MARITIME SAFETY INFORMATION RELAY THROUGH NAVIGATIONAL DATABASES - A step towards E-Navigation

Rafael da Silva, Paulo; Bessa Pacheco, Miguel; Reino Batista, Rui; Plácido da Conceição, Vítor; Lopes, Ana
Instituto Hidrográfico – Portugal

The concept of E-Navigation is still in a very early stage, in which identification and definition of its key elements is still occurring. However, there is already some consensus regarding the need of efficient data channels enabling a timely exchange of maritime safety information (MSI) such as: status of aids to navigation, navigational warnings, traffic constraints, pilotage services, etc. Another related issue is the ongoing discussion on web capabilities and web based services that will be included as a part of E-Navigation.

This paper is focused on explaining the work made in Portugal by the Instituto Hidrográfico (IH) developing web based services, supported by robust navigational databases, which are already providing mariners with MSI in an organized friendly manner.

Apart from tidal and wave information, IH has been using the web to disseminate periodic Notices to Mariners for a long time, but that was initially done in a rather simple way by providing digital (PDF) versions of the traditional journals. This has evolve in such a manner that a mariner may, for instance, verify the complete record of changes of a nautical chart or publication, consult product by product, create a custom portfolio and be automatically warned whenever it suffers a change.

Navigational databases and development of new services continue and IH expects to be able in the short term to provide a planning tool incorporating all the necessary information for planning a voyage, such as nautical charts, sailing directions, list of lights and MSI.

This paper will render the technical basis of the products being developed as well as the particulars that point to consider them as possible elements of E-Navigation.

INTRODUCTION

Instituto Hidrográfico (IHPT) is the Portuguese representative in the International Hydrographic Organization (IHO). It is a Portuguese Navy Central Department of Administration, reporting directly to the Chief of Naval Staff.

Devoted to marine sciences and technology, constantly aiming to provide high quality services and products, IHPT has been able of successfully satisfying both military operational requirements and a large number public services.

IHPT achieved the nomination of State Laboratory in April 2002.

IHPT's multidisciplinary capabilities often interact, namely in its core areas: Hydrography, Navigation and Oceanography. This has generated extraordinary amounts of data, either gross or processed, which forced IHPT to develop its own data management capabilities, that by itself has enabling the provision of new products and services, allowing a true reinvention of itself.

IHPT has been ensuring the fulfilment of Portuguese responsibilities in many issues related to the Safety of Life at Sea Convention (SOLAS)[1], explicitly producing nautical charts, electronic navigational charts, nautical publications and providing means to correct them by issuing Notices to Mariners (NtM). In a different approach, IHPT also contributes for a safer navigation as a playing part of the World Wide Navigation Warning System, by playing the role of national coordinator.

DISSEMINATION OF NOTICES TO MARINERS – THE OLD DAYS

Nautical documents unique characteristic, the ability of being kept alive, is only possible due to NtM.

In Portugal, a few decades ago, NtM were called "Postal Notices". As a matter fact, they were a small booklet resembling a postcard and, once they were published, the best way to distribute them was by mail. That format evolved only in 1993, but only because of an easier archiving.

By 1998 IHPT could not resist any longer the claims of the information society. A group of technical and administrative personnel visited the "*Service Hydrographique et Océanographique de la Marine*"[2] (SHOM) in order to learn the organizing methodology and process of NtM dissemination via WEB.

One year later NtM started to be released in IHPT official website as a single PDF file. What by today's standards can be considered retrograde or even dull information, did actually meant, in those days, a giant step in terms of flexibility and speed.

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[1] SOLAS Chapter V, Regulation 4 – "Each Contracting Government shall take all steps necessary to ensure that, when intelligence of any dangers is received from whatever reliable source, it shall be promptly brought to the knowledge of those concerned and communicated to other interested Governments." (Refer to the Guidance on the IMO/IHO World-Wide Navigational Warning Service adopted by resolution A.706(17), as amended).
Regulation 13 – "(…) 3. Contracting Governments undertake to arrange for information relating to aids to navigation to be made available to all concerned. Changes in the transmissions of position-fixing systems which could adversely affect the performance of receivers fitted in ships shall be avoided as far as possible and only be effected after timely and adequate notice has been promulgated."

[2] French Navy department that provides hydrographic and oceanographic services for France.

THE FOLLOWING STEP – ANAVnet

IHPT's Navigation Division has been steered having in mind the main goal of reducing navigator's workload while enhancing safety of navigation, making available automatic processes when/wherever possible.

Thus, considering the frequent need of consulting the history of a particular nautical document in order to update it, along with the different types of information that could affect it[3], it was clear that a new "clever" solution was required.

IHPT's Navigation Division and Data Management Centre worked together defining requirements and building a new on-line application – ANAVnet.

ANAVnet was meant to be a friendly on-line application, supported by robust and secure databases, capable of providing either entire NtM publications, or single NtM affecting individual documents; allowing in any case consultation and printing, including entire correction pages of nautical publications and graphical annexes to glue on charts.

Simultaneously, a perturbing reality grew stronger in everybody's mind: the fact that too many vessels, specially fishing and recreational, were not fitted with a NAVTEX receiver, many of which did actually missed a VHF radio, and that meant a total incapacity of receiving coastal Navigational Warnings (NW). Something had to be done in order to provide those mariners access to navigational warnings, even if it were only in a planning stage while still alongside.

It was then understood that maritime safety information (MSI) was by nature compatible with NtM, thus ANAVnet should also provide the possibility of consulting NW. Being IHPT the national coordinator for NW, inputting of data was facilitated.

In matters of NW ANAVnet allows consultation of warnings broadcasted by any of the Portuguese NAVTEX stations, both in Portuguese and English languages.

ONE MORE GAP TO COVER

Apart from NAVAREA and coastal NW, the WWNWS establishes the possibility of issuing warnings for local mariners, clearly covering harbour or port areas, but leaves this issue as a possibility to be covered by coastal States.

In Portugal, Maritime Authorities and Port Administration are legally commssioned and empowered to issue Local Navigational Warnings. However, the ability to disseminate information was limited, relying on wall displaying near official building's and faxes to marinas and sailing associations, along with VHF broadcast.

IHPT considered the possibility of gathering this type of NW nationwide and make it available through ANAVnet, but for that full cooperation from legally bounded parties was required.

What actually came to happen was much more efficient: a number of profiles for those parties were created, matching their area of responsibility. Through a user/password authentication process interested partners may introduce directly in ANAVnet their Nautical Warnings.

[3] Permanent, temporary or preliminary NtM.

Additionally, an automatic e-mail generation capability was created, stating which area had been affected, containing the whole text of the NW and, naturally, the promulgation authority. This enabled a sharp control on arriving data, evaluating possible implications in coastal NW issuing.

That capability was later extended in order to inform all interested parties of a given area of all activity scheduled to their jurisdiction, thus keeping all players updated in near real time.

ANAVnet DATABASE STRUCTURE

In order to achieve the proposed goals it was necessary to correlated NtM, coastal and local NW with the existing chart folio and nautical publications; furthermore there was a need to associate geographical areas to designated local authorities.

Concept modeling was done based on interviews to end users, navy navigators and system administrators from IHPT Navigation Division.

Entity relationship models were used in order to depict relationships between different authorities and their unique description attributes.

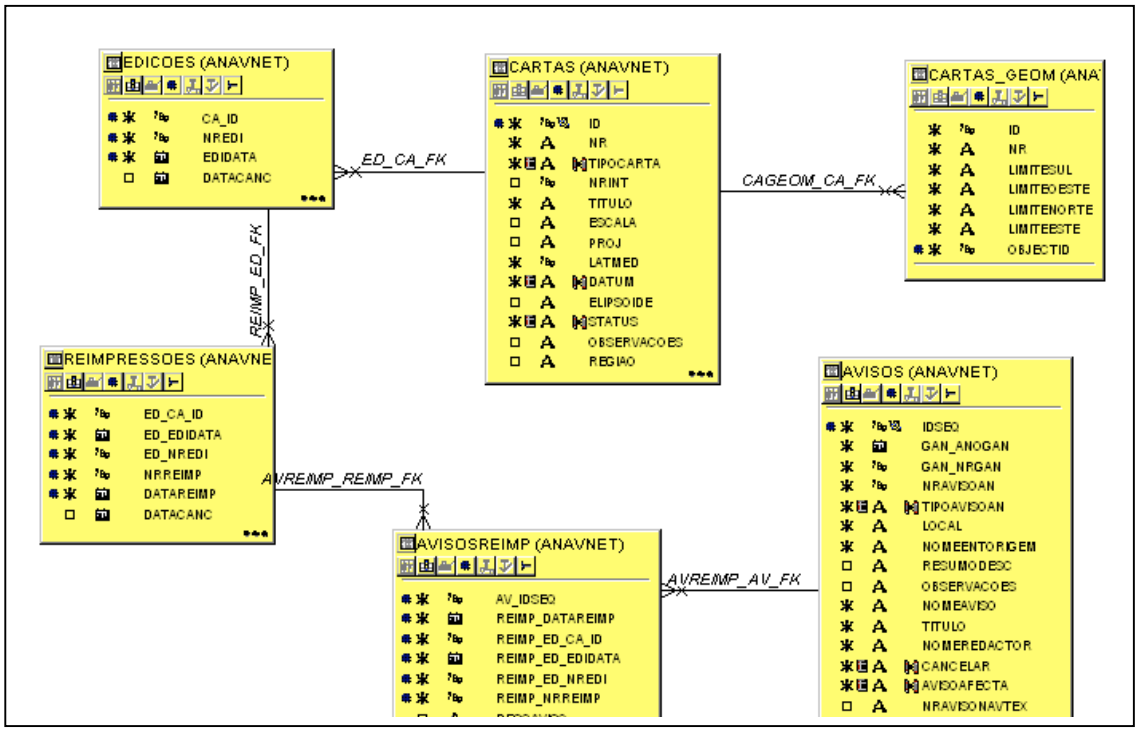


Table sample of ANAVnet process

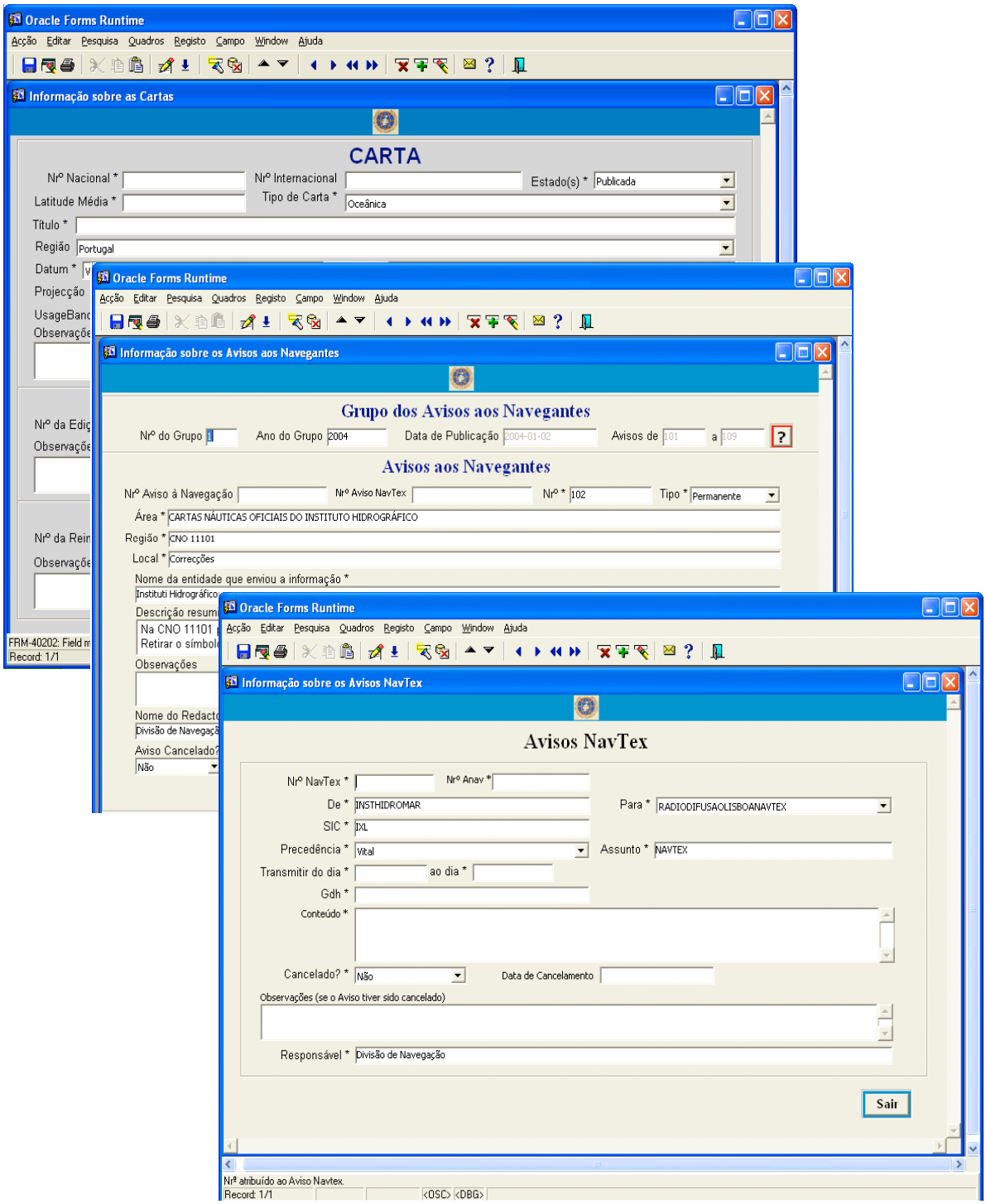
These models were then mapped to a set of tables in a database management system Oracle spatial.

A *relational-object* logical logging was used, where the graphic components (affecting for instant charts or publications) were stored as polygons or points in SDO

format (Spatial Data Option) in a table's column which describing attributes correlate with other tables through identification keys, or primary keys.

It was necessary to develop a few applications using Oracle forms in order to log the required data, both textual and graphical (polygons and points). This option allowed specific setup requirements in terms of man-machine interface.

All graphical data was kept accessible for other applications based on databases search. Furthermore, once they are given a geo-reference system they can be used in Geographic Information Systems.



Oracle Forms applications developed to log and search data

AN eNAVIGATION COMPONENT?

In spite of a still vague definition of eNavigation, all possible users, service providers and marine equipment manufacturers seem to agree that the final goal is to improve safety of navigation, while addressing security issues, as well as obtaining economical and financial benefits through standardization and efficient logistic processes.

Since ANAVnet deals with critical safety navigational information, making it readily available to a large community in a manner that could be easily implemented anywhere, and at reduced costs, it could be considered as part of the eNAV applications family that needs to be put in place.

Regarding eNavigation, a large number of requirements have been proposed resulting in an even larger number of matters that need to be addressed, such as significant gaps in world wide ENC coverage, the need of robust radio positioning systems and many more.

One particular aspect, that gathers wide consensus, is the need of a reliable communication network. For instance, Dr. Sally Basker has referred in many occasions that *"e-Navigation comprises a number of structural components"*, amongst which is the *"Transmission of positional and navigational information ship to shore, shore to ship and ship to ship"*.

In fact, data links have been included in the core of eNavigation diagrams since the concept was born. Meanwhile, Automatic Identification System (AIS) has naturally been included too. In spite of lack of statistics, IHPT believes that there is a growing tendency for abuse of the AIS VHF data link, using it for other purposes than the original ones (enhancing anti-collision and monitoring sea traffic), risking to compromise the service due to channel exhaustion.

Consideration should be given to the possibility of having the WEB as a possible component of eNavigation. IHPT believes that the WEB may cope with the need for dedicated, secure communication channels. We agree that some development will be required in terms of availability and standardization agreements; however, it could provide a number of advantages against the use of a radio link, such as lower pricing and resistance to spoofing or mystification.

The very modest way IHPT has been using the WEB, to provide ANAVnet quick updates, namely through RSS[4] which can be taken as an example of a simple channel of communication.

FUTURE DEVELOPMENTS

Looking forward to provide new added value service to mariners IHPT has probably found its way into eNavigation.

A List of Lights database is currently being developed and its will only have geo-referenced objects. Once completed, this database will be liaised with ANAVnet

[4] RSS is a family of Web feed formats used to publish frequently updated works a standardized format. An RSS document may include full or summarized text, metadata and author identification.
Initials "RSS" refer to the following formats: "Really Simple Syndication (RSS 2.0)", "RDF Site Summary (RSS 1.0 and RSS 0.90)", or "Rich Site Summary (RSS 0.91)".

in order to be automatically updated. Furthermore, it is intended to give remote access to Direcção de Faróis (Portuguese Lighthouse Authority), surveying teams and nautical charts compilers, providing an in-office/field application that enables real time updates.

There is still one more on-line application being developed, named “IH Skipper”. This application is meant to aid the planning stage of a short voyage along the coast (covering 150 nautical miles each time at the most); it will retrieve information from ANAVnet and List of Lights databases; it will add the real time information available from IHPT field sensors such as ODAS buoys, weather forecasts and possibly Sailing Directions information.