

## WENDWG6-04.1A2 Overlapping Data: Report on scenarios and test cases on ECDIS (IC-ENC)

Author: Liz Hahessy, IC-ENC Future Standards Manager

Date: 17<sup>th</sup> February 2016

Note: Although submitted to WENDWG after the formal deadline for discussion documents for WENDWG6, IC-ENC requests the WENDWG considers this paper, its implication, and the requested action from the WENDWG during discussion at the WENDWG6 meeting.

## 1. Executive Summary

1.1. This report summarises the findings of the IC-ENC investigation into ECDIS display issues caused by overlapping ENC data. It factually assesses and reports the display results observed from overlapping ENC data in a number of ECDIS.

1.2. The report covers:

- The background of the report including the current IHO Standards.
- the methodology and scope of the investigation.
- the limitations of the investigation.
- the results and conclusions of the investigation.
- five proposals for WENDWG6 consideration and discussion.

1.3. **The WEND Principles and IHO Standards quite clearly state “there must be no overlapping data between cells of the same Navigational Purpose”, however in reality a significant number of ENCs overlap each other in the global ENC folio. This report is not a reflection on any of the ECDIS manufacturers and systems have been kept anonymous. It is also noted that ECDIS OEM’s have made efforts to minimise the impact of overlapping data.**

1.4. The cells were tested on five ECDIS systems covering a range of kernels and versions of models. The results were quite variable with each system handling the overlap differently. The key findings are:

- overlapping data has erratic effects on the display of ENCs
- there is huge inconsistency between results in different ECDIS
- the main negative effects are on panning across the cell and the pick report summary
- overlapping data at the same scale in the same usage band causes the most severe display problems

1.5. The only way of being sure of eliminating these problems for users is for the producing nations to work together to remove all instances of overlapping data.

## 2. IC-ENC requests that the WENDWG:

- a. Considers the implications of this paper at WENDWG6 (March 2016).
- b. If WENDWG6 discussion supports it, widen the audience of this paper:
  - i. The WENDWG submits, with any additional commentary, to ENCWG for their comment.  
Note: HSSC Chair will attend WENDWG6, IC-ENC FSM (author) will attend ENCWG.

- c. If WENDWG6 discussion supports it, agree the next steps for this investigation. Some possible future actions include:
  - Forms part of RENC co-operation programme
  - Provide test data to HOs, VARs or OEMs for wider investigation
  - Investigation into SENC data display rules
- d. Circulate the paper to the ECDIS OEM that have been tested for direct comment
- e. Widen the **definition of an ENC ‘overlap’, to include** Scenario 2 (Same Scale, Different Usage Band). Scenario 1 (Same Scale, Same Usage Band) and Scenario 3 (Different Scale, Same Usage Band) are included in the existing definition.

### 3. Background

- 3.1. As part of IC-ENC’s support to WEND Working Group and to inform IC-ENC’s policy on overlapping data, IC-ENC has investigated the effects of ENC overlapping data within ECDIS systems.
- 3.2. The focus of this report is how this may impact on ECDIS displays and therefore the mariner. This report is not a reflection on any of the ECDIS manufacturers and all ECDIS systems are anonymous. Despite definite preventative statements in the WEND Principles and Technical Standards, there is still a considerable number of ENCs that overlap each other in the global ENC folio. This report considers an “overlap” as two cells with M\_COVR=1 data overlaying each other and with either:
  - The same scale and same usage band
  - The same scale and a different usage band
  - A different scale but the same usage band
- 3.3. The purpose of this report is to provide empirical evidence (as far as reasonably practical) of the actual, if any, impacts on display caused by the overlapping data on a variety of ECDIS systems.

### 4. IHO Standards

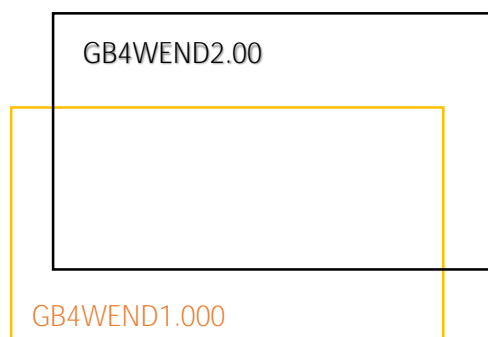
- 4.1. There are currently several IHO Standards regulating overlap policy.
- 4.2. The IHO S-57 Appendix B.1, Annex A – Use of the Object Catalogue for ENC (Edition 4.0.0) , **clause 2.1.8 states that “there must be no overlapping data between cells of the same Navigational Purpose, except at the agreed adjoining national data limits, where, if it is difficult to achieve a perfect join, a 5 meter overlapping buffer zone may be used.”**
- 4.3. The OEM manufacturers and the former DIPWG (now part of the ENCWG) have made significant steps to minimise the impacts of the overlapping data through the publication of Annex A to S-52 Presentation Library for ECDIS (version 4.0.1) – October 2014 (with Clarifications up to June 2015) **with an added statement in 10.1.3 “Despite the best efforts of the IHO, there are still areas of the world where ENC overlaps exist. Where an overlap of two or more cells exists the ECDIS must only display one cell for the overlap area and provide a permanent and persisting indication ‘overlap’”. It is for the ECDIS manufacturers**

to decide which cell will be displayed in an overlapping situation and therefore will not be consistent across different systems and models. It also cannot be guaranteed that all existing ECDIS systems will be updated for the new Presentation Library. Note: the work of Singapore (through the WENDWG) may lead to the opportunity for further refinement of these display rules.

- 4.4. The Guidelines for the Implementation of the WEND Principles states in section 1.7 that “ECDIS systems will operate unpredictably in areas where significant overlapping ENC coverage is present, raising a potential navigational risk to end users. Where overlapping coverage exists the Producer Member States should recognize their responsibility and take the necessary steps to resolve the situation”. **Further information is supplied on how to resolve overlaps and the sequence of procedures.**
- 4.5. The IHO Standards are quite clear in that overlapping data is not acceptable, poses a risk to the mariner and that neighbouring producer nations must co-operate to achieve no overlaps.

## 5. Test Methodology

- 5.1. Test cells were created using IEC test data set GB4X0000.000. This cell was amended to cover the scenarios listed below. This resulted in duplicate encoding within the ENCs except where we had manually altered them. To create the overlapping situation the limits of the cells were adjusted and extended (*Fig 1*).



*Figure 1 – Control cell and overlapping cells*

*Orange cell – GB4WEND1.000 – 1:45,000 – control cell*

*Black cell – GB4WEND2.000 (1:45,000), GB4WEND3.000 (1:22,000) & GB5WEND4.000 (1:45,000)*

- 5.2. The cells were tested across 5 different systems of ECDIS, which covered three different kernel types. One system was a unique kernel the others were a combination of their own kernel and another system. This provides quite a broad test across different ECDIS systems and accounts for approximately 30% of ECDIS market share (estimated from 2010 figures, sufficient to provide an indication). Two of the systems were different models of the same OEMs system. Three other ECDIS were identified for testing but were unable to load the cells. Further details on the cells that are unable to load can be found in the results section.

5.3. The five ECDIS systems were tested with the three scenarios listed below:

Scenario	Cell 1	Cell 2
1 – Same Scale, Same Usage Band	GB4WEND1 (scale 1:45,000)	GB4WEND2 (scale 1:45,000)
2 – Same Scale, Different Usage Band	GB4WEND1 (scale 1:45,000)	GB5WEND4 (scale 1:45,000)
3 – Different Scale, Same Usage Band	GB4WEND1 (scale 1:45,000)	GB4WEND3 (scale 1:22,000)

5.4. Testing was conducted against the following criteria with expected results listed below:

5.4.1. Panning – For the purposes of this report panning is considered as traversing across the cell, moving the view point whilst remaining at the same scale. Panning should be a smooth transition with only one cell displayed and listed in the Pick report. The panning results should be consistent and repeatable.

5.4.2. Zooming – The cell displayed should be appropriate for the compilation of the cell with smooth transition of display while zooming in and out of the display. The corresponding Pick report should be consistent and listing one cell only.

5.4.3. Pick Report – For the purposes of this investigation it has been considered preferential for the Pick report to only list the display cell with all objects in scope detailed. Guidance in S-52 regarding Pick reports is limited and currently under review, so it is likely different systems have implemented the display differently. If multiple cells have been listed in the Pick report it has been recorded whether they both listed full or partial information.

5.4.4. Display of designated features – GB4WEND1.000 was treated as the control cell with different features and attribution checked against the overlapping cells in the three scenarios. Key navigational features were captured to test the display and distributed over the cell to detect differences in display, especially at the edges. The features amended included lights, buoys, traffic separation schemes, caution areas and restricted areas. See Annex A for a diagram of the objects amended.

5.4.5. Passage plan – **the ship's passage should run smoothly across the screen and the cells switch accordingly.** The appropriate navigational warnings should be produced.

## 6. Evaluation of investigation - Limiting factors

6.1. Whilst efforts have been made to standardise testing there are limiting factors to the investigation conducted, such as:

- a) Scenario 2 (same scale and different usage band) is not strictly an overlap according to the IHO S-57 definition but it has been included it to review how it displays.
- b) Whilst every effort has been taken to standardise the ECDIS there were differences in display settings and this has been taken into account when comparing the ECDIS results.

- c) Other encoding factors may impact the overlapping display, further input from the OEM companies would be required to fully explain.
- d) Display has been viewed at compilation scale where possible, **some systems wouldn't** display the cell at compilation scale and the nearest scale for viewing was used.
- e) The ECDIS were tested in an office based environment which may not fully a mariners "at sea" experiences.
- f) The test cells used have been produced to reflect a worst case scenario and may according produce extreme results. The cells are band 5 Harbour cells which were used to test the navigational significant objects. Most of the overlapping cells worldwide are of a smaller usage band and the overlaps would cover a smaller proportion of the cell.

## 7. Results of Investigation:

7.1. A summary table and results of interest are detailed below.

7.2. Further detailed results can be found in Annex B, which includes in pictures of the issues identified for each ECDIS system.

7.3. Full results are to be provided in a supplementary document - WENDWG6-04.1A2 – Part B, to follow.

Note, Section 8 Conclusions, Section 9 Requests of the WENDWG, and Section 10 References follows the result summary table.

WENDWG6-04.1A2 Part A

ECDIS	Scenario	Pan	Zoom	Pick Report
A	1	See Annex B Figure 2 & 9	See Annex B Figure 17	
	2	See Annex B Figure 9		
	3	See Annex B Figure 9		
	Comments	Generally pans ok but inconsistent as to which cell is displaying at the edges and at what point it changes. Both cells listed in Pick report at edge.	Display of cells change as zoom in and out of cell at the edges for scenario 1 & 2. More stable in the centre of the cell. Scenario 3 zoomed as expected.	Reports items from display cell except at the edge. The cell varies due to panning and zooming issues but pick report is accurate. Where duplicated reports in full.
B	1	See Annex B Figure 3		
	2			
	3			
	Comments	Pan relatively stable in scenarios 1 & 3 but keeps a stored memory of cell with both cells reporting in the Pick report at limits. Pan in scenario 2 consistent.	Scenario 1 zoom in and out not the same at the centre and edge. Scenario 2 & 3 stable zooming.	Scenario 1 & 3 occasionally report both cells and 2 <sup>nd</sup> cell <b>doesn't list full capture. Potentially only listing safest</b> option. Scenario 2 consistent and only lists one cell.
C	1	See Annex B Figures 2, 5, 6 & 9	See Annex B Figure 17	
	2	See Annex B Figures 5, 6 & 9		
	3	See Annex B Figures 5, 6 & 9		
	Comments	Generally pans ok but inconsistent as to which cell is displaying at the edges and at what point it changes. Both cells listed in Pick report at edge.	Display of cells change as zoom in and out of cell at the edges for scenario 1 & 2. More stable in the centre of the cell. Scenario 3 zoomed as expected.	Reports items from displayed cell except in edge of cell. The cell varies due to panning and zooming issues but pick report is accurate. Where duplicated reports in full.
D	1	See Annex B Figures 4, 7, 8, 10 & 11	See Annex B Figures 7, 8 & 18	See Annex B Figures 10, 11, 13, 14, 15 & 16
	2	See Annex B Figures 7 & 8	See Annex B Figures 7 & 8	
	3	See Annex B Figures 7 & 8	See Annex B Figures 7, 8, 19 & 20	
	Comments	Screen routinely 'blues out' whilst panning.	Screen routinely 'blues out' whilst zooming.	Scenario 1 & 3 occasionally report both cells and 2 <sup>nd</sup> cell <b>doesn't list full capture. Potentially only listing safest</b> option. Scenario 2 consistent and only lists one cell.
E	1	See Annex B Figure 3		See Annex B Figure 12
	2			
	3			
	Comments	Pan more stable but at cell limits multiple cells in Pick report. Pan in scenario 2 consistent.	Both cells regularly report in the pick, except in scenario 2 which only displays the dominant cell.	Example in scenario 1 where Pick report was empty. Scenario 2 stable and consistent. Scenario 3 regularly reports both cells in Pick report.
	Significant display issues	Some unexpected display or reporting issues but usable	Operating as generally expected – only minor issues	

## 8. Conclusions:

### 8.1. Summary of findings:

- 8.1.1. The results of testing on ECDIS show that overlapping data has erratic effects on the display of the ENC's.
- 8.1.2. There is huge inconsistency between results in different ECDIS, and even with regards to the display and the Pick report even within the same ECDIS systems.
- 8.1.3. The main issues with the ECDIS display appear to be with panning across the screen and the Pick report details. Panning across cells appears to work on complex algorithms ranging from percentage of cell covered, largest scale and even down to alphanumerical order.
- 8.1.4. Scenario 1 (cells have the same scale and the same usage band) causes the most severe display problems.

### 8.2. Mitigating factors

- 8.2.1. ECDIS manufacturers have taken steps to minimise the impact through the agreement of the Annex A to S-52 Presentation Library for ECDIS version 4.0(.1). Whilst this change is significant in the fact it acknowledges an overlap is possible, contrary to IHO **Standards, it doesn't provide mariners with further information regarding which of the cells is safer or appear to guarantee the ability to Pick which cell you wish to use.**
- 8.2.2. There is also no guarantee that ECDIS will be updated to the new Presentation Library. **All of ECDIS in this trial only display one cell at time, apart from one which wouldn't display either cell at compilation scale, the Pick report however often reported multiple cells. The 'overlap' indication will be useful to identify that there are overlapping issues but it will not necessarily solve the display issues.**
- 8.2.3. **It is clear therefore, that although a 'step in the right direction', it remains the responsibility of ENC Producers to take all action possible to remove all instances of overlapping data.**

### 8.3. Summary

- 8.3.1. The only way to be confident of eliminating all navigational problems resulting from overlapping data is for the producing nations to work together to remove all the instances of overlapping data.
- 8.3.2. **Hydrographic Offices should not expect, or rely, on the ECDIS OEM's to modify their systems to overcome the issues presented by overlapping data.**

8.3.3. When completing standard documentation the political and technical aspects cannot be considered in isolation. IHO standards make it quite clear that overlapping ENC data is not acceptable or allowable but there are numerous situations where this does not **reflect the 'real life' situation. The ECDIS OEM's encoded their systems in line with IHO Standards** resulting in an inconsistent handling of overlapping ENC data.

8.3.4. RENCs can assist cooperate and coordinate clipping between neighbouring countries and through RENC-RENC co-operation (see ENC Data Flow between RENCs diagram, a **separate WENDWG6 Paper**). **However, this activity can prevent 'accidental' overlapping data (and is doing so effectively).** It is beyond the remit of RENCs to legislate/act in areas where overlapping data is the result of disputed political boundaries.

8.3.5. Note: WENDWG6 discussion will also include analysis of the research conducted by Singapore on this topic.

9. IC-ENC requests that the WENDWG:

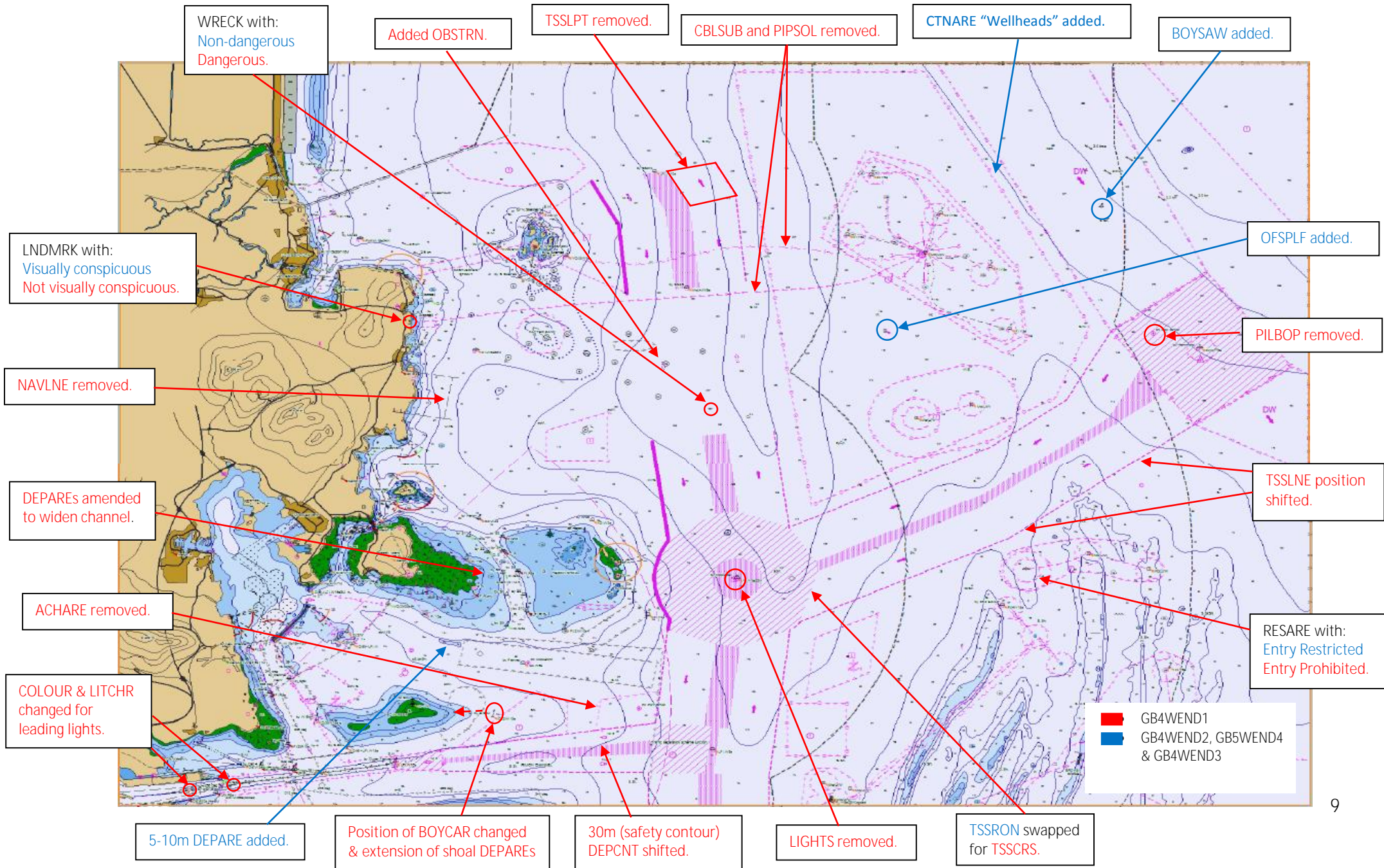
- a. Considers the implications of this paper at WENDWG6 (March 2016).
- b. If WENDWG6 discussion supports it, widen the audience of this paper:
  - i. The WENDWG submits, with any additional commentary, to ENCWG for their comment. Note: HSSC Chair will attend WENDWG6, IC-ENC FSM (author) will attend ENCWG
- c. If WENDWG6 discussion supports it, agree the next steps for this investigation. Some possible future actions include:
  - Forms part of RENC co-operation programme
  - Provide test data to HOs, VARs or OEMs for wider investigation
  - Investigation into SENC data display rules
- d. Circulate the paper to the ECDIS OEM that have been tested for direct comment
- e. **Widen the definition of an ENC 'overlap', to include Scenario 2 (Same Scale, Different Usage Band). Scenario 1 (Same Scale, Same Usage Band) and Scenario 3 (Different Scale, Same Usage Band) are included in the existing definition.**

10. References and associate papers:

- WENDWG5-12 A –Monitoring the WENDWG Work Programme
- Guidelines for the Implementation of the WEND Principles as endorsed by the 11<sup>th</sup> WEND Committee Meeting (Tokyo, 2008)
- IHO S-57 Appendix B.1, Annex A – Use of the Object Catalogue for ENC (Edition 4.0.0 June 2014)
- Annex A to S-52 Presentation Library for ECDIS (version 4.0.1) – October 2014 (with Clarifications up to June 2015)
- D-10 – Overlapping Data & Production Responsibility – IC-ENC P-1 presented to WENDWG5-05E
- The assistance of the UKHO Technical Product Support Team must be acknowledged in providing access to ECDIS systems for testing.



Annex A – Test Data - manually amended navigational significant objects



## Annex B – ECDIS results

### Panning

Panning was conducted at between display scales of 40-50k depending on the ECDIS system. For Scenario 3 panning was conducted at 40-50k and 20k to take into account the variation of the compilation scale of the cells.

Apart from ECDIS D all of the ECDIS displayed Scenario 1 and 2 in a similar way. The control cell (GB4WEND1) is the dominant cell with the overlapping cell only displaying extending from the limits of the control cell.

The point at which the system switched over to display the overlapping cell was different for each system. Control cell GB4WEND1 has a deliberate no coverage area around the edge of the cell which has impacted display (*Fig 1*).

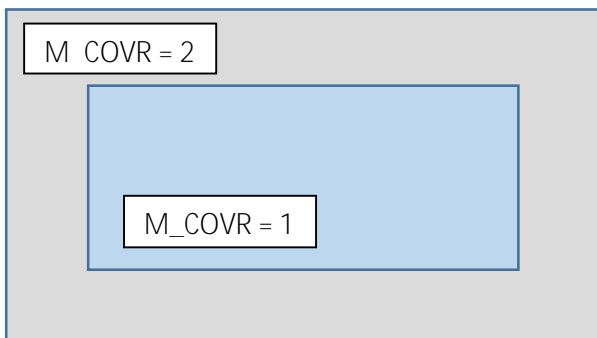


Figure 1 – *M\_COVR* limits of GB4WEND1.000

ECDIS A & C display the overlapping cell in the no coverage area (*Fig 2*), ECDIS B & E (*Fig 3*) show the *M\_COVR*=2 area on the display, with ECDIS D filling the area with a tan land tint (*Fig 4*).

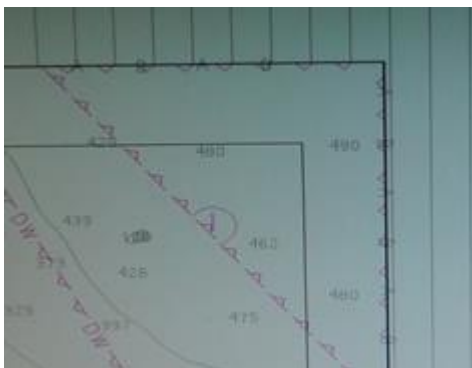


Figure 2 – ECDIS A & C do not display the *M\_COVR* = 2 area



Figure 3 – ECDIS B & E display M\_COVR=1 area

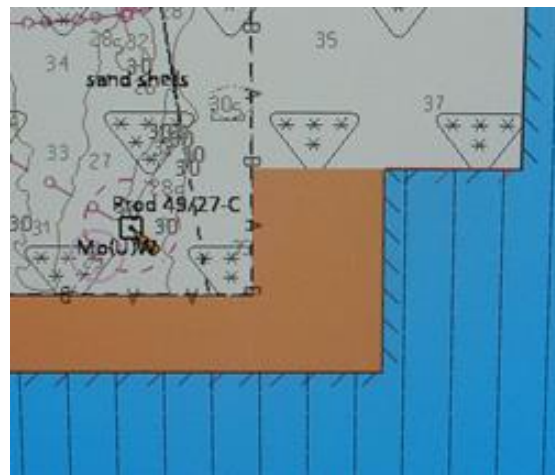


Figure 4 – ECDIS D displaying M\_COVR as land tint

All of the systems tested only display one cell at a time. At the centre of the cell panning was the most stable. Generally the cells displayed correctly at compilation scale in the centre of the cell, the display at the limits of the cells was more inconsistent. Whilst panning across the screen in all scenarios ECDIS A & C both switched to the overlapping cell as soon as the limits of GB4WEND1 came into display (Fig 5 & 6)



Figure 5 - On ECDIS C the orange info point picks up GB4WEND1



Edge of GB4WEND1  
and start of  
GB4WEND2

Figure 6 - On ECDIS C the orange info point picks up GB4WEND2 as the edge of GB4WEND1 enters the screen.

Whilst panning across the cells some of the ECDIS seem to have a stored memory of where was previously clicked. On ECDIS A, B & C if you initially click at the centre of the cell on control GB4WEND1 and panned to the east it will list cell GB4WEND1 in the Pick report until you are solely in the overlapping cell area. Likewise if you initially clicked in the overlapping cell area and panned westwards towards the centre of the cell the overlapping cell for example GB4WEND2 rather than GB4WEND1 would list in the Pick report. The results at the edge of the control cell limits are less consistent with the cell selected in the Pick report often unrepeatably if you pan away and return to the same location.

Scenario 2 in ECDIS B & E display well with GB4WEND1 displaying as the dominant cell until only inside the limits of GB5WEND4.

Scenario 3 responds differently with ECDIS A, B & E displaying GB4WEND1 as the dominant cell at 40k and GB4WEND3 displaying as the dominant cell at 30k, this is to be expected taking scale into account. ECDIS C & D respond slightly differently with GB4WEND3 being the dominant cell even at 40k.

ECDIS D responded to displaying the overlapping cells and panning across the screen in a more unpredictable manner than the other systems. ECDIS D was unable to pan successfully across the cell at compilation scale. Whilst traversing at the same scale in the centre of the cell the screen would display blue (Fig 7 & 8). **When the display 'blued out' it would only reinstate by panning to the edge of the cell.** Further investigation may be required into the effects of the over scale on the display.



Figure 7 - TSSLPT highlighted on ECDIS D at 45k



Figure 8 – TSSLPT highlighted on ECDIS D at 45k having panned slightly to the south

Generally panning on the systems was quite variable. The results were generally inconsistent and often unrepeatably in the same circumstances. While the systems handled the M\_COVR differently all systems did handle displaying the overlapping data, except for ECDIS D which was unstable and unable to display the data correctly.

### Pick report

The Pick report and panning are related in this investigation as it was identified that while the ECDIS only displayed one cell, in certain circumstances both cells reported in the Pick report and occasionally with differing results. As previously mentioned while traversing across the cell at the edge of the control cell limits multiple cells are often reported in the Pick report (*Fig 9*).

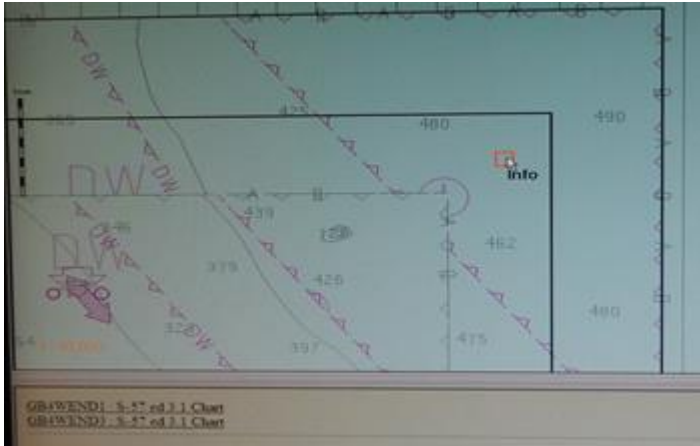


Figure 9– ECDIS A & C list GB4WEND1 & GB4WEND3 in Pick report at same location

It was noticeable that ECDIS A & C handled the multiple cells better than other systems, generally the Pick Report only displayed information from one cell in all of the scenarios. ECDIS B, D & E reported multiple cells in the Pick report for Scenarios 1 & 3 but **didn't report any for Scenario 2 which would suggest usage band is more important than scale regarding display.**

As mentioned in the methodology deliberate differences were introduced into the overlapping cells to observe how they were reported in the Pick reports. The majority of the duplicate reporting was observed when selecting the object classes of which some examples are listed below.

Restricted Area:

GB4WEND1 has a restricted area captured with attribution of entry prohibited on the overlapping cells the attribution has been changed to entry restricted.

- ECDIS A & C in all scenarios only list one cell in the Pick report with the correct attribution, either the control or the overlapping cell.
- ECDIS B in Scenario 1 & 3 lists both cells in the Pick report for the RESARE but the RESARE is only reported in GB4WEND1 and attributed as entry prohibited. The Pick report is displaying the safest option but is not fully listing all expected information.
- ECDIS D in Scenario 1 lists both cells in the Pick report both with differing attribution (*Fig 10 & 11*). This clearly has potential to confuse a mariner.
- ECDIS E in Scenario 1 displays a blank Pick report (*Fig 12*).

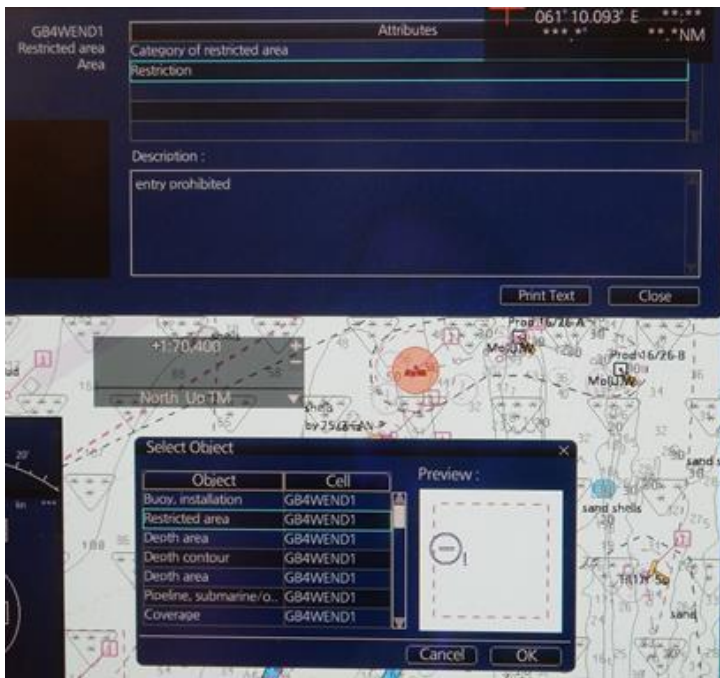


Figure 10 – ECDIS D displaying RESARE with multiple cells listed in Pick Report. GB4WEND1 displays entry prohibited



Figure 11 – ECDIS D displaying RESARE with multiple cells listed in Pick Report. GB4WEND2 displays entry restricted

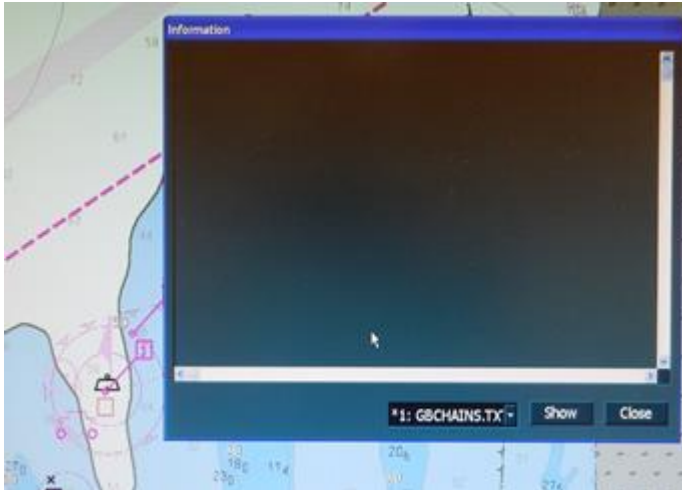


Figure 12 – ECDIS E RESARE selected but no information listed in the Pick report

Traffic Separation Scheme:

In GB4WEND1 the TSSLPT was manually altered to narrow the extent of the lane with the overlapping cells keeping the original capture.

- ECDIS A, B & C in all scenarios only list one cell in the Pick report with the correct attribution, either the control or the overlapping cell.
- ECDIS D in Scenario 1 lists both the control (GB4WEND1) and overlapping cell (GB4WEND2) of the TSSLPT and if selected from the Pick report will display the corresponding TSSLPT (Fig 13 & 14). In Scenarios 2 & 3 the Pick report only lists one cell either the control or overlapping cell.
- In Scenario 1 ECDIS E lists both cells in the Pick report but only GB4WEND1 lists the TSSLPT. The other scenarios list one cell with the correct attribution, either the control or the overlapping cell.



Figure 13 – ECDIS D displaying TSSLPT with multiple cells listed in Pick Report, GB4WEND1 selection highlighted



Figure 14 – ECDIS D displaying TSSLPT with multiple cells listed in Pick Report, highlighted TSSLPT different in GB4WEND2.

Wreck:

The GB4WEND1 WRECKS attribution was amended to dangerous wreck from the original capture on the overlapping cells of non-dangerous wreck.

- ECDIS A, B, C & E in all scenarios only list one cell in the Pick report with the correct attribution, either the control or the overlapping cell.
- ECDIS D in Scenario 1 lists both the control (GB4WEND1) and overlapping cell (GB4WEND2) WRECKS in the Pick report with GB4WEND1 listing the wreck as dangerous and GB4WEND2 as a non-dangerous wreck (Fig 15 & 16). In scenarios 2 & 3 the Pick report only lists one cell, either the control or the overlapping cell.



Figure 15 – ECDIS D displaying GB4WEND1 WRECKS with dangerous wreck attribution





Figure 16 – ECDIS D displaying GB4WEND2 WRECKS with dangerous wreck attribution

Zooming (Display Scale):

Zooming on the ECDIS was conducted between the ranges of 10k – 125k at a set position at the edge of the cell and in the centre of the control cell. It is accepted that these ranges would not be safe for navigation but it demonstrates how the cell display is affected.

The results from zooming in and out of the cell were more consistent than panning, especially when the cells had a different compilation band or usage band (Scenarios 2 & 3). Scenario 1 had more inconsistent results, for example on ECDIS A & C at the edge of the cell at 30k GB4WEND1 displays in the Pick report, at 40k it switches to GB4WEND2 until 100k where the Pick report displays information for GB4WEND1 again (Fig 17).

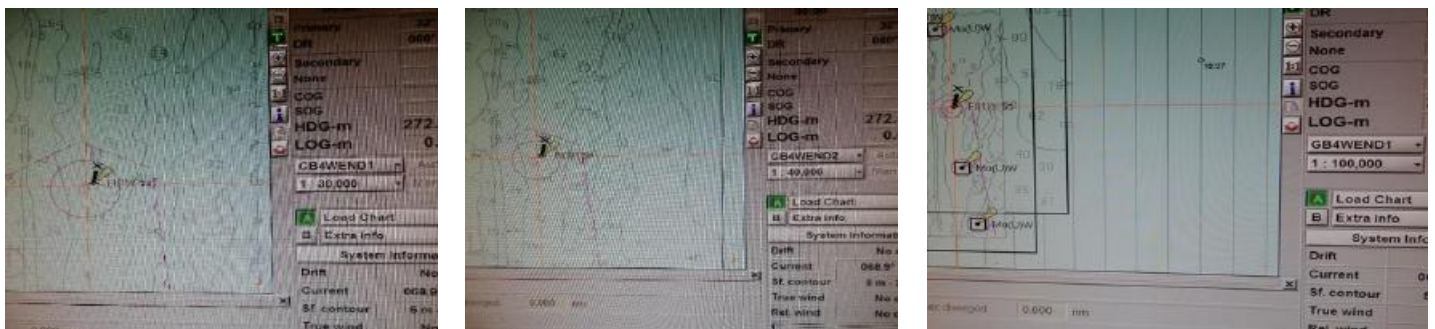
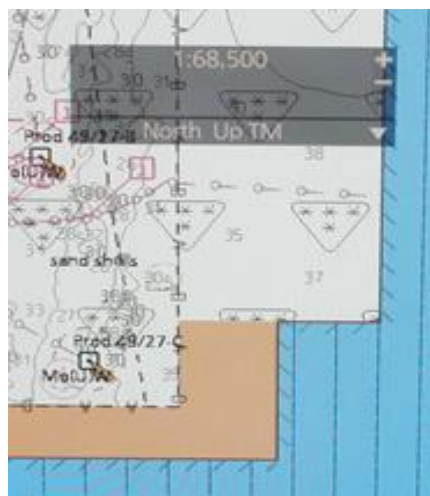
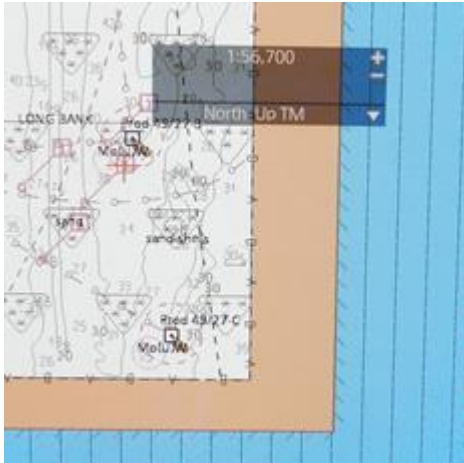


Figure 17 – ECDIS A & C differing chart selection based on display scale

ECDIS D showed similar results for Scenario 1 with the overlapping cell displaying and disappearing as the zoom changed. At 56k GB4WEND1 displays, at 59k the overlap with GB4WEND2 displaying as well. At 62k just GB4WEND1 displays and at 68k the overlapping cell has returned to view (Fig 18).



(Figure 18 - ECDIS D Differing overlap view based on display scale)

Minor changes in display scale can cause features to appear and disappear from display. On ECDIS D the change in display scale leads to a different cell displaying and an object disappearing. At 43k GB4WEND3 displays and a PILBOP is captured and visible (Fig 19) but at 45k GB4WEND1 becomes the display cell where the PILBOP hasn't been captured and is no longer visible (Fig 20). Similar results were displayed by ECDIS A in Scenario 1 where the PILBOP displays at 40k on GB4WEND2 but if the display scale is changed to 30k then GB4WEND1 displays and the PILBOP is not visible.



Figure 19 – ECDIS D GB4WEND3 displaying at 43k with PILBOP visible



Figure 20 – ECDIS D GB4WEND1 displaying at 45k with PILBOP no longer visible

ECDIS D shows erratic display results but this is mainly due to the blue screen that is displayed below 45k (Fig 8 above).

### Objects

The majority of the results recorded from checking the navigational objects have been summarised by the panning and Pick report summaries. Full details can be found in Annex A where each ECDIS results are shown.

### Passage plan:

Two identical ship passages were tested on two of the ECDIS systems (A & B). The display during the route was smooth with no unexpected actions occurring, such as the screen showing items appearing

and/or disappearing or the screen display the world view as it crossed the overlap. These two examples have previously been reported as issues with overlapping or gaps in data on ECDIS. The routes did not report exactly the same errors but this may be due to ECDIS settings. On the whole navigational safety warnings were triggered accurately.

This aspect of the investigation could be completed in more detail but would require assistance from OEMs or expert ECDIS practitioners.

#### Cells not loading:

Additionally there were three ECDIS systems where the cells would not load onto the system. Of those one system has a unique kernel and the others either solely use another OEMs kernel or have a combination of another OEMs kernel with their own. As previously stated the cells are created from test cells with deliberate errors in. For the purposes of this investigation the cells were not amended to fix errors as it would have created a variation in the test cells.

**Evidence of both cells displaying at once hasn't been found in the systems tested** but anecdotal evidence suggested a situation where cells of differing compilation scale are both displaying. Following developments in ECDIS since 2006 it is hoped that this is now a historical issue. Further testing on a broader range of systems would provide more certainty whether this problem has been resolved.

Overall the results broadly fit into 6 categories:

1. One cell displays and the Pick report displays corresponding cell only
2. One cell displays but both cells display in Pick report in full
3. One cell displays with both cells displaying in Pick report but not in full detail
4. One cell displays but as pan across the screen the display switches to overlapping cell with different display and Pick report
5. Once cell displays but there is no detail in the Pick Report
6. **Cells won't load on ECDIS**

It is noticeable that on the majority of systems the cells are more stable at the centre of the control cell and it is towards the edge of GB4WEND1 and continuing overlapping cell that issues start to occur.