

# "Production and Distribution of ENC-The Portuguese experience"

Lt. Cdr. Luis Pais

Instituto Hidrográfico – Portugal (IHPT)

Rua das Trinas, 49 1249-093 Lisboa

T: (+351) 21 3914073 E-mail: hidrografia@hidrografico.pt

## **Abstract**

The IHPT, the official Nautical Chart production organization in Portugal, has been developing since the beginning of the late 90's a reengineering of its chart production methods. From the implementation of a digital folio production structure based on commercial software, concurrent with the traditional paper chart production methods, this dynamic and flexible structure has also developed for last two years the necessary ENC production and update capabilities. Member of PRIMAR, the first established Regional Electronic Navigation Chart Center (RENC), under the WEND concept, the IHPT experience has proven that the exchange of information and technical cooperation, such as the common effort for a final high quality product, within an international body can improve and provide the right framework for the optimization of a work flow production and to be a major contributor for the modernization of a traditional Hydrographic Office.

## **Introduction**

Following the global proliferation of information technologies, the availability of very accurate positioning systems, such as the Differential GPS Systems (DGPS) and the miniaturization of powerful computer machines, the Electronic Chart Display and Information Systems (ECDIS), were the technological driving forces for the development of Electronic Nautical Charts (ENC). At the same time, standards and specifications, both for ENC and ECDIS, have been developed through the International official bodies - the International Maritime Organization (IMO), the International Hydrographic Organization (IHO) and the International Electrotechnical Committee (IEC) - to the point where both official ENC and ECDIS have now reached the market.

## **Responsibilities**

Portugal, a maritime nation with historical references back to the discoveries era, in the fifteen and sixteen centuries, has the second largest European Economic Exclusive Zone (EEZ). Such a large geographical area requires a demanding technological and human effort not only to survey but also to update the seabed information. Being Portugal a member of the International Hydrographic Organization (IHO) and of the International Maritime Organization (IMO), a signatory country of the Safety Of Life At Seas convention (SOLAS), the IHPT, in accordance with national legislation is the sole national responsible for the production of nautical publications and cartography.

In accordance with the latest revision of Regulation 19, Chapter V of the SOLAS convention, it is stated that: "...*signatory governments will take measures with the aim of guaranteeing the highest*

*possible level of standardization for charts and nautical publications, taking into account wherever possible, the relevant international resolutions and recommendations...*” which means conforming to the IHO standards. Complying with the existing and future international recommendations, and believing that a new product such as the S-57 ENC will greatly contribute towards the safety of navigation, the IHPT has been developing, for the last decade, expertise in the world of digital cartography.

### **Traditional vs. Digital Cartography**

Traditional cartographic work, based on colour separation and manual processes, is the opposed of the digital hydrographic office (computer based) and in particular the production of Electronic Navigation Charts (ENC).

Traditional cartography, defined for the purposes of this paper as the manual techniques used for the production of a paper chart (before the advent of the computer), can be split in six components [Curran, 1988]:

1. Compilation Work – selection of the information collected for the production of the new edition of the paper chart;
2. Image generation – the process of assigning symbol type, shape and structure to features on a map;
3. Image registration – the technique to ensure that individual colour components fit each other in the map;
4. Contact copying at scale – the operation used to produce same-size line, half-tone and continuous-tone positives and negatives by a direct contact process;
5. Image separation / combination – the techniques used to produce multicolour maps by the sequential overprinting of a number of separate colour components;
6. Printing.



Figure 1  
 Traditional vs. Digital cartography

Geographic Information Systems (GIS) are automated systems for the capture, storage, retrieval, analysis and display of spatial data. In such systems, the final maps reflect an emphasis on query and response rather than display [Clark, 1995].

Although GISs were meant to assist data managers in the planning and decision-making they are usually supplied with an interface or contain their own cartographic display.

The generation of charts, in a GIS, provides the user with either an intermediate or a partial solution to a problem relieving the cartographer from tedious and error prone tasks and introducing the ability to manipulate colour and display parameters (perspective, scale, etc...), giving new types of maps and media display, such as the interactive multimedia and animation.

### The IHPT – three work flows and two final products

The IHPT has been developing the concept of digital hydrographic office since the beginning of the nineties. Facing the retiring of most of its cartographers, with a major background in traditional cartography, and planning ahead to introduce the Electronic Chart production, it seemed the right time to reengineer chart production processes and to introduce new survey methods and technologies.

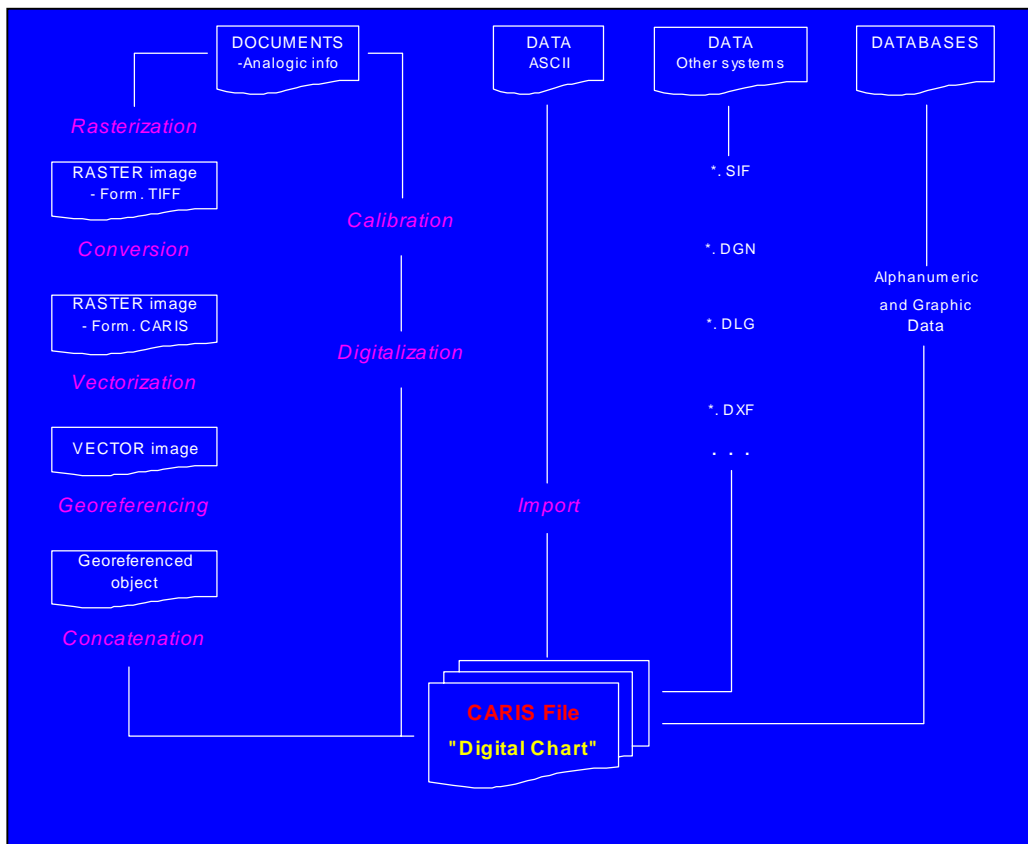


Figure 2  
Digital File Production - Work Flow

The availability of new technologies in positioning (DGPS OTF), survey (Multibeam) and charting (ENC) were the driving force for a major project that required a large investment in equipment, human resources (recruiting and training) and planning. After an international tender, CARIS software package was implemented and the first Nautical Chart produced by means of Computer Assisted Cartography was released in 1995. The integration of multibeam data in a paper chart was achieved in 1998 (26308 – Port of Setúbal) and the first ENC (PT526303) officially released in 2000.

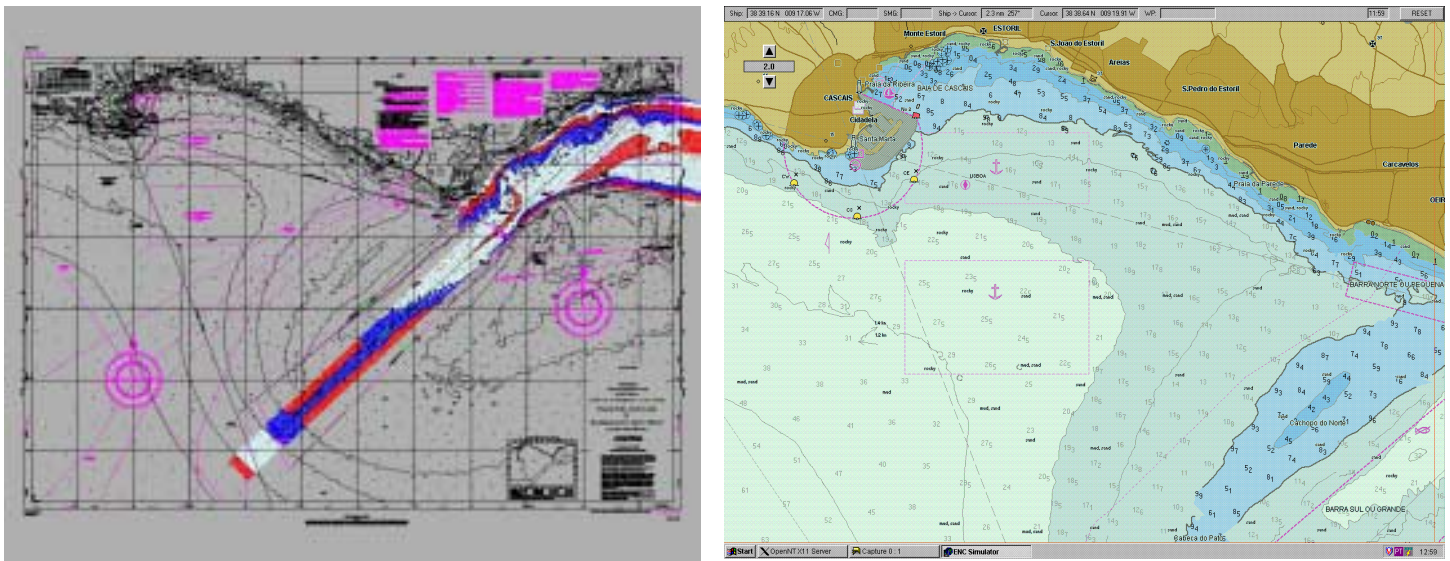


Figure 3  
Multibeam data on top of a CARIS file.  
Correspondent cell PT526303-Port of Lisbon

Some of the challenges of such a re-engineering of processes were the need to keep traditional paper chart production concurrent with GIS based cartography and ENC production. From the 53 paper charts folio, some of which included several insets in different scales – navigation purposes, 102 S-57/3 cells are planned for release. The need to keep a traditional cartography work flow, is due to the fact that IHPT decide not to “massively” digitize the all folio of paper chart and instead build new charts (GIS based) with updated information only, meaning that in order to keep the stock of needed nautical charts, there were not enough resources on the digital work flow production.

## The ENC production and updating

The ENC project started in 1998 with the implementation of ENC production / Quality Control software (CARIS and SevenCs) and training of four technicians, two of them to integrate the ENC workflow production. By the end of 1998 the first test data set (Cell 115 – Corvo e Flores) was produced. During 1999 the coverage of the Port of Lisbon was a priority. Both office and on board (hydrographic survey ship D. Carlos I) Quality Control tests were run intensively. The first official S-57/3 ENC was released in February 2000, through PRIMAR's authorized distributors.

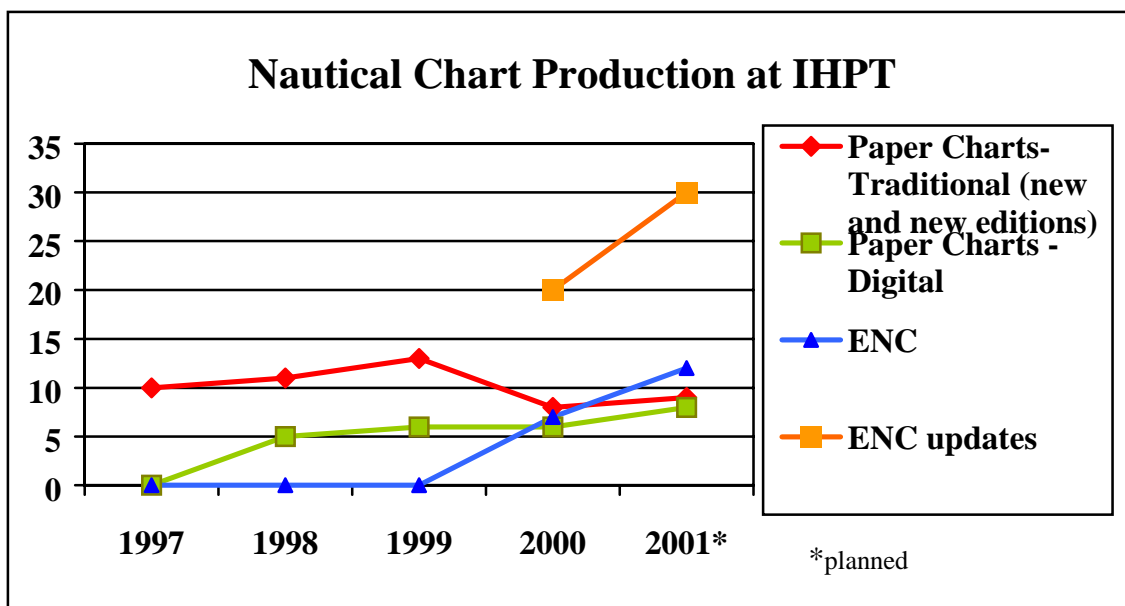


Figure 4

Nautical Charts production at IHPT

Updating has always been a complex and demanding task in S-57/3. The issue of synchronization with Notices to Mariners (NtM), logistic and legal issue, has caused a debate within all the group of people involved in production, with the important contribution and sharing of ideas at the various working groups in PRIMAR. Although the legal implications of not having synchronization in place are not yet clarified, the IHPT is currently issuing ENC updates (PRIMAR's weekly CD) at the same week they are available to the public at the Internet.

## IHPT and PRIMAR

The Portuguese Hydrographic Institute has signed the Helsinki agreement in 1997, becoming a founding nation of the first Regional Electronic Navigation Chart Centre (RENC) in accordance with the WEND principles. Being the most southern nation of this organization was the driving factor that caused the former Northern Europe RENC to change its name to a broader European RENC. Since then, an ENC official service was established under the brand PRIMAR with the sole purpose “to act on behalf of Cooperating Hydrographic Offices, as their common instrument, to assemble their national Official hydrographic vector data into a consistent, uniform ENC service, to make it widely available, to contribute to the safety of navigation, the protection of the environment and the effective operation of maritime activities”.

The IHPT, a cooperating office of the RENC, has been actively involved in the technical working groups, sharing experiences and contributing to a better understanding of the navigator expectations and needs from a new navigation tool, the ECDIS. The content of Portuguese ENCs are not just in accordance with an international format but also tend to reflect the richness of information dispersed through a multitude of nautical publications, with a special emphasis on detailed metadata.

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