

**6th IHO-HSSC Meeting  
Vina del Mar, Chile, 11-14 November 2014**

**Information Paper for consideration by HSSC**

**Australian experiences in deriving paper charts from ENC**

**Submitted by:** Australia

**Executive Summary:** Action HSSC5/44 invited Australia to share its experiences in moving towards a production arrangement of deriving paper charts from ENC. While the transition has not yet been fully implemented, this information paper details the preparations, experiences and lessons learnt so far. While Australia remains committed to achieving this arrangement, the transition is being undertaken both conscientiously and cautiously.

Related Documents: Nil

Related Projects: Nil

## **1 Introduction / Background**

1.1 Australia has full ENC coverage at least equivalent in content to the paper chart series. ENC updates include the equivalent of permanent Notices to Mariners, as well as Temporary and Preliminary Notices. The Australian Charting Area includes Australia, Papua New Guinea and offshore islands, and the largest single part of Antarctica. The overall charting area is larger than all of Europe, to be achieved with 38 cartographers, and 120 staff overall – efficiency is absolutely vital.

1.2 The AHS has a centralised “Digital Hydrographic Data Base” (DHDB) for analysis and de-confliction of hydrographically relevant data. However, as production tools embedded within the system are obsolete and too slow for practical use<sup>1</sup> data for both ENC and paper charts is currently exported from the database to a cartographer’s workstation and completed independently using ‘modern’ production software. Independent completion has created difficulty in ensuring consistency of data across ENC and paper charts.

1.3 To increase production capacity the AHS also uses external contractors working to AHS specifications, with all charts submitted back to the AHS for review, acceptance and publication. For many years data supplied to contractors was extracted as a ‘pack’ of multiple themes and datasets, with the contractors often required to make subjective assessments regarding chart content from the supplied data. Subjective decisions, even within the AHS’ specifications, could potentially make the rendered chart look quite different to one prepared by in-house staff. The workloads associated with preparation of data packs and contractual acceptance (and correction) of externally compiled paper charts

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<sup>1</sup> Caris HPD was acquired and integrated into the DHDB in early 2014. As ENC are progressively published as new editions through HPD, the full connection between data and published ENC will be restored.

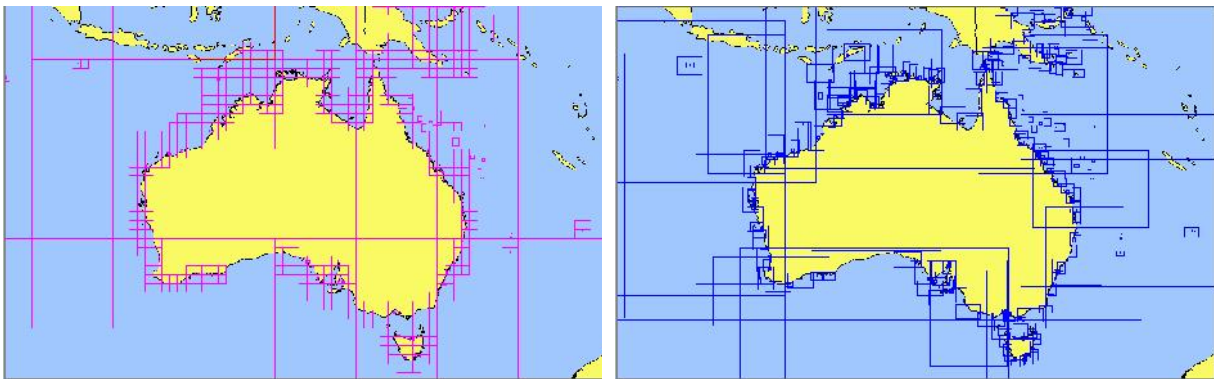
and ENC are high, and left many of the AHS' workforce feeling that they were working for the contractors.

## 2 Production and organisational requirements

2.1 Since completion of initial ENC coverage (and apart from routine addition of new and amended information) the AHS has since moved into a second phase of ENC production - improving the ENC, particularly noting that they are used quite differently to paper charts. In response to demands from marine pilots in particular, a growing number of Australian ENC contain data at significantly greater compilation scales than the corresponding paper chart, particularly in port and port approach areas.

2.2 Other factors needing to be considered included:

- The demand towards greater data levels in ENC than the corresponding paper chart - this dictates that the content of ENC can be generalised to create a paper chart of smaller scale, however, a paper chart with standard data density cannot be used to generate a higher data density / larger scale ENC.
- Accurate and appropriate content remains AHS' highest priority, with the "presentation" aspects of a paper chart of somewhat lesser importance (but still a source of pride for the cartographers).
- The AHS is required to reduce its workforce to levels below when it had a single (paper chart) product line to manage, despite the overall task now being significantly larger.
- The higher complexity and evolutionary nature of encoding ENC (even within the existing specifications), versus the quite static nature of paper chart specifications, which dictates that retention of ENC skills in-house is of greater importance than paper chart skills.
- The weakness of some contracted organisations in appropriately conducting sounding selection, and the impact on AHS staff when this has to be redone.



*Figure 1 – extracts from the Australian Chart Index (online catalogue) showing limits of Band 1 to Band 5 ENC and paper charts for the equivalent area*

### **3 The Solution**

3.1 The solution chosen by the AHS is to work towards derivation of paper charts from ENC. This achieves all of the AHS' production and organisational requirements. The AHS' overall systems architecture and workflow is:

- Source data receipt into data repositories for bathymetry, imagery, tidal information, Aids to Navigation, and other nautical information (wrecks, maritime boundaries, etc).
- Registration, risk and impact assessment (against published information), rules-based assignment of priority for charting action.
- Data quality assessment, de-confliction with existing data (replace, merge, etc).
- Progress data to an "ENC ready" state in Caris HPD (either scale-less layer or largest scale on which the data appears).
- Generate ENC updates and new editions, derive paper chart updates (Notices to Mariners, Block or patch corrections).
- Derive paper chart new editions from publication-ready ENC. Most paper chart production to be undertaken by contractors and reviewed / published by the AHS.

### **4 Transition time**

4.1 The time taken to fully transition has been affected by factors outside the AHS' control. These have included funding for the overall DHDB refresh program to progressively upgrade the various modules within the system, renegotiation of support arrangements for the DHDB, and a rapidly shrinking workforce in the face of increasing demands.

4.2 Factors within the AHS control have included the controlled transition from existing production software to Caris HPD, in particular:

- May – Sep 2013: Caris HPD pilot team trained then development and initial documentation of all processes.
- Feb – Apr 2014: Training and full transition to HPD (rolling program of training courses, followed by immediate transition to HPD for all students as they finished their course). Overall transition took six weeks.
- Mar – May 2014: Exclusive focus on ENC updates and Notice to Mariners (no new editions).

## 5 Lessons learnt (Analysis / Discussion)

### 5.1 Lesson 1 – Culture.

- While senior cartographic staff have embraced the concept, a small percentage of other cartographers have gone so far as to raise the question “If we don’t make paper charts, what will the cartographers be doing?” Unfortunately, this significantly undervalues the role of the modern nautical cartographer, but the attitude has required patient attention to correct.
- In fact, the AHS believes there are greater challenges in getting the best out of ENC specifications than most cartographers even recognise. This has been reinforced by sending all senior cartographers on an IMO generic ECDIS Course in the company of experienced marine pilots and ship masters, run on a multi-platform Bridge Simulator equipped with a full Integrated Navigation System<sup>2</sup>. Armed with this experience, implementation of an “ENC first” strategy has resulted in a mind-shift amongst these staff, who now actively consider how to make ENC more useful to the mariner, rather than limiting their thinking to how to copy a paper chart. This mind-shift has taken place even without full implementation of the chronological process of publishing every ENC before the corresponding paper chart.

### 5.2 Lesson 2 – Scale. There were initial concerns that five scale bands would not meet the requirements for the many more paper chart scales used by the AHS.

- Coastlines and depth contours. A coastline or depth contours ‘drawn’ for the largest scale in a scale band have been found to work quite well at anything up to four times that scale. For example, contours generated for a 1:12,000 ENC still work for a 1:50,000 paper chart, with possibly only a small degree of generalisation required if the seabed is particularly uneven.
- Sounding selection. The AHS has confirmed that sounding selection suited to a larger scale ENC makes a useful dataset from which to generalise a smaller scale paper chart. For example, the approximate 300m sounding interval used at 1:12,000 for a large scale ENC can be thinned using SCAMIN to suit a 1:22,000 ENC / 1:25,000 paper chart, as well as a 1:50,000 paper chart. However, the soundings which have been suppressed using SCAMIN are still available in the event alternate “approved” soundings are required on a paper chart to avoid clashing with other features (such as a compass roses, Aids to Navigation, text descriptions, maritime boundaries, and so on.). This practice is ultimately no more than the process of generalisation from large scale to small traditionally used to derive paper charts at differing scales – it is only the display material (screen or paper) that has changed.
- Additional soundings to support paper chart requirements. Sounding selection on an ENC for a comparable paper chart, such as a 1:22,000 ENC and 1:25,000 paper chart, provides insufficient choice for the paper chart compiler with no extra soundings available where soundings conflict with Aids to Navigation, text descriptions, maritime boundaries, and so on. For a paper chart of 1:25,000, a sounding selection at 1:12,000

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<sup>2</sup> ECDIS / Radar/ AIS/ position, speed, heading/ship handling.

provides the necessary additional soundings if required, with SCAMIN (already required for the ENC) used to initially thin that selection ready for the paper chart.

### 5.3 Lesson 3 – Chart content.

- **Geographic Names.** Area-based geographic names on ENC may be factually correct but are a poor driver of positioning on the paper chart. Some form of mock-up is beneficial to augment AHS paper chart specifications – the most useful is a suitably annotated copy of the existing paper chart, if necessary. In contrast, geographic names applied to point and small features translate well to paper charts, but may require minor position adjustment to meet presentation requirements (such as shifting a light description to one side of a channel beacon).
- **Chart notes.** The AHS Chart Notes database remains referenced to paper charts, with links to ENC derived as initial coverage was established. The ongoing link to paper charts has proved useful in the preparation of data packs for out-sourced paper charts. Noting that Australian ENC are grid-based rather than chart based, a review of localised notes applied to ENC is being progressively undertaken.
- **Tide panels and tidal stream panels.** Management of these product-level panels also remains optimised for paper charts, even though the source information is managed spatially.

### 5.4 Lesson 4 – Reviewing and editing charted content.

- Possibly the greatest single impact upon overall production processes has been in how the AHS reviews and edits chart content. For many decades the AHS has included two rounds of editing of charts in production; the first focussed on content, and the second focussed on cartographic presentation. Reviews involved returning a draft chart to the relevant AHS data theme manager (such as maritime boundaries) to ensure ‘their’ data was factually correct on the chart. The second round of edits was specific to the presentation on the product – in the context of paper charts it referred to the “look” of the paper chart, not factual correctness, so circulation of the paper chart for this presentation review is entirely appropriate.
- For many decades, feedback from both the content and presentation review phases was provided via written corrections and comments referenced to a marked-up copy of a new paper chart. However, in the context of ENC first, there is no longer a very large piece of paper for the external editors to write on – it hasn’t been made yet. To address this, a basic printout of the chart<sup>3</sup> accompanies the new ENC as it circulates for content review. Once all production is derived from ENC published via Caris HPD, cartographers and theme managers will be able to apply corrections and comments via a “mark-up” feature within the HPD software.
- In parallel, the AHS is undertaking a number of significant changes in the way it manages non-bathymetric data – it is expected that by mid to late 2015 data management practices will be sufficiently refined to remove the need for review of chart content by data theme providers. Primarily, this will be achieved by theme

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<sup>3</sup> Generated from the ENC using SevenCs software

managers being required to provide data in ENC-ready format – this includes more than merely being provided in S-57.

- Further, the AHS is currently considering a number of cartographic options to significantly reduce the cartographic interventions required to achieve the final accepted “look” of the paper chart. For example, this includes changing the colour of depth contours to one which does not interfere with soundings, thereby removing the need to both gap (and check) contours. Other options may include creating a dedicated space for title blocks and chart notes outside the defined area of a chart to avoid the need to juggle the layout of a chart.

## **6 Conclusions**

6.1 This paper has been submitted for information only – Member States may draw their own conclusions regarding the applicability of this paper to their own particular circumstances.

## **7 Justification and impacts**

7.1 This paper has been submitted for information only. However, Australia has:

- noted the demand for greater levels of detail being sought by mariners in areas of constrained navigation;
- recognised that standard content paper charts can be derived from ENC, but not vice versa;
- found that a published ENC is a robust way of “packaging” data for a contractor to produce a paper chart, as long as it is accompanied by a mock-up of the intended chart (normally a marked-up copy of the existing edition);
- found that the resulting change in thinking by cartographic staff has significantly influenced changes to Australian ENC specifications which are already improving the fitness for purpose of Australian ENC.

## **8 Action required of HSSC**

8.1 The HSSC is invited to consider and discuss this paper.

Annex A: Case Study – Approaches to Ashburton

## Case Study - Approaches to Ashburton

### Requirement

New ENC and paper charts are required for a new port in north-west Western Australia. Vessels will be of deep draft and typically 300 metres in length.

New products will be:

- ENC at 1:12,000 compilation scale (incorporating the dredged channel at 1:4,000 or 1:8,000), and
- Paper Chart at 1:50,000.

Existing ENC and paper charts for coastal navigation will also require updates to incorporate new data.

### Process

Sounding selection at approximately 300m apart equates to soundings approximately 4cm apart when the screen display is set to 1:12,000. This sounding interval both recognises the length of the vessels operating in the area, and fits within the AHS specified requirement of 2 to 4 cm on screen.

Contours were compiled at 1:22,000 from source data, providing a limited amount of generalisation. Contours were compiled at 1:22,000 are accurate enough for the ENC at 1:12,000, and require some, but not excessive, generalisation for the paper chart @ 1:50,000.

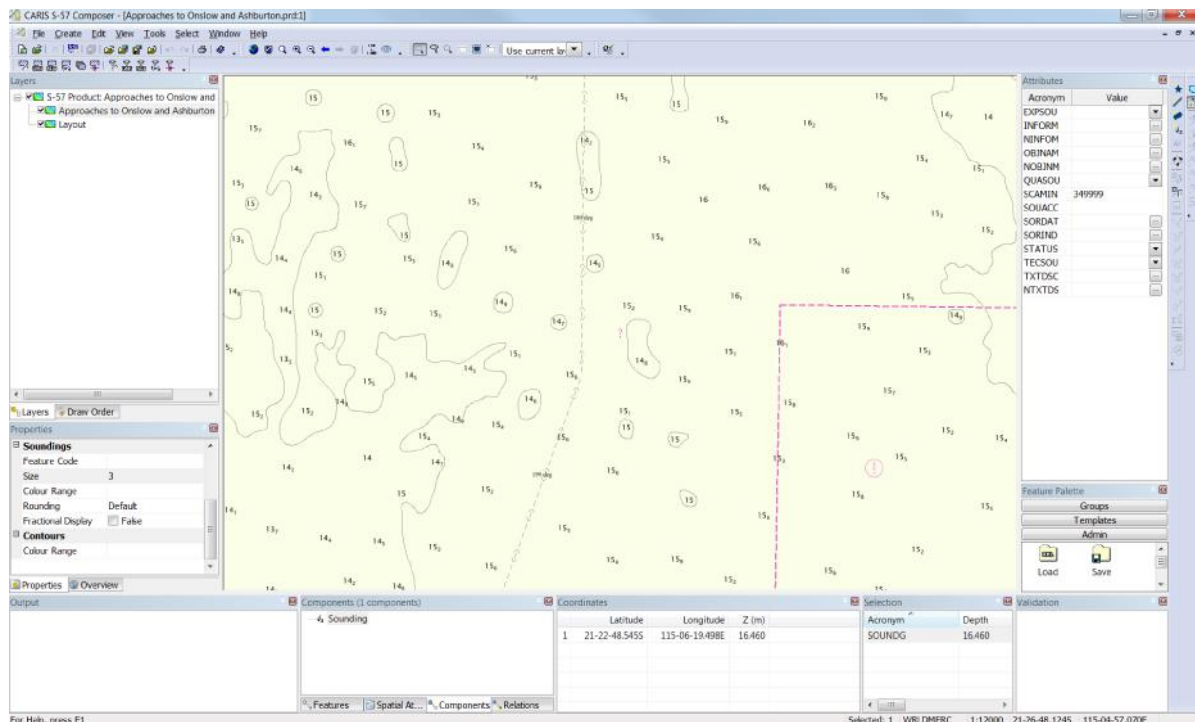


Figure 2 - 1:12000 screen display, no SCAMIN applied

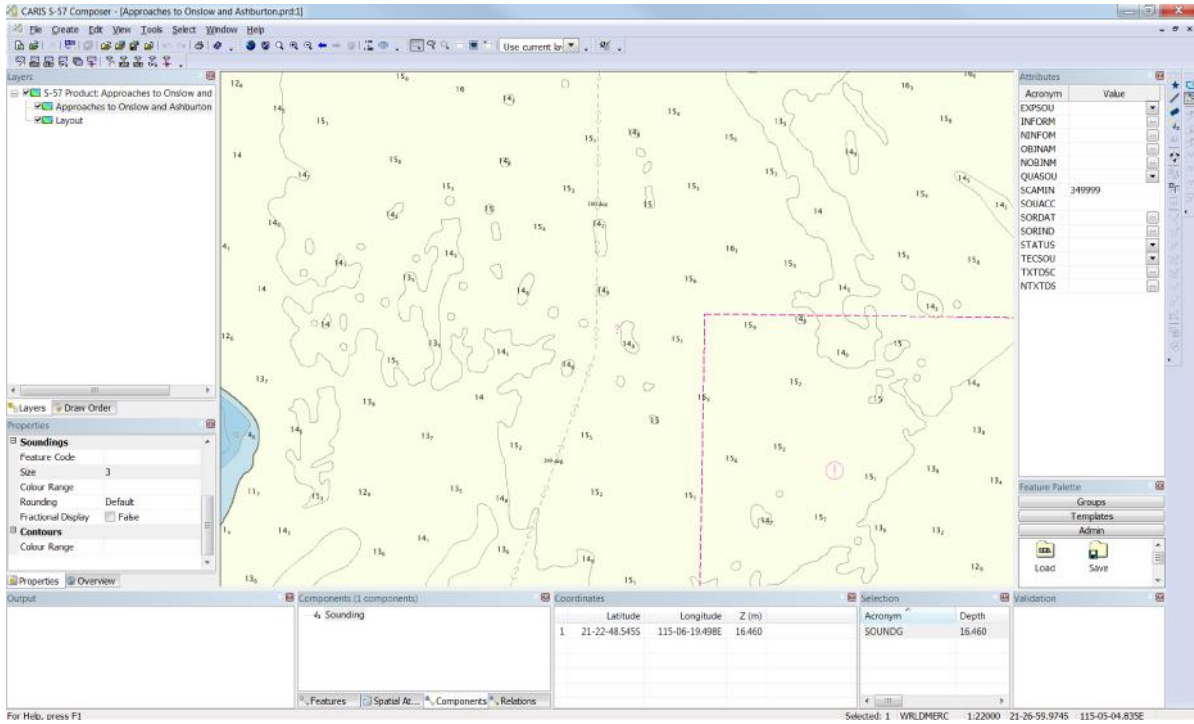


Figure 3 - 1:22000 screen display, one level of SCAMIN applied

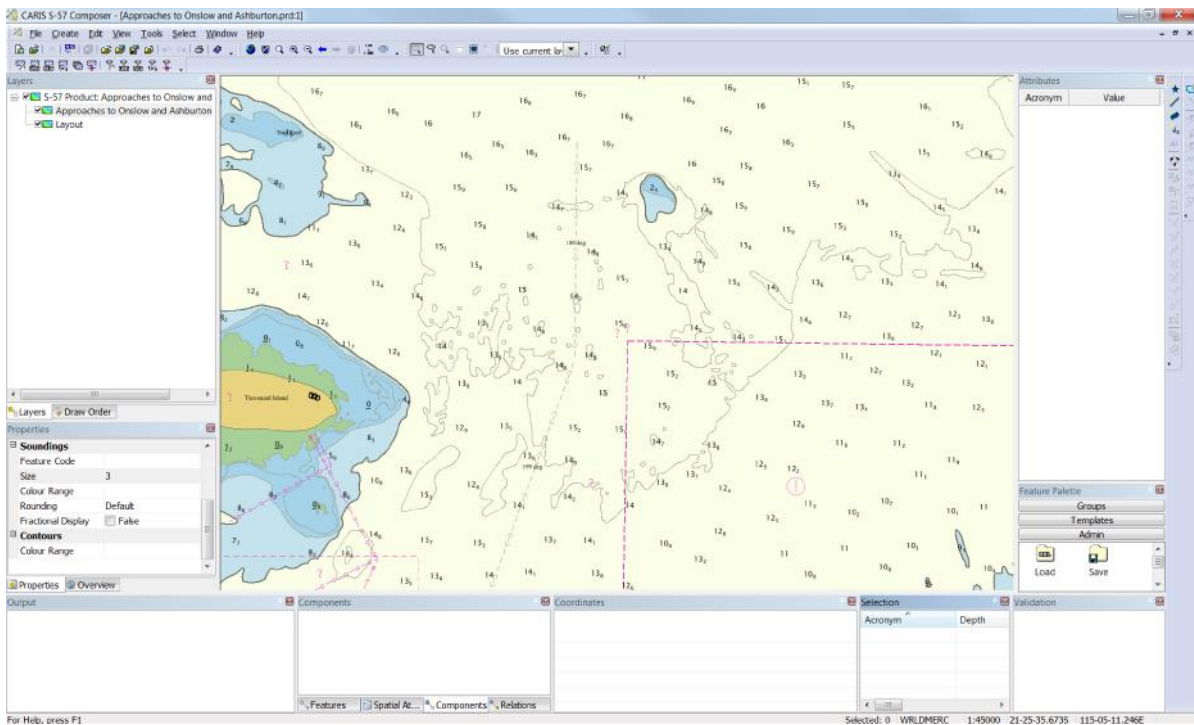
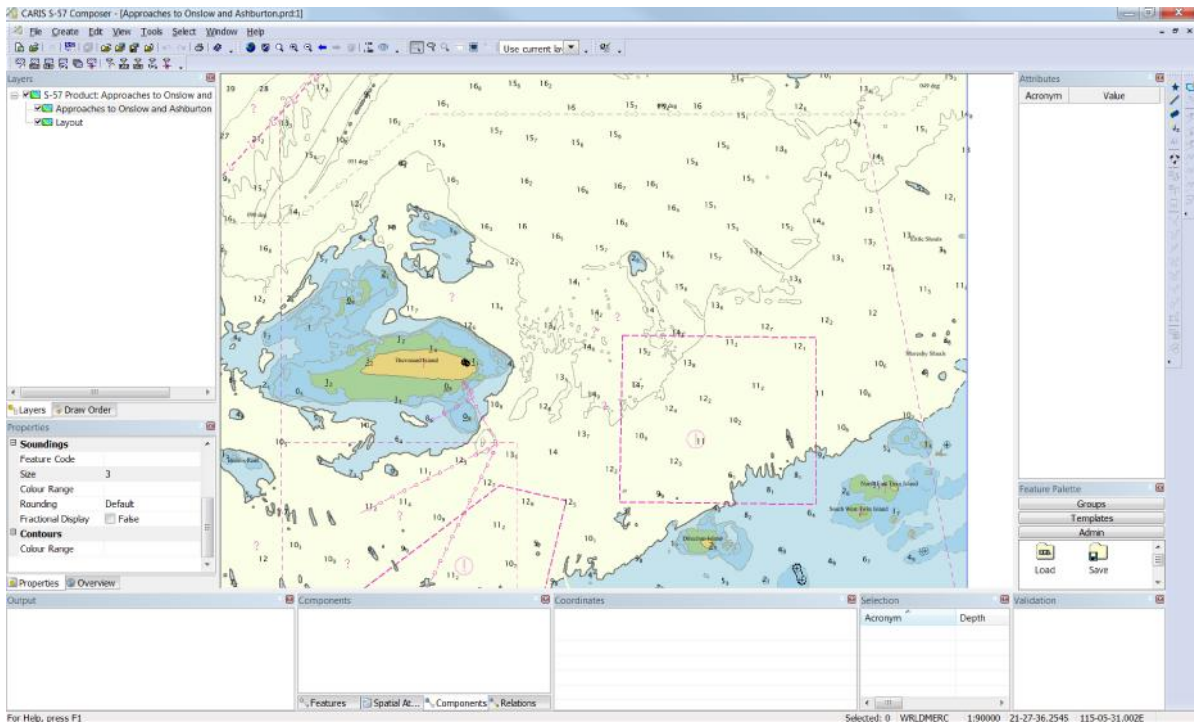


Figure 4 - 1:45000 screen display, one level of SCAMIN applied





*Figure 5 - 1:90000 screen display, two levels of SCAMIN applied*

### Primary observation

The one sounding selection and careful application of SCAMIN for an ENC can be used to produce four levels of charting detail. The reverse process from paper chart to ENC would require this to be undertaken four times.