Towards Consistent Production of Marine Information Overlays: Configuring ESRI’s PLTS Nautical Solution

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Methods
To produce the computer environment for consistent production of the MEP MIO several products needed to be produced or configured:
- MEP Specification Sheet
- XML Schema Maps
- MEP MIO Database
- Field Filter table Entries
- Master Condition Table entries
- Error table entries

The database created integrated new MEP MIO features from the specification sheet with ENC features. The XML schema maps were created by merging the database schema with the specification sheet. Figure 1. Filter Master Condition and Error table configurations were completed using Microsoft Access. These modifications were created to provide attribute constraints on the MEP MIO features during maintenance and creation and error messages when constraints are violated.

Results
This project sought to create a computer environment conducive to consistent production and reproduction of Marine Environmental Protection Marine Information Overlays in S-57 format. To create this environment ArcGIS PLTS Nautical Solution was configured to perform the necessary functions to constrain attribution and ensure geometric coincidence. Additionally database customization occurred to provide a storage container for MEP data, conceptual work flows for MIO creation were developed, and XML maps developed to provide a means to import and export data.

To meet the import requirement modifications were made to the XML configuration file. The modifications made to the XML document allowed for importation of existing ENC cells and MIOs into the database (this functionality is not fully tested). To meet the construction of attribution and geometric coincidence requirement three configurations were made: database and knowledgebase configuration, and topology rule implementation.

A new database model was created that allowed for storage of ENC and MIO data together. This allowed the MIO and ENC data to interact and ensure coincidence of geometric representations through ArcGIS functionality. To ensure proper data coincidence topological rules were created and implemented through ArcGIS. Topology management is controlled by core ArcGIS and implemented as expected.

To constrain attribution of features the ENC knowledgebase was configured. Conditions defined using where clauses for attribute control properly constrained values, filters disabled and enabled the proper attributes for editing, and when a condition was violated during on-the-fly attribute validation the proper error was through and the edits to attributes were not accepted. For the polygon subtypes of both coral reef and marine protected area the conditions for attribute control did not work properly during on-the-fly attribute validation but were caught using Data reviewer attribute validation. result of errors in the PLTS application code that has been verified by the client.

Export functionality was not reached. The export functionality has been thoroughly tested and the final diagnosis for failure is the PLTS Nautical Solution application. The software is failing to properly update PLTS controlled attributes. These attributes are necessary for maintaining the connection between geometric primitives and feature geometry. This results in a mismatch within the table and causes the export engine to fail every time an export is attempted. This is a documented and known problem with PLTS Nautical Solution at the .9.2 build.

Conclusion
In conclusion this project examined and extended the current abilities of the Environmental Systems Research Institute’s PLTS Nautical Solution to make it viable for MIO creation. This project focused on three aspects of ESRI products for extension or modification: The Electronic Navigational Chart (ENC) data model, the data interoperability capabilities between the native ENC data format (S-57) and ESRI’s geodatabase, and the data management and maintenance capabilities of the Production Line Tool Set (PLTS) Nautical Solution.

Background
S-57 is the standard developed by the International Hydrographic Organization, IHO, for digital hydrographic data. Marine Information Overlays must adhere to it and as such the data used in MIOs is very labor intensive to maintain. Using GIS has enabled the consistent production and reproduction of data used for these purposes. Still, several key factors must be kept in mind: storage of features and interaction to ensure proper coincidence of features, proper importation and exportation of the data, adherence to standards.

Problem
A Marine Information Overlay (MIO) is considered to be “supplementary information needed by the mariner” (Nelson, 2003). This data can be used for many purposes, but the overarching purpose is that of a decision support tool. This information should not interfere with the primary decision support tools it is being used with, i.e. ENC. Ensuring MIOs are standardized, consistent, properly coincident, and do not interfere with ENCs or navigation is the problem this project worked to solve. In order to do so, a preliminary MEP encoding guide needed to be produced (built on the NOAA MEP encoding guide) and ESRI’s PLTS Nautical Solution needed to be extended in three ways: import/export, knowledgebase configurations, and topological rule definitions. In addition workflows documenting the conceptual creation and best practices needed to be developed.

Acknowledgements
Special thanks to Rafael Ponce and Andy Ommen from ESRI, and Douglas Flewellong and James Ciarocco from the University of Redlands.