented in the current version of S-64. Such monitors just use more pixels to fill a "picture unit" of 0.3 mm.

Conclusions

16. Test descriptions of the S-64 should be amended to allow all acceptable "picture unit" (pixel) sizes of a monitor intended for use by and ECDIS.

17. Adjusting of nearly every test of S-64 to cover individually the possibility to use a monitor with another "picture unit" (pixel) size than around 0.3 mm is a huge task. Better idea is to add a new clause in the end of introduction after the clause "*1.10 Notes on ECDIS screen samples*". The new clause 1.11 could be as below

1.11 Notes on tests descriptions and required results

The test descriptions and required results in this standard are based on the IHO standard screen of 270 x 270 mm and "picture unit" (pixel) size of about 0.3 mm. The S-52 allows other values of "picture unit" (pixel) size as long as the "picture unit" (pixel) count per specified symbol is at least same or higher as specified in the presentation library (for example nominal size of CHKSYM01 is 16 x 16 "picture units" (pixel))

If the "picture unit" (pixel) size of the monitor is other than about 0.3 mm, the following notes may be applicable to the test descriptions and required results:

Test of correct size of symbols (4.7.2)

The limits of not less than and not greater than shall be adjusted for actual "picture unit" (pixel) size of the monitor in use. The allowed tolerance range is 0% downward and 10% upward. For example, "picture unit" (pixel) size of 0.6 mm would result at least 9.6 mm and not more than 10.2 mm.

Displayed scale

Typically, each screen sample inform displayed scale, which is result of applying "picture unit" (pixel) size of 0.3 mm. If the size of "picture units" (pixels) is different, the resulting displayed scale changes accordingly for the same result as in the screen samples. Accordingly means here relative to actual "picture unit" (pixel) vs the nominal IHO "picture unit" (pixel) of 0.3 mm.

For example, "picture unit" (pixel) size of 0.6 would result that the displayed scale is 0.5 times of the displayed scale (for example 1:20 000 as test result would be 1:10 000, etc.), processing based on compilation scale (CSCL) would use a value of CSCL multiplied by 0.5, processing based on

SCAMIN would use a value of SCAMIN multiplied by 0.5, processing of overscale indication would use a value multiplied by 0.5etc.

Recommendations

18. Recommendation is that ENCWG meeting Apr 2018 records in the minutes of the meeting that

- S-52 allows larger "picture unit" (pixel) size than 0.3 mm as long as the result meets the requirements of the S-52
- ENCWG either
  - o agreed to add new clause 1.11 into the S-64
  - or
  - o has a plan to amend the S-64 by correspondence for decision making by the ENCWG to be completed before the submission deadline for the HSSC-11, May 2019 meeting.

Justification and Impacts

19. Justification for the proposed change is the fact that the current test description limit selection of the monitor more that the requirements in the S-52.

20. Impact of the change is to allow manufacturers to offer affordable big monitors as alternative to current small monitors used for ECDIS:

Action Required of ENCWG

The ENCWG is invited to:

a) agree on the issue presented in this paper

b) record the decision on this issue as documented evidence into the minutes of the meeting

c) either agree to

- add proposed new clause 1.11 into the S-64

or

- set a task to draft final wording of the related textual changes of the S-64 to be completed before the submission deadline for the HSSC-11, May 2019 meeting