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Paper for Consideration by NCWG

Paper Chart Automation

Submitted by:	Esri (Craig T. Greene and Patricia Sheatsley)
Executive Summary:	Automated chart production in the maritime domain, what are its limits and what, if anything, can be done to remove those limits
Related Documents:	None
Related Projects:	None

Introduction / Background:

1. As mapping technology continues to evolve, automation is being leveraged in a variety of domains to generate hands-free navigational-quality products. In the maritime domain, a high level of automation can already be achieved when authoring paper charts. However, automation is most likely to thrive where predictable and repeatable patterns can be found; yet, there still exist some aspects of nautical paper charting where the patterns are seldom repeatable or predictable.

   This paper outlines some of the aspects of nautical paper charts that make automation more elusive than it has been in other domains, and asks the NCWG if there is interest in using the standards to support repeatable, automatable, cartographic patterns.

Analysis / Discussion:

2. Factors limiting automation:
   - Links between S-57 and S-4 are not always explicit
     - 2..1. Maritime paper charting standards are engineered around a graphics-based approach, rather than being attribute-driven.
     - 2..2. Unique interpretations of the symbology thwart “off-the-shelf” solutions.
   - Inconsistency in paper chart layouts
     - 2..1. Multi-plan sheets
       - 2..1.1. It is difficult to organize multiple plans on a single sheet in an automated way that would accommodate the unique layout patterns found in many nautical charts.
       - 2..1.2. Single plan sheets are more conducive to automation.
     - 2..2. Locating marginalia within the plan (map face).
       - 2..2.1. When content, like title blocks, projection information and explanatory notes, is contained within the map face based on available space over land or other navigationally insignificant information, it guarantees that each chart will require manual finishing to place those elements.
       - 2..2.2. If marginalia is located outside the plan, it can be fixed in the same location for every sheet.

2..3. Scales

2..3.1. Many hydrographic offices maintain a portfolio of charts that cover a dozen or more scales of paper products (over 100 unique scales in some cases).

2..3.2. Automation is more achievable when there are fewer product scales.

- Precise text placement

2..1. Powerful label engines already exist, but none can yet compete with a human cartographer.

2..2. Is automated placement good enough though?

- Inconsistency in data coverage

2..1. High resolution data is only captured in navigationally significant areas, making it difficult to neatly grid product extents, as they are in the topographic domain.

3. Feasibility of change
   - Many of these factors exist for very legitimate reasons, and it may be unreasonable to suggest major modifications to them.
4. As the thought leaders driving the standards for maritime cartography, how does the NCWG envision the future of paper products?
   - Do you envision automation, or even web-based chart production, impacting the future of paper products?

Conclusion:

5. Automated cartography is being employed in virtually every mapping domain, and this trend is unlikely to leave nautical charts left behind.
6. Many of the aspects of nautical charting that make it difficult to automate may not be easily changed.

Recommendations:

7. Author a standard that uses attribute-based logic to determine S-4 outputs
   - The S-52 standard, with its presentation library, and the latest S-58 standard, Version 6.0.0, both leverage SQL-like attribute definitions to derive their outputs directly from the S-57 encoding.
8. Define a standardized layout
   - Consistent marginalia placement ‘around’ the plan – outside of the map face.
   - Encourage the adoption of single sheet plans.

Justification and Impacts:

1. Justifications

1.1. There are several factors (the evolving mission of the hydrographic office, budget pressures, advances in mapping technology, changes in usage-patterns) that are driving the demand for more automation from production systems.

1.2. Where graphics-based applications were more common even just a decade

ago, ENC-first, database/attribute-driven symbolization is becoming (or has already become) the norm.

1.3. If the shift away from heavy human-interaction and toward machine driven automation is unavoidable, the NCWG should be the organization that defines what constitutes the nautical chart of the future.

2. Impacts

2.1. Resources to author an attribute-driven standard that utilizes SQL-like operators to derive S-4 symbols from S-57 (S-101) attribution.

2.2. Resources to define a standard paper chart layout that is suitable for automation.

Action required of NCWG:

3. No action required unless NCWG agrees that there is value in creating an attribute-driven set of symbology rules and a standardized layout.