

Paper for Consideration by SAIHC ICCWG Gridded ENC Scheme Options for SAIHC Region

Submitted by:	UK
Executive Summary:	A discussion paper to consider potential benefits of gridded ENC scheme in SAIHC region
Related Documents:	https://nauticalcharts.noaa.gov/publications/docs/ENC-Transformation.pdf http://www.cmar.csiro.au/csquares/about-csquares.htm
Related Projects:	S-101, Future of the Nautical paper chart

Introduction / Background

There is a growing expectation that there is a requirement for greater marine geo-spatial information in the future as the blue economy in Africa develops. There is also a growing understanding of the need to protect coastal marine environments. Mangroves, tidal marshes and seagrasses are critical along the world's coasts, supporting coastal water quality, healthy fisheries, and coastal protection against floods and storms. The SAIHC coastline has important areas of sea grass and mangrove that is home to rich marine life and is important in sequestering and storing carbon from the atmosphere. The blue economy in the SAIHC region has offshore energy discoveries, rich fisheries and marine mining.

We are now in the 'decade of S-100' which plans to harness the potential of marine data and make it available for use by a wide range of non-navigational users as well as the mariner. To ensure that the SAIHC ENC scheme is optimally designed for future needs we must consider the following aspects: future navigation requirements, blue economy, environmental protection, S-100 (including S-101 which will replace S-57).

As an alternative to deriving ENC schemes from paper chart limits some nations have moved to a gridded ENC scheme. A gridded ENC scheme will provide the opportunity to include enriched data content when S-101 ENCs are made. It may also support other S-100 marine data initiatives for other users and the gridded cells will be convenient data packages to manage and sell. The conformity of cell size may allow a better estimation of costs, effort, time and price. It is also likely to be easier to catalogue and monitor progress.

As the SAIHC ENC scheme continues to evolve it is worth considering future requirements and emerging developments in the field of ENC production and identifying opportunities to improve the regional ENC coverage.

Analysis / Discussion

We need to consider if in the future there will be a requirement to have larger scale ENC coverage of the whole of the SAIHC coastline to meet the needs of navigation, blue economy and environmental protection. Should we decide that larger scale coverage is required then we will need to determine what scale is needed, do we have approach and harbour usage bands or just approach.

We will need to understand the opportunities that the new S-100 and S-101 specifications provide to the ENC producer and user. We also need to understand the limitations and constraints of S-100 when designing ENCS, particularly regarding file size. At the current time ENCs need to be smaller than 5Mb, therefore in order to meet this limit whilst including

potentially richer data sets and greater information in S-101 we may need to consider having multiple smaller extent ENC's to cover the same area as the previous cells.

To assist vessels using safety contour functionality in ECDIS it will be necessary to provide more contour values. This will allow a vessel with a 12m draft for instance to set a 13m safety contour if it needed. Currently this is not always possible as the ENC may only have 10 and 20m contours, the ECDIS would use the next contour value of 20m which would set off alarms whilst the vessel was still in enough water depth.

As an alternative to deriving ENC schemes from paper chart limits some nations have moved to a gridded ENC scheme. With the decline in paper chart use and production processes shifting towards greater ENC production and away from paper chart production there is less need for ENC limits to agree with paper chart limits. Many offices are now finding that paper chart maintenance is inefficient and are looking for ways to automate or simplify their paper chart production. Gridded ENC's may support future solutions for automated paper chart production from ENC's. The United States (NOAA) is currently transforming their ENC scheme. <https://nauticalcharts.noaa.gov/publications/docs/ENC-Transformation.pdf>

A gridded scheme for all user bands is probably not required as we have established UB 1 coverage already. User band 2 is also largely completed but we could consider a 4 degree by 4-degree grid to cover the deeper offshore areas that do not already have user band 2 coverage. User band 5 is unlikely to be needed as the resolution may be too large for most areas of SAIHC. Instead I recommend considering a gridded scheme for user bands 3 and 4. User band 3 could possibly be at 1-degree resolution and user band 4 could be at 0.25 resolution. This would allow the cell sizes to be similar to existing extents

There may be an opportunity to use the gridded scheme as a reference for other activities such as SAR or disaster management. It may be possible to name the cells in a way that allows the position to be identified, this should be easy with 1-degree cells for instance. An example could be GB30742E (GB = producer, 3 = UB3, 07 = 7 degrees south, 42E = 42 degrees east.) As the cell names are 8 letters then we cannot add the Southern hemisphere character also, however as all SAIHC positions are Southern then we should be able to omit the 'S' from the name.

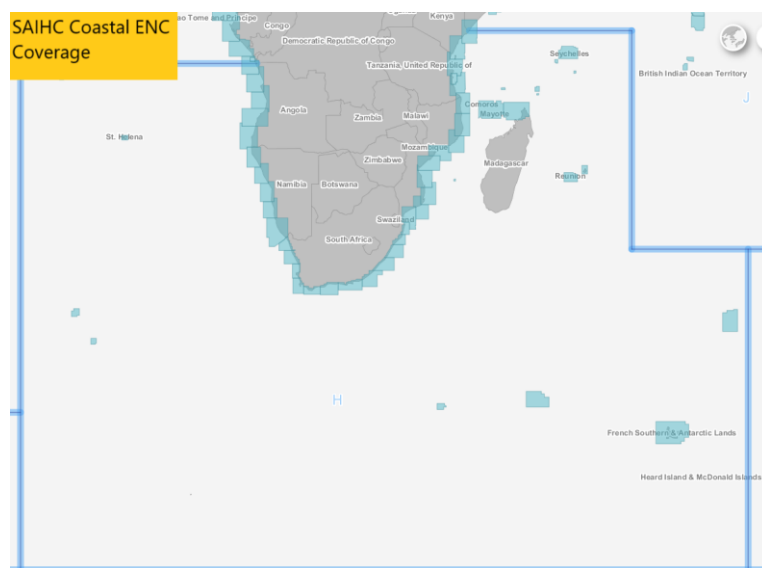


Fig 1. Existing coastal user band ENC coverage in SAIHC.

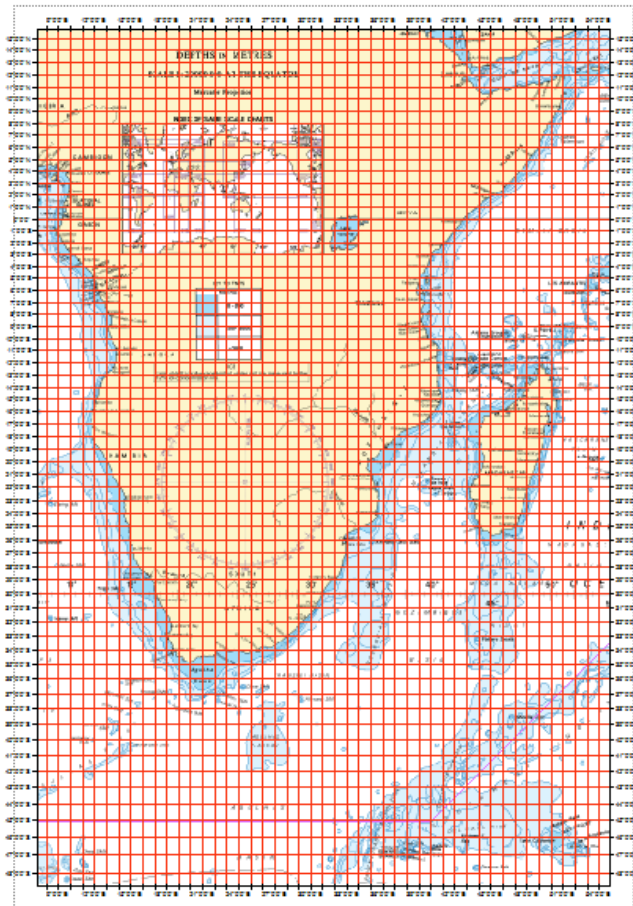


Fig 2. Example of a 1°x 1° user band 3 gridded ENC scheme

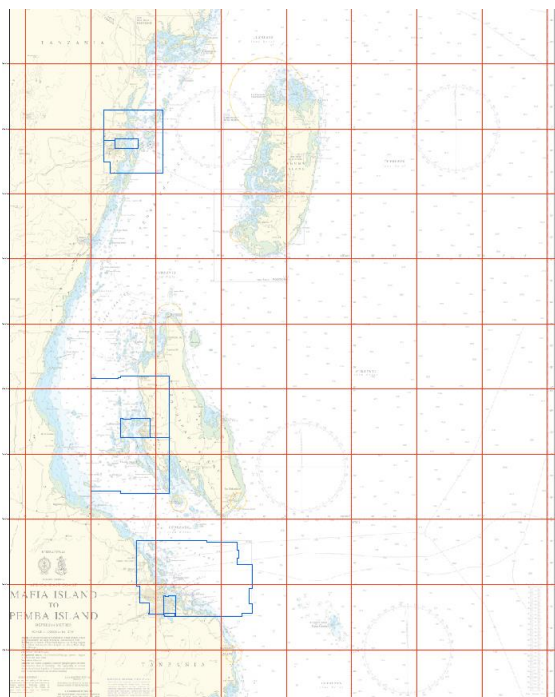


Fig 3. Example of a user band 4 grid (0.25°x 0.25°) shown in red, existing GB band 4 cells are shown in blue

There are a growing number of examples of other nations introducing gridded ENC's. The United States and the Rep of Korea have both moved to gridded ENC's. Their grid cell sizes are not the same but have similar cell sizes for band 3 cells at approximately 1 degree by 1 degree.

Another maritime gridded system to consider is the C-Squares grid.
<http://www.cmar.csiro.au/csquares/about-csquares.htm> This is a widely used marine grid system developed by WMO but used by fisheries organisations such as ICES. This system would allow some commonality with organisations already using data sets referenced to this grid. However, its naming convention is not suitable as it's up to 16 digits long (twice as long as permitted for ENC's). "C-squares" (acronym for "concise spatial query and representation system") is a grid based global locator system developed to facilitate the indexing, searching, and retrieval of georeferenced information within an intuitive, human- and machine-readable notation system.

GEBCO also use a gridded system and their latest grid has a resolution of 0.25 degrees which would be compatible with ENC user band 4 extents.

Conclusions

Further discussion and investigation into the potential benefits and disadvantages of a gridded ENC scheme for the region are needed. There are many factors to consider and a regional gridded scheme would require the support from all members. As nations start to develop gridded ENC's it would be useful for SAIHC to maintain awareness of developments and understand if there are opportunities to improve the ENC coverage in our region.

Recommendations

SAIHC ICCWG should conduct further investigation and discussion into a potential ENC grid for SAIHC. It would be useful to get the views of other members, particularly the coastal states that do not have existing band 3 or 4 coverage.

Justification and Impacts

- a. Potential benefits may be gained in data management and enriched ENC content.
- b. Potential benefits to wider geo-spatial user needs and blue economy management.
- c. May support automated production of paper charts from ENC's and reduce future maintenance effort by Hydrographic offices.
- d. Re-scheming existing ENC's would require significant effort
- e. Many areas do not have sufficient bathymetric data to allow new ENC's to be made.
- f. Gridded ENC cells may fall awkwardly across ports or international borders.
- g. Extra updating and processing effort needed for multiple cells instead of one.
- h. Users may not choose to purchase all of the cells needed for situational awareness.

Action required of SAIHC ICCWG

The SAIHC ICCWG is invited to:

- a. ~~endorse~~
- b. ~~agree~~
- c. note this paper and consider discussing further.