Paper for Consideration by S-101 Project Team

S-101 Data Coverage Rules

Submitted by:	S-101 Project Team Chair
Executive Summary:	The intent of this paper is to clarify the rules for S-101 DataCoverage Features as there is a discrepancy between the main product specification and what is in the DCEG.
Related Documents:	TSMAD18-6.3E TSMAD29 10.3D S-101 Product Specification Baseline S-101 DCEG Baseline
Related Projects:	N/A

Introduction / Background

Over the years the concept of S-101 Data Coverage rules have been addressed, revised, addressed and revised. At TSMAD29 it was brought to the project team's attention that there is currently a large inconsistency between what is specified in the main part of S-101 and what is specified in the DCEG for S-101. This paper seeks to provide a single set of rules for datasets and dataCoverage features for S-101.

Analysis/Discussion

The current version of S-101 Main Document outlines the following rules for datasets and dataCoverage features:

4.5.2 Dataset rules

In order to facilitate the efficient processing of ENC data the geographic coverage of a given **maximum Display Scale** may be split into multiple datasets.

The discovery metadata of a dataset must list all the **Data Coverage** features contained within that dataset and their assigned scale attributions.

An ENC update dataset must not change the limit of a **Data Coverage** feature for the base ENC dataset. Where the limit of a **Data Coverage** feature for a base ENC dataset is to be changed, this must be done by issuing a new edition of the dataset.

Datasets must not cross the 180° meridian; this includes both the **Data Coverage** features and the **bounding Box**.

4.5.3 Data Coverage rules

A dataset may contain more than one **Data Coverage** feature**,** but must not contain more than three total **Data Coverage** features. The data boundary is defined by the extent of the **Data Coverage** features and must be contained within the **bounding Box**.

NOTE: Annex CXX.X provides guidance for ENC producers regarding how to create datasets with multiple **Data Coverages.**

The **Data Coverage** features within a dataset must not overlap.

Datasets with the same maximum display scale may overlap, however the set of all **Data Coverage** features within these datasets must not overlap. This rule applies even if several producers are involved. There must be no overlapping data of the same **maximum display scale**, except at the agreed adjoining national data limits, where, if it is difficult to achieve a perfect join, a 5 metre overlapping buffer zone may be used; and for this situation, there must be no gaps in data.

When a dataset has multiple **Data Coverage** features, then the **minimum display scale** must be the same for all **Data Coverage** features within the dataset. The **maximum display scale** for multiple **Data Coverage** features within a dataset may be the same or different.

In a nutshell, S-101 outlines the following rules:

1. A dataset may contain more than one **Data Coverage** feature

2. A dataset must not contain more than three total **Data Coverage** features.

3. The data boundary is defined by the extent of the **Data Coverage** features and must be contained within the **bounding Box** of the dataset.

4. The **Data Coverage** features within a dataset must not overlap.

5. Datasets with the same maximum display scale may overlap, however the set of all **Data Coverage** features within these datasets must not overlap. This rule applies even if several producers are involved.

6. There must be no overlapping data of the same **maximum display scale**, except at the agreed adjoining national data limits, where, if it is difficult to achieve a perfect join, a 5 metre overlapping buffer zone may be used; and for this situation, there must be no gaps in data.

7. When a dataset has multiple **Data Coverage** features, then the **minimum display scale** must be the same for all **Data Coverage** features within the dataset. The **maximum display scale** for multiple **Data Coverage** features within a dataset may be the same or different.

However, the S-101 Data Classification and Encoding guide states the following:

2.5.7 Seamless ENC coverage

ENCs should form a seamless coverage in navigable waters of the producer's area of responsibility. However, it is often impractical to do so in all radar range scales, and therefore S-101 ENCs declare a scale range, which dictate between what scales the data can be used.

All data within a dataset must have the same minimum scale, but portions of a dataset can have a different maximum scale than other parts, depending on the best scale required for navigation in an area for the purpose of the ENC data.

There must be no gaps in data between adjoining datasets if they share the same scale range in part or in full. Similarly, there must be no overlapping data between datasets if they share same scale range in part or in full, except at the agreed adjoining producer data limits, where, if it is difficult to achieve a perfect join, a 5 metre overlapping buffer zone may be used.

Differences between the S-101 Product Specification and the DCEG:

S-101 only limits overlapping data at the same Maximum Display Scale for the individual dataCoverage feature within the dataset. Therefore the rule can be interpreted as follows:

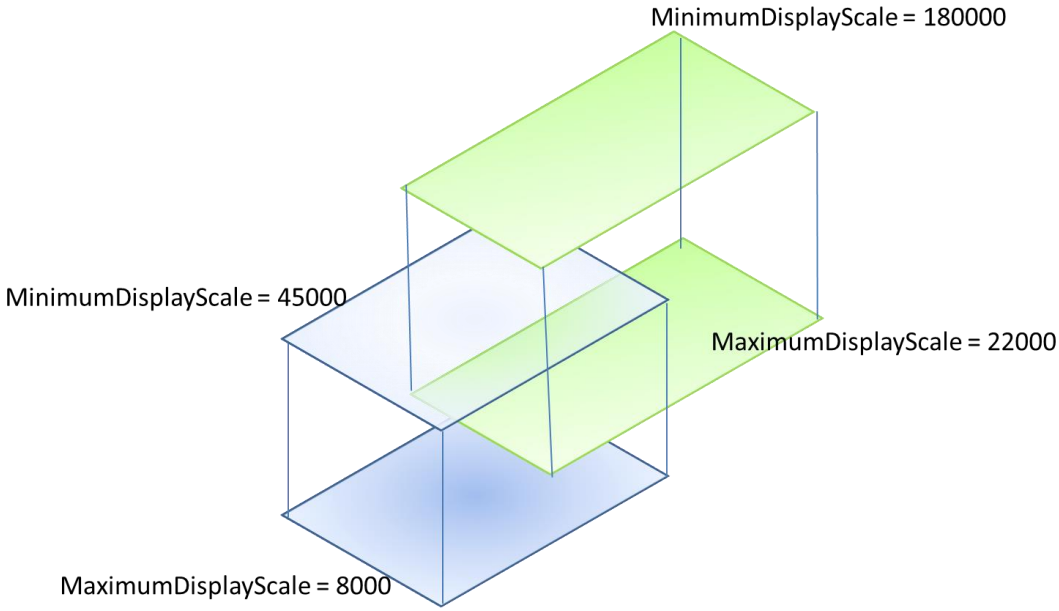


Figure 1: S-101 Interpretation of dataCoverage rules

NOTE: For purposes of this example, there is only a single dataCoverage feature that is equal to the extent of the dataset. Therefore the maximumDisplayScale of the dataset is equal to the maximumDisplayScale of the dataCoverage. In addition, S-101 does not currently carry minimumDisplayScale as part of the dataset metadata so the miniumDisplayScale in this example is that of the dataCoverage.

This means that according to the data loading and unloading algorithm the ECDIS would load in the ENC data based on what the mariner has selected as their viewing scale and what is the best available data in that location.

The DCEG states that there must be no overlapping data between datasets if they share the same scale range in part or in full.

It should be noted that the DCEG language has not been harmonized to what is currently in S-101, however, at the last Test Strategy Meeting it was noted that this has led to different interpretation of how the rules are laid out in S-101.

However, according to what the DCEG states then the above scenario would be illegal and data would have the following representation.

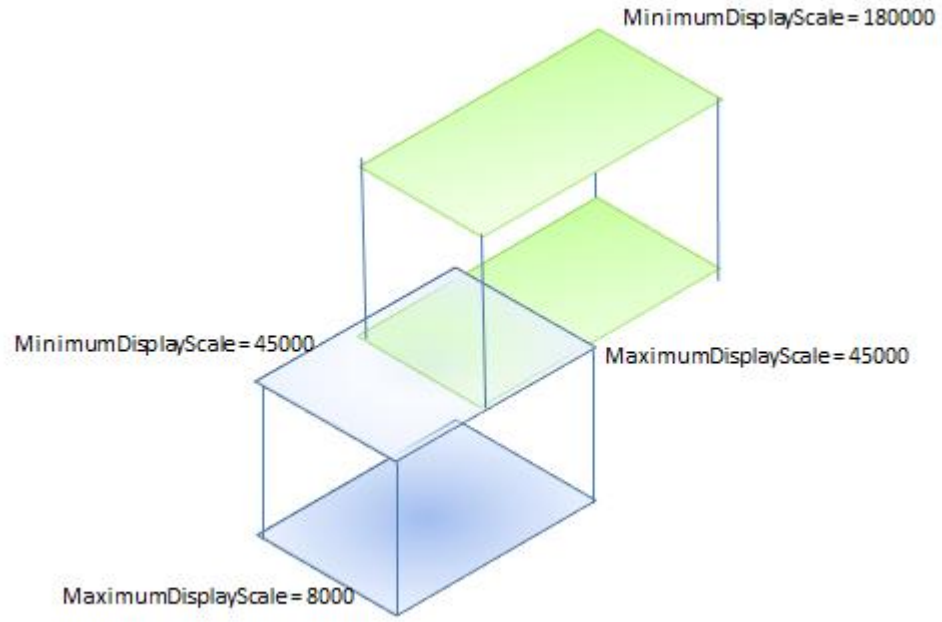


Figure 2- The paper's author's interpretation of the DCEG (it is probably a wrong interpretation)

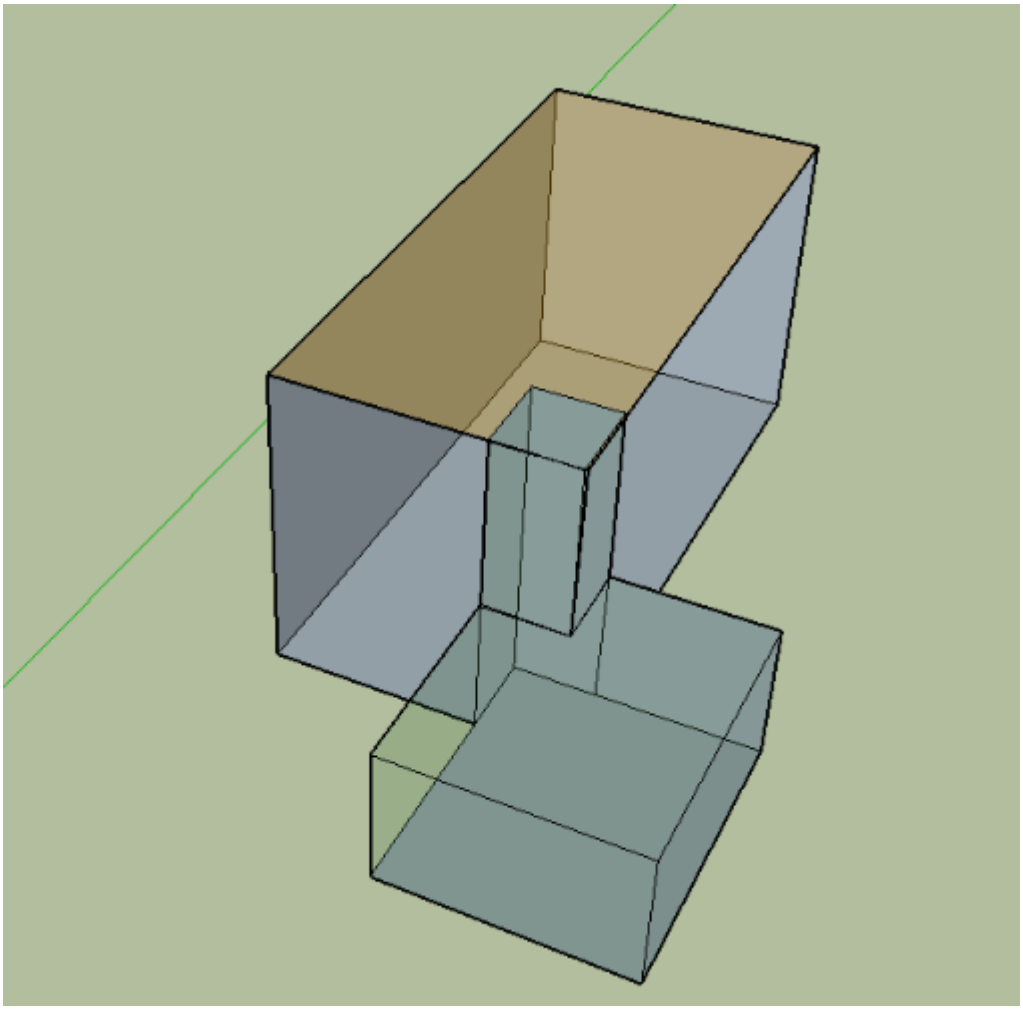


Figure 3: DCEG Interpretation of dataCoverage rules (from Jeppesen)

NOTE: This figure depicts three different datasets.

Conclusions

According the issues above there is a known inconsistency between what has been set out in the DCEG and what has been specified in S-101. However, because of this issue the S-101 Project Team needs to confirm which methodology for data coverage rules is correct, noting that the DCEG introduction has not had a full review by the S-101 Project Team.

It can also be concluded that the scenarios laid out in S-101 for data loading and unloading may have led to this confusion. While the main algorithm clearly uses three datasets where the scale range will overlap, the worked out scenarios do not.

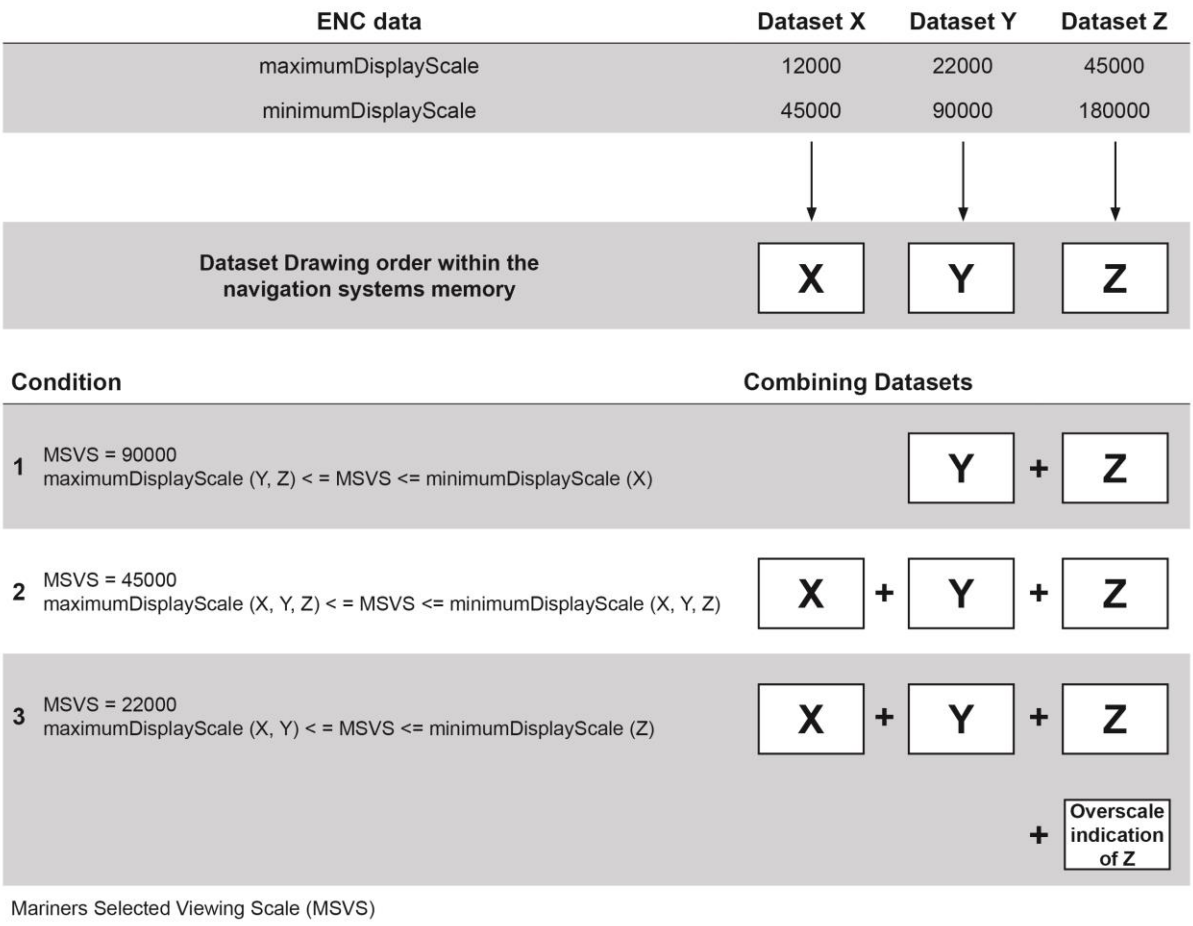


Figure 4 - From S-101: Data Loading and Unloading Algorithm

NOTE: It has been pointed out that this figure only refers to Datasets and that the figure should be amended to show that it is the dataCoverage that is contained within the dataset that is driving these rules.

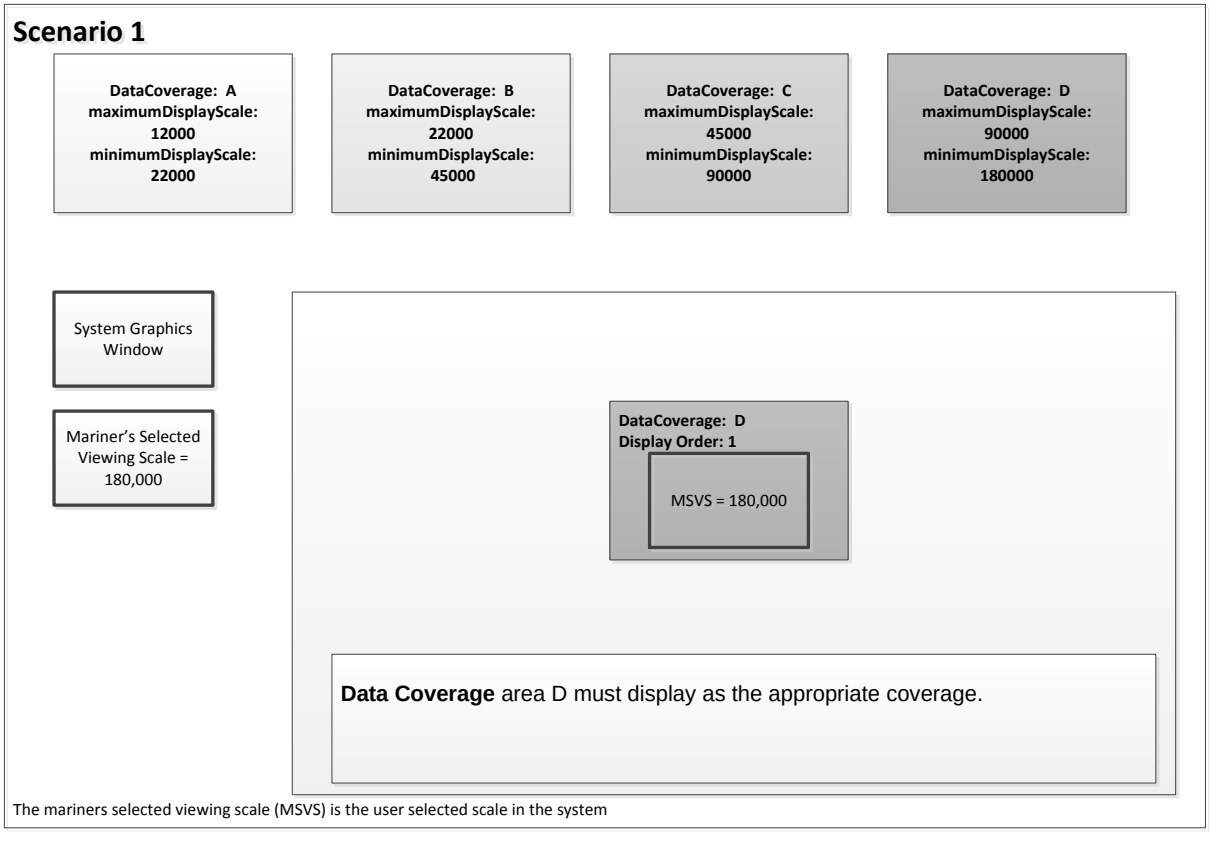


Figure 5 - From S-101: Data Loading and Unloading Scenario

Recommendations

It is recommended that the S-101 Project Team reaffirm the S-101 rules for dataCoverage. In addition the following actions are recommended:

1. Modify the text in 4.5.3 of S-101 to be a bulleted list. This will allow for easier understanding of the specification. It is proposed to use the following text that contains some further clarification:

    - A EN dataset must contain at least one **Data Coverage** feature, but must not contain more than three **Data Coverage** features.

    - The data boundary of the EN dataset is defined by the extent of the **Data Coverage** features and must be contained within the **bounding Box**.

    - The **Data Coverage** features within a dataset must not overlap, however Data Coverage features from different datasets may overlap if they have differing maximum display scales.

    - Datasets may overlap, however there must be no overlapping **Data Coverage** features of the same **maximum display scale**, except at the agreed adjoining national data limits, where, if it is difficult to achieve a perfect join, a 5 metre overlapping buffer zone may be used; and for this situation, there must be no gaps in data.

    - When a dataset has multiple **Data Coverage** features, then the **minimum display scale** must be the same for all **Data Coverage** features within the dataset. The **maximum display scale** for multiple **Data Coverage** features within a dataset may be the same or different.

2. Include the following rules as an additional point of clarification:

    - When a dataset has only a single **Data Coverage** feature the **maximum display scale** and **minimum display scale** of the dataset must be equal to the **maximum display scale** and **minimum display scale** of the **Data Coverage**.

    - When a dataset has multiple **Data Coverage** features then the **maximum display scale** of the dataset must be equal to the largest **maximum display scale** of the **Data Coverage** feature.

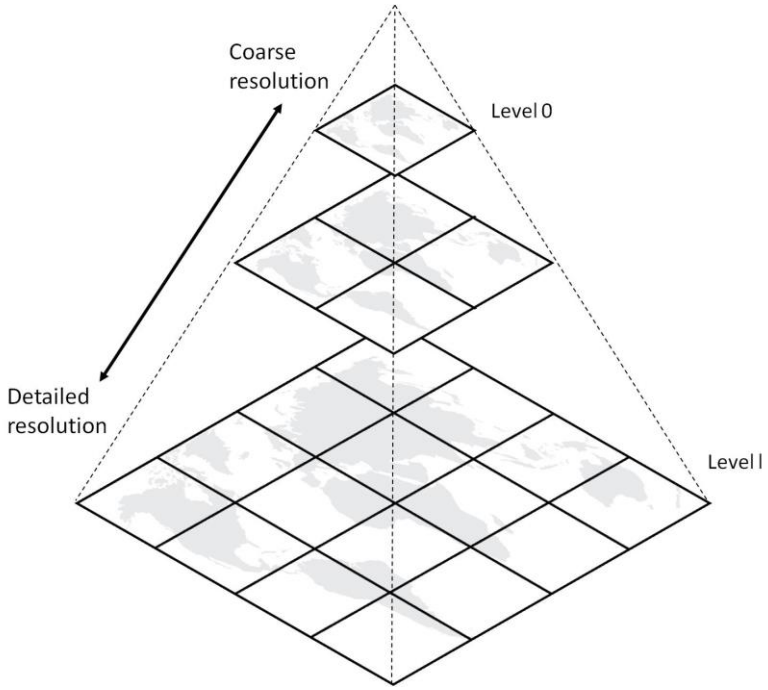
    - The **maximum display scale** is considered to be the equivalent of the compilation scale of the data.

3. Include a figure similar to Figure 1 of this paper to help users visualize the specification
4. Amend the Data Loading and Unloading Algorithm to reflect that it is using the Data Coverage feature of the dataset
5. Amend the scenarios in 4.7.1 to show how the rules will work
6. Consider adding in the minimum display scale of the dataset in the S-101 catalogue metadata.
7. Amend the DCEG to reflect the rules laid out in S-101

Justification and Impacts

The primary purpose of this paper is to reconfirm the rules set out in S-101 and to remove any ambiguity with their interpretation. For example, the guidance provided by the DCEG may lead to even more issues. For example, stating that data cannot overlap within the scale range implies that there will need to be further specification as to what the range of data should be – which would be stepping back towards the old concept of S-57 scale bands.

The concept outlined in S-101 follows similar protocol used in Google and Bing maps for their tiling schemes.



As the user zooms in and out the best available data at that scale is used based on the ship's position, the mariner's selected viewing scale and best available data. The data loading and unloading algorithm uses this same concept by keying in on maximum display scale of the data coverage within the viewing window to display the best available data based on the mariners selected viewing level.

Action Required of the S-101 Project Team

The S-101 Project Team is invited to:

a. note the paper

b. agree recommendations 1 through 7 as outlined in this paper.