Paper for Consideration by TMS5

Portrayal experience from prototype S-101 viewer

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Executive Summary:	This paper is about experience gained with feasibility study prototype developed by Furuno Finland
Related Documents:	
Related Projects:	S-100 Portrayal, S-101

Introduction / Background

1. This is the first time we report hands on experience from our internal S-101 viewer prototype. Target of our internal prototype has been to gain own experience about implementation of S-100 and S-101.

2. Our company is an ECDIS manufacturer so our focus is in viewer part and not in production of data sets. Therefore we have waited that others provide "ready to test machine readable material" instead of us trying to "cook" such material ourselves (for example using S-57 to S-101 converters + manual editing, etc.). As test material we have used IHO test data posted by Tony Pharaoh on 26th Jun 2015 and test material created by DMA (Denmark) for EfficienSea2 project.

3. The base of our prototype has been our S-57/S-52/S-63 based ECDIS, for which a few things have been extended to handle S-100/S-101:

- Import method from ISO 8211 encoded S-101 ENC into our internal SENC
- Internal object catalogue to house both traditional S-57 and new S-101 ENC charts
- Import method for the SVG symbols and colour palettes into our internal symbol cache
- Alternative process path for the so called "drawing list". For S-57 ENC charts this process is based on the machine readable look-up-tables from DAI-file of the S-52 Presentation Library. For S-101 ENC chart this process is based on machine readable Portrayal catalogue as defined in S-100 and as provided by the S-101 draft Product Specification.

Many fundamental parts of our prototype are as they have been with the traditional S-57/S-52/S-63 based ECDIS

- Capability to handle multiple charts for drawing of the visible chart area
- Capability to handle alerts and indications based on the largest scale available (obviously still based on hardcoded rules of object/attribute combinations implemented by our source code for both S-57 and S-101 ENC charts)
- Final drawing from the "drawing list" to the target display. Final drawing gets the items to be drawn from "drawing list" arranged by their drawing priority. Further final drawing fetch the associated spatial coordinates from the SENC, fetch the associated symbols shapes from the internal symbol cache and perform the actual drawing for the display surface.

4. For portrayal of S-101 ENC charts we implemented the XSLT based method specified in Ed 2.0.0 of S-100.

Observations

5. We have seen similar portrayal mistakes as reported by SPAWAR and KHOA from their testbeds in 2016 and 2017 meetings of S-100WG. We do not feel that we could add a lot of value by pointing all these mistakes at this stage. We believe that within due time mistakes such as wrong colour token, missing specification of a colour token, wrong symbol shape reference, etc. in the portrayal catalogue will be fixed.

6. Main observations reported in this paper focus on the still open issue of portrayal method - XSLT or Lua ?

7. We have observed similar drawing speed performance issues as SPAWAR with a conclusion that XSLT combined with current feature catalogue is not suitable for end user product intended to draw S-101 ENC charts

7.1. The worst performance issue is with spot soundings. This issue is a combination of the design decisions of S-101 feature catalogue together with S-101 portrayal catalogue. Processing of spot soundings is totally different from portrayal of other feature object already implemented in the test version of the portrayal catalogue. Spot soundings need in addition to feature objects and attributes also the full geometry of the S-101 ENC dataset. This is because spot soundings are unique in use of 3-dimensional spatial coordinate (location + depth) while all other 3-dimensional feature

objects have their depth or height as an attribute. In spot sounding rich charts this may cause up to 2-3 seconds additional processing time for the drawing, which is off course beyond acceptable (this even after we optimized input to XSLT to be only z-values of spatial part referenced by the spot soundings). Figure 1 explains the process path spot sounding and figure 2 explains the process path for feature objects which do not need to access spatial geometry during the XSLT processing.

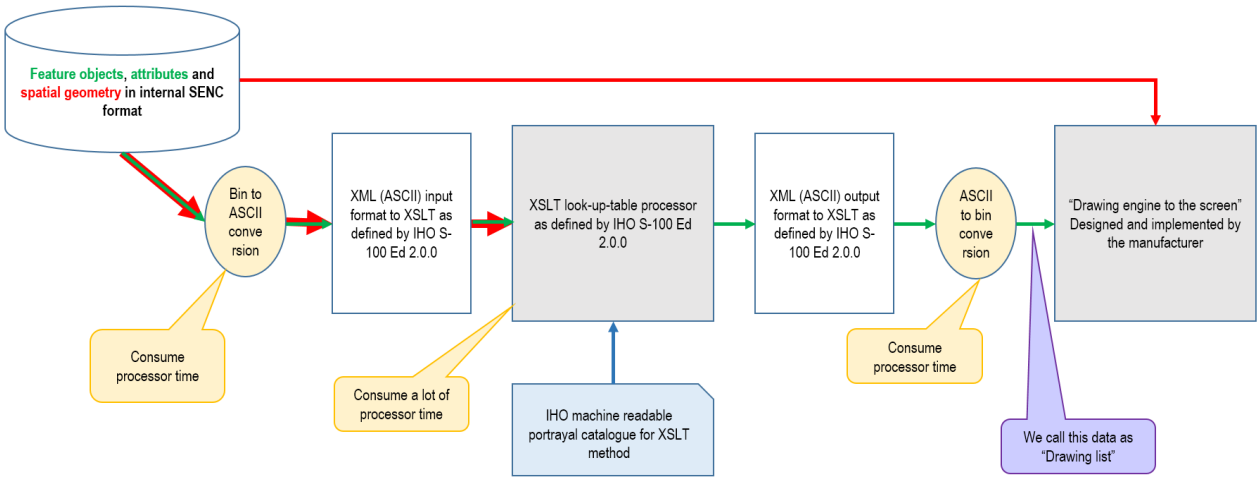

Figure 1 - Process path spot sounding

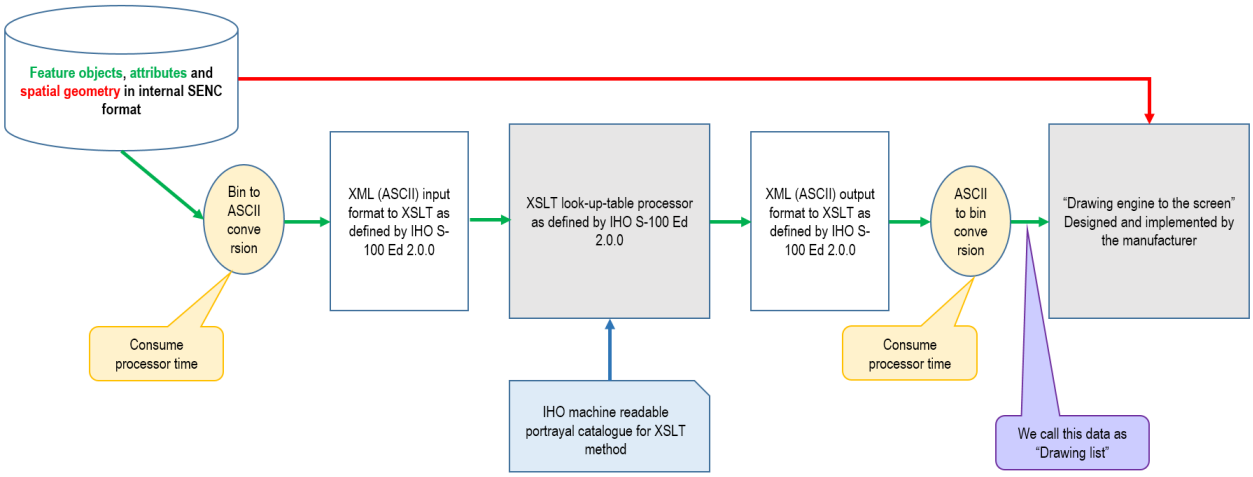

Figure 2 - Process path for feature objects which do not need to access spatial geometry during the XSLT processing

7.2. Portrayal of feature object which include everything needed for portrayal is not such a problem as spot soundings. For them the processing delay penalty is in scale of hundreds of milliseconds (when compared to S-57/S-52 implementation using the DAI file of the S-52 presentation library). The source of this processing delay is ASCII text conversions. The XSLT processor reads XML encoded ASCII text and output XML encoded ASCII text. At input the binary based SENC content is needed to convert as XML to XSLT processor and at output the XML based drawing instructions need to be converted into suitable binary format for the actual drawing engine.

8. Manufacturer proprietary hardcoded internal optimization as listed below might be enough to solve drawing speed performance issue, but that kill the IHO promise of "possibility to update S-10x products without sw upgrades by the manufacturers)

- Handle only subpart of soundings, etc. based on intelligent algorithm
- Cache the result and input geometry into SENC format to avoid processing again
- Pre-filter before look-up-table processing by scale, etc.

Proposals

9. The spot sounding issue is in some details analogue to the CSP (Conditional Symbology Procedure) issue. The S-101 solution to avoid hardcoded CSP of the S-52 style presentation in the S-100 sw implementation has been to have additional attributes supporting the portrayal attached to each feature object (for example the underlying depth area is available as an attribute instead of being solved from chart content by the portrayal). The spot soundings miss this kind of attribute which would make the feature object itself self-sufficient. Obviously the consequence would be that

spot soundings would be encoded as 2-dimensional geometry with an attribute value containing the depth (i.e. in same style as depth areas, etc.)

10. One could ask if there is any other way how to solve the spot sounding issue. Obviously one could pre-process the import of S-101 ENC chart into the SENC so that there would a proprietary hidden manufacturer attribute to contain the depth of each spot sounding. But result would be loss of the key feature of the S-100 concept as whole - the IHO promise for maritime community has been machine readability and resulting ability to update feature object models and their portrayals without ECDIS manufacturer introducing software upgrades. Therefore this issue is important to solve so that unmodified feature and portrayal catalogues can be used by ECDIS manufacturers.

11. The spot sounding issue can be seen as generic - all spatial attributes, for example low accuracy, etc. should be moved from the spatial geometry part of the S-101 as attributes as this is the one and only way to enable enough performance for the viewers. The spot sounding issue including the generic extension is independent of XSLT or Lua as the technical method of implementing the "look up tables".

Conclusions

12. Mandatory minimum is to solve the spot sounding and similar generic cases issue.

13. The XSLT method might survive as feasible portrayal method for simple feature object models of some foreseen S-10X Product Specifications. However the always present performance penalty from binary ⇔ XML ASCII conversion would call for selecting the Lua as the portrayal method. We need to remember that current testbed viewers are typically drawing only a single chart - the real life ECDIS product need to handle tens of parallel ENC chart plus all not yet implemented/tested things such as multiple S-10X product at the same time, alerts and indications based on S-10X product specs, etc. If we ignore the seriousness of the drawing speed, the result might be that manufacturers need to go for proprietary optimization of their drawing engines which will break the dream of machine readability and upgradeability of the future ECDIS systems without a need for simultaneous sw upgrade.

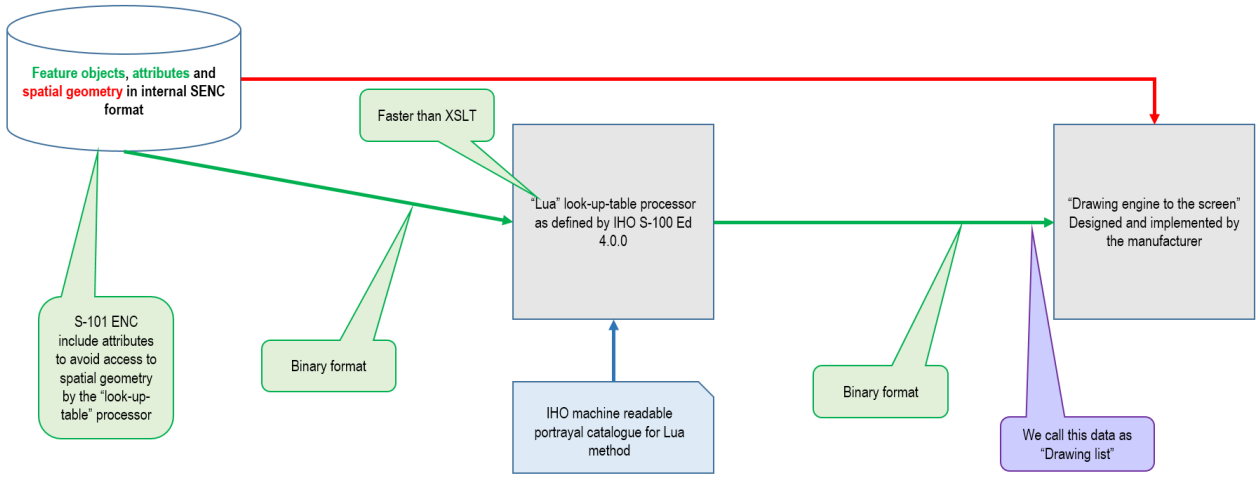

Figure 3 - Possible improved process path based on Lua

Action Required of TMS5

The TMS5 is invited to:

a) note the issues presented in this paper

b) consider what is the best way forward and act based on that decision

Annex A, Sample screen shots from the prototype

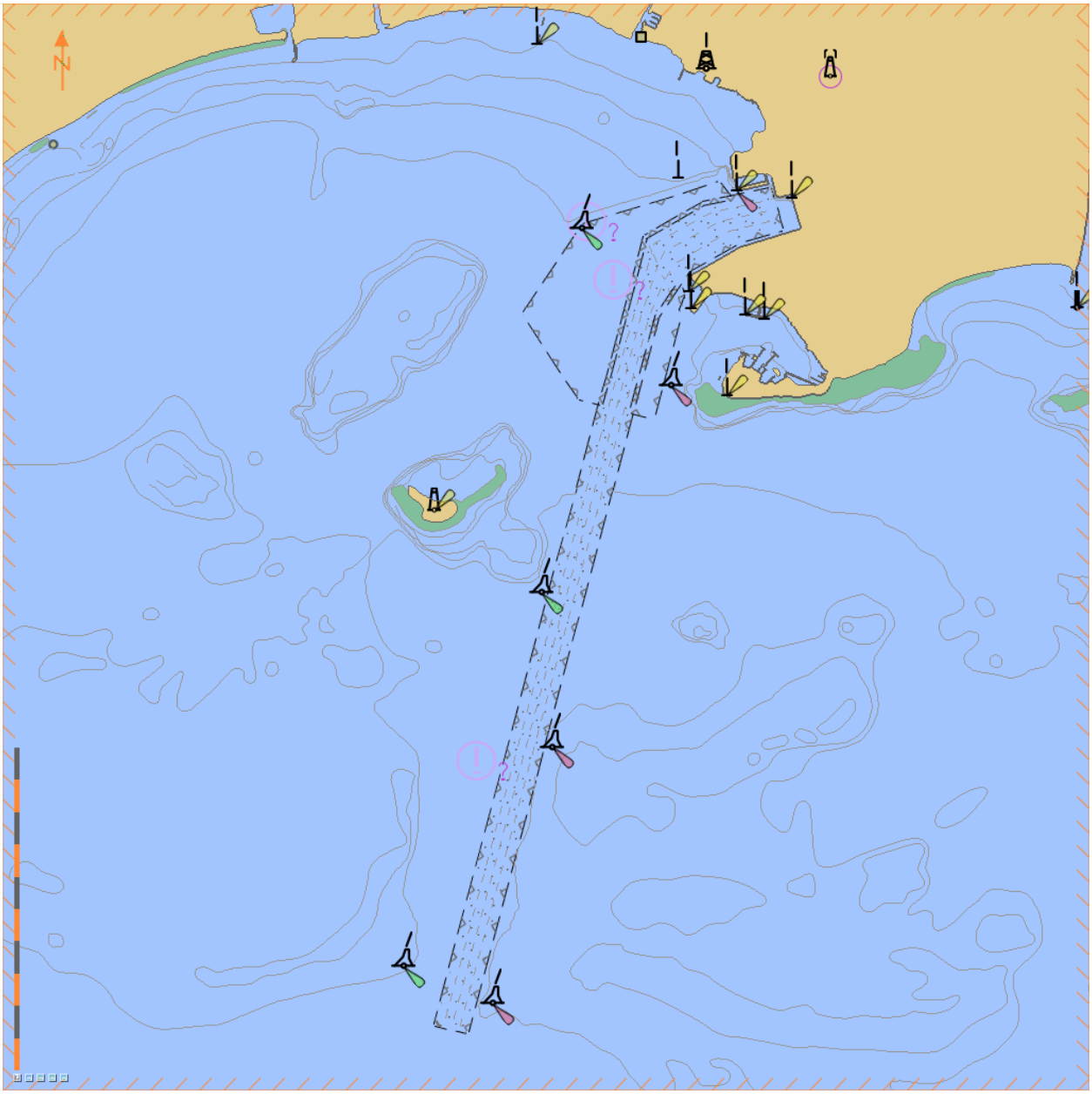

Chart AADLULBD05 without spot soundings

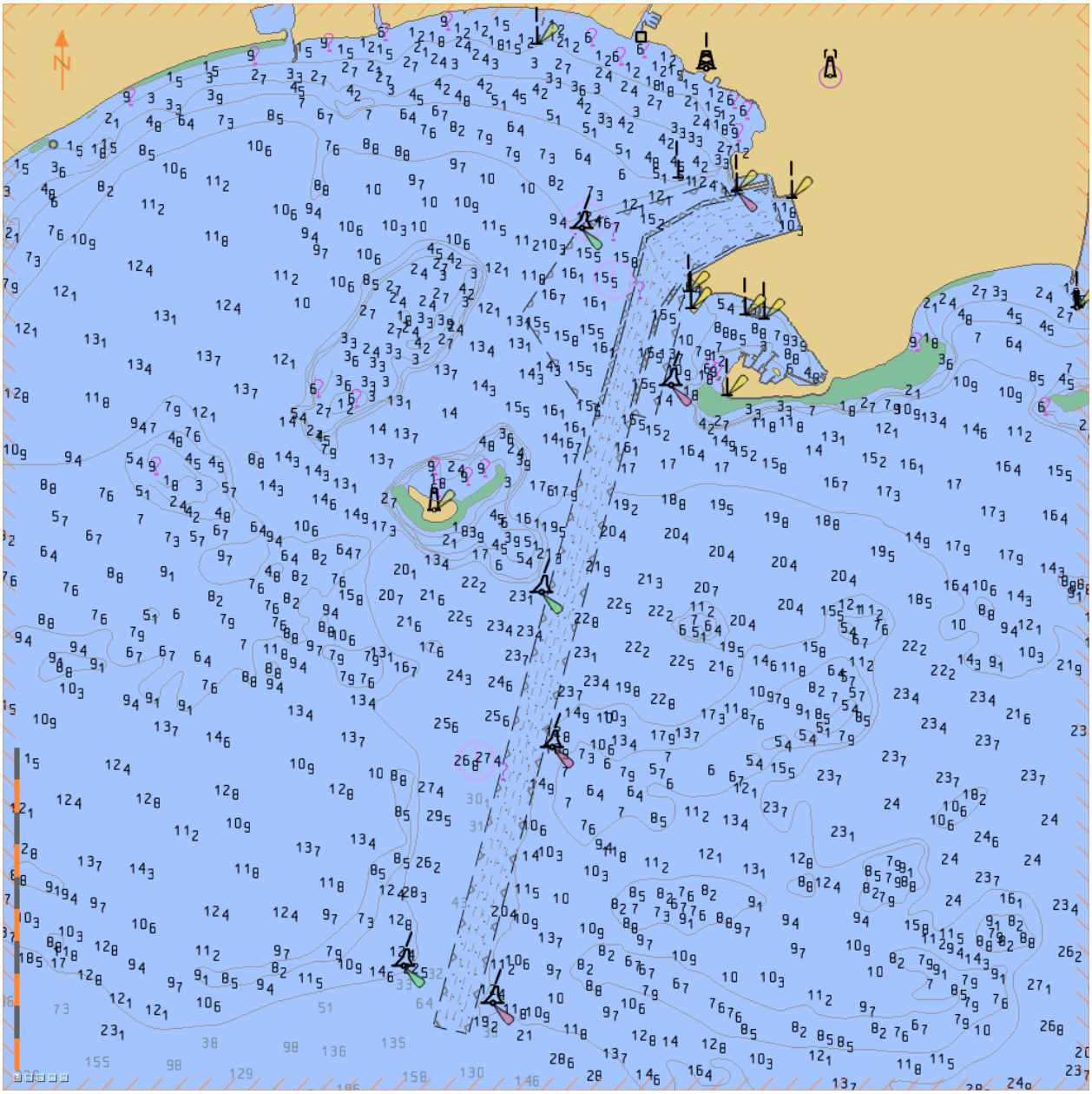

Chart AADLULBD05 with spot soundings

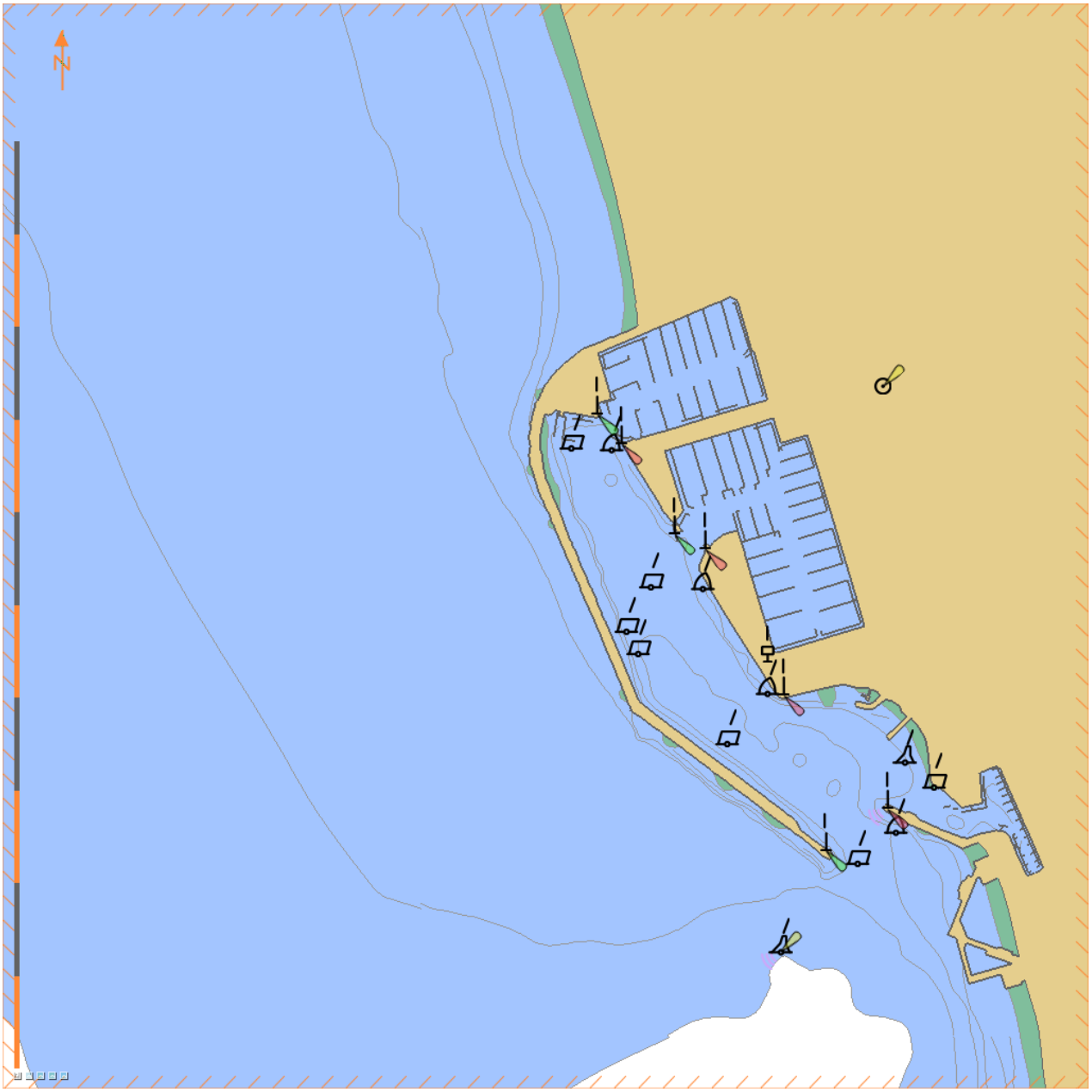

Chart AADLULGD03 without spot soundings

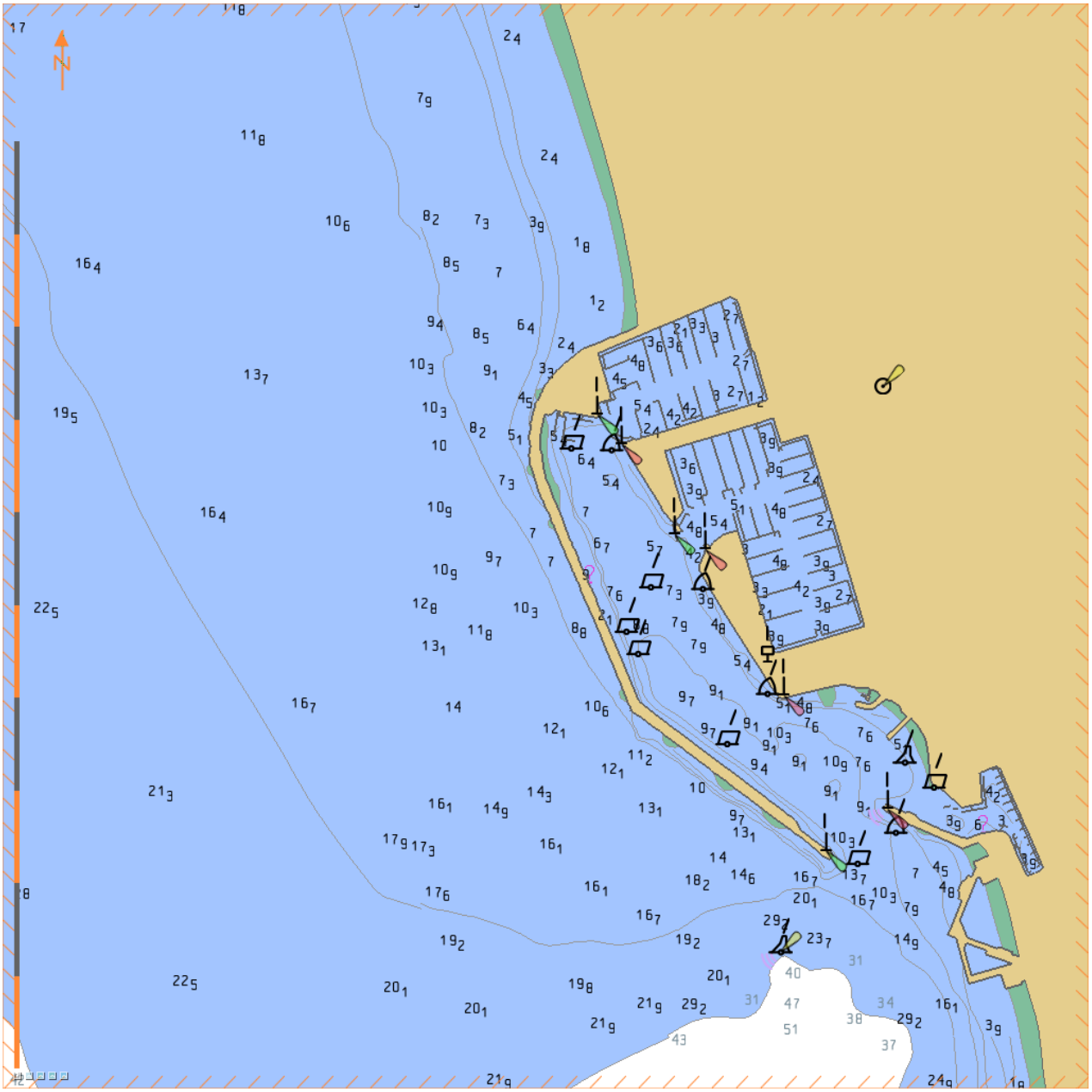

Chart AADLULGD03 with spot soundings