

US Army IENCs and Hydrographic Database Technology

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An essential feature of any charting programme is continual maintenance and dissemination of consistent, updated and significant products. With recent advances in Hydrographic Product Database (HPD) technology it is now possible to link and merge paper-chart and IENC production. Since USACE paper charts vary in currency, format and presentation, new production methods are being explored. As part of its navigation programme the US Army Corps of Engineers provides nautical charts for more than 9,100 miles of inland waterways in 23 different river/waterway systems. Thirty-five of the forty-five Corps District & Division offices independently contribute to or publish navigation charts. These chart folios are based on satisfying local needs and requirements, resulting in numerous variations in physical format, size, symbol-set and publication frequency.

Inland Waterway IENCs

In 2001, the Corps initiated an electronic-chart programme to develop and support new digital charts for electronic navigation on US inland waterways. The programme began by transforming existing digital river data and digital chart data into a new product: the Inland Electronic Navigational Chart (IENC). As of September 2004, 56 IENC cells have been produced and published online. Updating navigation charts, whether paper or electronic, is an essential safety element for any vessel.

Numerous changes regularly occur in the river system, including channel dredging, construction, navigation-aid maintenance and natural variations in river bottom. Once significant changes occur a new edition chart is often published. Currently, the IENC programme is producing new-edition electronic charts and updating them at a faster pace than does the Corps paper-chart programme, where chart editions may be five to seven years old and must be updated manually.

Mississippi River

In 2003, in conjunction with the USACE, IIC and 30001 Inc. developed a prototype paper chart derived from Mississippi River IENC data. The principal objective of this project was to determine the practicality of producing paper-chart products from IENC data using existing CARIS GIS and HOM tools. Other objectives included investigating large-volume production feasibility, process automation potential and alternative digital formats. The prototype chart was designed to join with the NOAA Mississippi River Chart 11370 and continue up river to approximately Mile 324. The final product was envisioned as a double-sided chart, easily folded into multiple segments for convenient use and easy printing of individual sections, even on a consumer-grade colour printer.

The production effort initially concentrated on creating a custom IENC import procedure to semi-automatically extract all spatial and attribution data required for the paper chart. Since IENC data only covers a narrow 2-mile wide corridor along the main waterway, supplementary information (roads, levees, tributaries etc.) was imported for more uniform data coverage and to enhance the aesthetics. Cartographic presentation was tackled next. Creating cartographic borders, scale-bars, graticules and positioning text proved to be both challenging and labour intensive. Addition of a custom colour palette and presentation library enhanced the data.

The resulting paper chart (Figure 2) is an accurate and visually pleasing representation of the source IENC. The CARIS GIS and HOM tools have proven suitable for the task, providing the features needed to fulfil this project. These tools also supported automation of certain portions of the process. Several raster versions of the final product were also created to support internet distribution (PDF), ECS devices (BSB) and other GIS applications (GeoTiff). In addition, some possible improvements to the process were identified. These included better support for cartographic presentation, IENC attributes extraction and, above all, the ability to preserve a dynamic link between the source IENC and paper product. Overall, the project was largely successful and all objectives were achieved.

Atchafalaya River

As a follow-on project, a second paper-chart prototype was derived from the Atchafalaya River IENCs. Again the principal objective was to judge the feasibility of producing paper-chart products from IENC data. However, this project's emphasis was on large-volume production issues utilising the latest technology offered by the CARIS Hydrographic Production Database solution. Additional focus was placed on limiting the manual production effort and long-term data maintenance aspects. The final product was a double-sided chart, folded into multiple 8 1/2" x 14" segments to facilitate printing of individual sections using standard-size printer paper.

Initially the production effort focused on importing IENC data into a HPD source database, which was easily accomplished due to already existent S-57 import tools. Once loaded, source data was modified to create seamless coverage ready for further production. The lack of data outside of the 2-mile corridor along the main waterway posed the same concern as before. Consequently, additional data (roads, levees, tributaries etc.) was imported to fill in the "white space" and provide more comprehensive coverage. Cartographic features such as border, scale bar and graticule were far easier to manage this time due to the intuitive tools already present in HPD. Text

extraction from S-57 attributes and its subsequent placement were also much better supported.

Like the Mississippi project, the resulting Atchafalaya paper chart is an accurate and visually pleasing representation of the source IENC (Figure 3). The HPD platform performed well and provided intuitive tools for virtually every step in the project. Overall, the pilot fully met all expectations, while the level of automation was increased and the dynamic link between source data and final product was retained.

Superior Approach

Both pilot projects resulted in a similar outcome and as such each method represents a practical solution for creating paper/raster products using S-57 format data as the principal data source. However, the HPD-driven approach is far superior in almost every respect. It provides improved production workflow, many more advanced tools for paper-chart production and better support for the cartographic framework. It also allows for a far greater level of automation, ultimately reducing manual effort. Consequently, it is more suitable for large, long-term projects. A number of other potential opportunities and benefits are possible with HPD. First, retaining a close link between source data and paper-chart products can significantly facilitate data maintenance and timely or simultaneous product release. It can also facilitate closer synchronisation between IENC and paper chart formats, resulting in improved consistency and version control across the entire product line.

Since the mission of the Corps is the collection of very broad, digital-source data, normally for multiple use for navigation, engineering and environmental purposes, GIS databases are constructed to serve the entire Corps planning and technical community. In this environment mapping tools and finished plates must be suitable for routine re-purposing and the support of multiple product lines. Digital and paper end products must both be maintained and consideration given to the integration requirements of larger Corps automated systems.

Overall, a HPD-like method may extensively streamline the production process and combine workflows across all products, significantly reducing dataproduction and maintenance costs. An important result of the project has been the initiation of a review of all paper-chart requirements by the Corps for standardising physical format, symbol sets, update cycles, linking to IENC production, and exploring print-on-demand.

Related Links

- www.mvn.usace.army.mil/ENG/s-57/index.asp
- www.tec.army.mil/echarts
- www.iictechnologies.com

<https://www.hydro-international.com/content/article/us-army-iencs-and-hydrographic-database-technology>
