Revisiting Display Scales Based on Radar Ranges

NOAA

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INTRODUCTION

- NOAA is in the process of re-scheming their ENC suite based on binary scales
  - Adopting “Binary” scales are where optimal viewing scale halves (or doubles) with each increment
  - Breaks away from traditional paper chart compilation scales
  - New Scale values do not conform with the max/min display scales specified in S-101 product specification (based on radar ranges).
  - Binary chosen as it simplifies the display of data in different systems and matches schemes implemented in web mapping services
  - Simplifies compilation as generalization rules are linearly aligned to the scales
  - Allows for less recompilation of the data during the re-scheming project

IHO SCALE RANGE SCHEMAS

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IHO Maximum – Minimum Display Scale Schema (a)	Google Map - Rounded Display Scale Schema (b)	NOAA Display Scale Schema (c)	Metric EU Based Display Scale Schema (e)
1:10,000,000			
1:3,500,000 - 1:10,000,000			1: 6,400,000
		1:5,120,000	1:3,200,000 – 1:6,400,000
	1:4,608,000		
1:1,500,000 - 1:3,500,000	1:2,304,000 – 1:4,608,000	1:2,560,000 – 1:5,120,000	1:1,600,000 – 1:3,200,000
		1:1,280,000 – 1:2,560,000	
1:700,000 - 1:1,500,000	1:1,152,000 – 1:2,304,000		1:800,000 – 1: 1,600,000
	1:576,000 – 1:1,152,000	1:640,000 – 1:1,280,000	
1:1:350,000 – 1:700,000	1:288,000 – 1:576,000	1:320,000 – 1:640,000	1:400,000 – 1:800,000
1:180,000 – 1:350,000	1:144,000 – 288,000	1:160,000 – 1:320,000	1:200,000 – 1:400,000
1:90,000 – 1:180,000	1:72,000 – 1:144,000	1:80,000 – 1:160,000	1:100,000 – 1:200,000
1:45,000 – 1:90,000	1:36,000 – 1:72,000	1:40,000 – 1:80,000	1:50,000 – 1:100,000
1:22,000 – 1:45,000	1:18,000 – 1:36,000	1:20,000 – 1:40,000	1:25,000 – 1:50,000
1:12,000 – 1:22,000	1:9,000 – 1:18,000	1:10,000 – 1:20,000	1:12,500 – 1:25,000
1:8,000 – 1:12,000	1:4,500 – 1:9,000	1:5,000 – 1:10,000	1:6,250 – 1:12,500
1:4,000 – 1:8,000			1:3,125 – 1:6,250
1:3,000 – 1:4,000	1:2,250 – 1:4,500	1:2,500 – 1:5,000	
1:2,000 – 1:3,000			
1:1000- 1:2,000			

IHO PROBLEM

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- In S-101 it is currently mandatory that each coverage feature within a dataset be assigned maximum and minimum scale values from the list defined in the product specification
  - Based on Radar Ranges – these are standardized in bridge equipment (all? ECDIS? Chart Radar?). [ranges based on 0.3mm rule and standardized screen size)
  - First proposed and accepted circa TSMAD 2008 – Cape Town
- Elimination of usage bands within S-101
  - Still three for cataloging purposes in the metadata

4.6 Display Scale Range

A scale range of a dataset is used to indicate a range of scales between which a producer considers the data is intended for use. (See clause 4.7 for how datasets are to be loaded and unloaded within a navigation system.) The smallest scale is defined by the **minimum display scale** and the largest scale by the **maximum display scale**. These scales must be set at one of the scales specified in clause 3 (spatial resolutions).

CORE ARGUMENT - THEORY VERSUS REALITY

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- THEORY: The mandatory scales were put into place to resolve ENC loading issues in ECDIS
  - ECDIS does not have standardized zoom levels and therefore there were instances where certain ECDIS would not load certain cells.
  - In practice the mapping of paper chart scales to ENC CSCL was not done consistently during ENC creation
  - Usage bands add nothing to the display issue – they eliminate overlap but no mandatory mapping of CSCL to Usage band exists so producers can produce cells at any CSCL in any usage band as long as they respect the overlap rule.
  - There is still a big disparity in CSCL between different producers but work has progressed between member states over time to harmonise practices.
  - The goal of ENC display should be that ECDIS data loading strategy is deterministic and repeatable between manufacturers
- REALITY: Mandating scales will hinder transition to S-101
  - If it forces producers to recompile data to a set of predefined scales in order to fit within a narrow subset of possible viewing scales then this is potentially an enormous workload
  - The core issue is actually ECDIS loading and display strategies and settings (disparity of zoom levels) and ability of users to see appropriate data for the viewing scale the equipment is set to.
- THEORY: S-101 has also included a data loading and unloading algorithm
- REALITY: This algorithm is a first implementation and has not been tested within testbeds yet.

WHERE WE ARE

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- At the S-101 PT meeting – NOAA presented a paper asking for reconsideration of the scales mandated in S-101
- Provided the following options
  - Include national scale implementations
  - Or – change the MUST to a SHOULD/MAY

- Outputs from the PT meeting were:
  - To further discuss at TSM7
  - Identify the root issues, define the actual problem and revisit whether it should be addressed through one or more of the following strategies:
    - Purely through a tested loading strategy
    - Through dialogue with OEMs over more standardized zoom levels in ENC viewing equipment
    - Imposition of mandatory max/min scales.
    - Harmonisation of scales between neighbouring producers

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S-101 DATA LOADING AND UNLOADING STRATEGY

- Clause 4.7 in S-101
- A new algorithm based on producer defined dataset display scales (minimum and maximum) for dataset loading and unloading within a navigation system is prescribed in S-101 in order for the appropriate ENC to be viewed at the mariner's selected viewing scale.
- This will simplify the process for navigation systems, giving clear and concise rules on how and when data is loaded and unloaded.
- The concept of navigation purpose is restricted for use in presenting ENCs in a visual catalogue and must not be used for determining which dataset should be displayed.

4.7.1 DATASET LOADING AND UNLOADING ALGORITHM

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ENC data	dataCoverage X	dataCoverage Y	dataCoverage Z
maximumDisplayScale	12000	22000	45000
minimumDisplayScale	45000	90000	180000
Dataset drawing order within the navigation systems memory	**X**	**Y**	**Z**

Condition		Combining Datasets
1	MSVS = 90000 maximumDisplayScale (Y,Z) <= MSVS <= minimum displayScale (X)	**Y** + **Z**
2	MSVS = 45000 maximumDisplayScale (X,Y,Z) <= MSVS <= minimum displayScale (X,Y,Z)	**X** + **Y** + **Z**
3	MSVS = 22000 maximumDisplayScale(X,Y) <= MSVS <= minimumDisplayScale (Z)	**X** + **Y** + **Z** + **Overscale indication of Z**

Mariners Selected Viewing Scale (MSVS)

IHO 4.7.1 CONTINUED

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1. In order for systems to properly load and unload data as the mariner is zooming in and out using the mariner's selected viewing scale (MSVS) the following algorithm must be used.
2. Create selection List

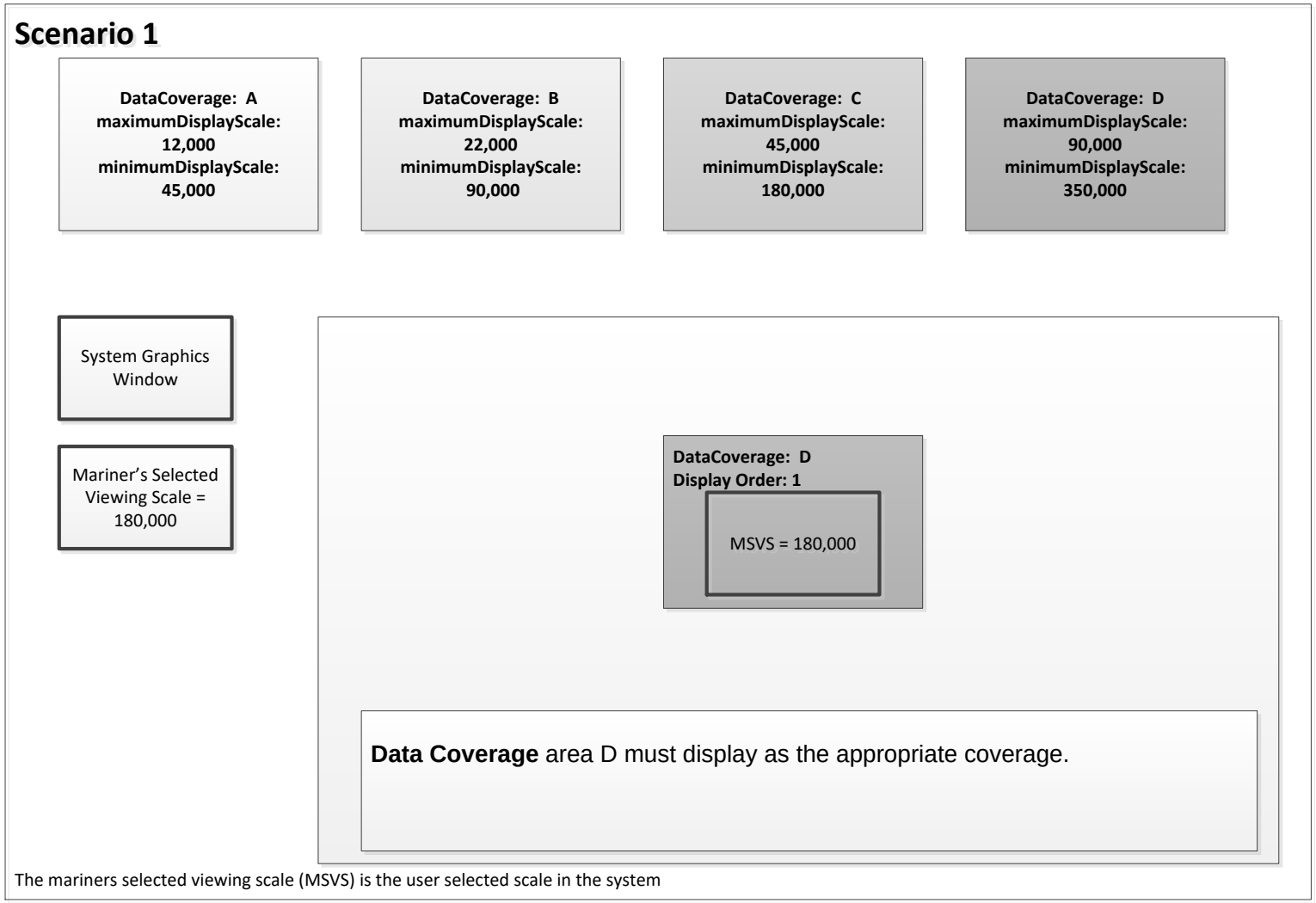
    a) All **Data Coverage** areas within the graphics window within scale range (covered by the MSVS) are firstly ordered by **maximum Display Scale** and secondly by the largest percentage of coverage if **Data Coverage** areas have the same **maximum Display Scale**

    b) All other smaller scale **Data Coverage** areas within the graphics window are firstly ordered by **maximum Display Scale** and secondly by the largest percentage of coverage if **Data Coverage** areas have the same **maximum Display Scale**

    c) The display order is from the smallest **maximum Display Scale** to the largest **maximum Display Scale**, that is the **Data Coverage** area with largest **maximum Display Scale** will be displayed with the highest priority

3. If the MSVS is larger than the **maximum Display Scale** of an area within the window, turn on overscale indication.
4. If the mariner selects an individual dataset to load it must be displayed at its **maximum Display Scale**, that is MSVS is set to the **maximum Display Scale** of the selected dataset, and then the algorithm is used to fill the graphics window.

SCENARIO 1: SIMPLE DATA COVERAGE DISPLAY



SCENARIO 2: DISPLAY OF TWO DIFFERENT OVERLAPPING DATA COVERAGES

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Scenario 2

DataCoverage: A
maximumDisplayScale: 12,000
minimumDisplayScale: 45,000

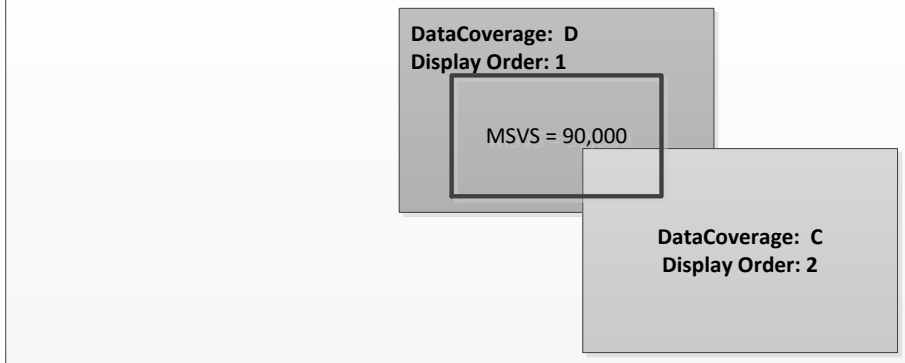
DataCoverage: B
maximumDisplayScale: 22,000
minimumDisplayScale: 90,000

DataCoverage: C
maximumDisplayScale: 45,000
minimumDisplayScale: 180,000

DataCoverage: D
maximumDisplayScale: 90,000
minimumDisplayScale: 350,000

System Graphics Window

Mariner's Selected Viewing Scale = 90,000



The System graphics window will zoom in and pick up larger scale coverage within the window – **Data Coverage** area C, in addition to displaying area D. As **Data Coverage** area C has a better scale range the display of this **Data Coverage** takes priority over area D

The mariners selected viewing scale (MSVS) is the user selected scale in the system

SCENARIO 3: DISPLAY OF THREE DIFFERENT OVERLAPPING DATA COVERAGES

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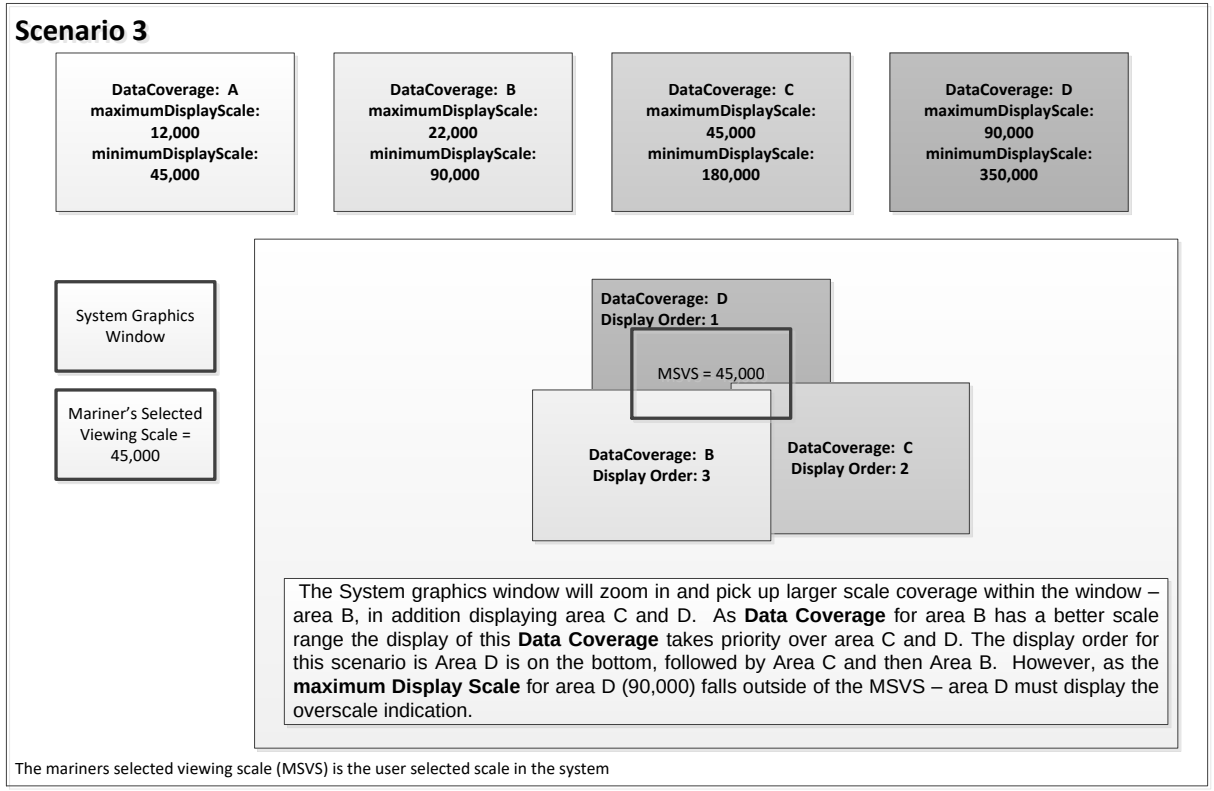
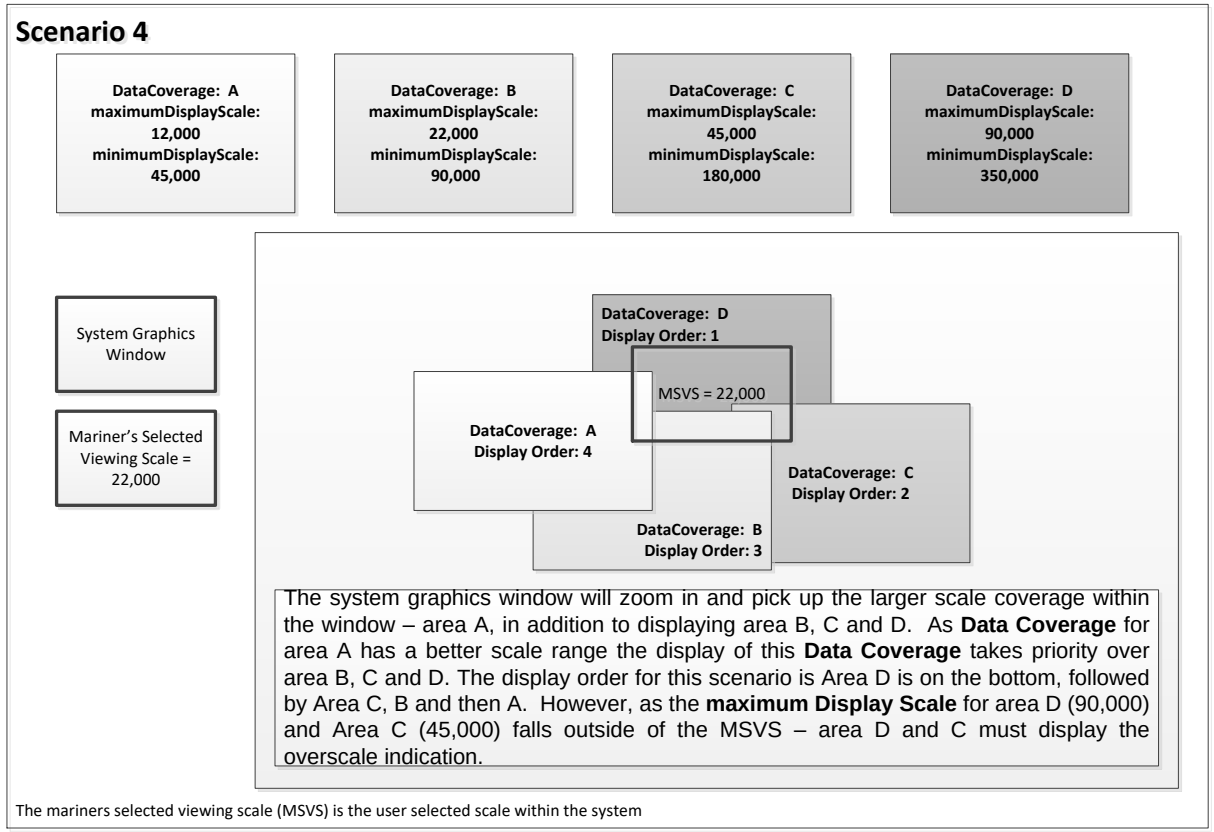


SCENARIO 4: DISPLAY OF FOUR DIFFERENT OVERLAPPING COVERAGES



IHO QUESTIONS

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- Is the Display Loading and Unloading Algorithm still a valid methodology?
  - Will it still work if there are no constraints on the scale selection
  - Implications for SCAMIN Calculations aren't documented
- Should we bring back usage bands and mandate the scale banding of them??
  - Usage bands have two purposes:
  - Indicate what data producers feel the "purpose" of charts are and how that maps to scale
  - Overlap "rules".
- What is the root of the problem? Duplicate ECDIS displays with same settings and same charts at same zoom levels <u>should</u> show the same charts
  - If all ECDIS had the same zoom level settings this would be the case with the current algorithm
  - Up to data producers to coordinate between themselves the optimum arrangement of scales (and SCAMIN) to form a coherent picture for the end user
  - Scale bands and overlap rules are guidelines at best and can't be enforced. Arguably WEND and the RHCs have more power to "fix" the problem.
- Suggested actions
  - IHO survey manufacturers to establish what zoom levels are available on each ECDIS and promulgate among member states
  - Recommend in S-101 that member states work with all available information and in regions to optimize scales and display of cells at chosen scales.
  - This would include agreeing coverage at scales (which could be banded by agreement). Leave WEND and RHCs to determine guidelines for coverage between states.
  - Leave states to determine their own scale banding of cells.
  - The 0.3mm rule should be revisited and enforced within cells to avoid ludicrous scaling of cells.

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