

**ECMAN
A STANDARD DATABASE MANAGEMENT SYSTEM
FOR ELECTRONIC CHART DISPLAY
AND INFORMATION SYSTEMS (ECDIS)**

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Abstract

Electronic Charting made its debut over 10 years ago in the Canadian Arctic. At that time, its applications were limited to keeping a ship in the centre of a very narrow, ice filled channel. Today, electronic charting is viewed by some as being an answer to many of the major concerns of the shipping industry. Electronic charts can provide the information, currently available in the various formats and locations on the bridge, in a single integrated display system. To do so, this information must be accessible and properly managed.

This paper reviews Universal Systems' solution to the data management requirements of electronic charting.

INTRODUCTION

Today, modern ships are being designed to include an 'Electronic Chart Display and Information System', ECDIS, to aid in navigation. In its most complete design, ECDIS integrates all aids to navigation into one system; that is chart information, positional information, ship's parameters such as course and speed, echosounder, radar and others.

The navigator will have continuous display of the ship's position and predicted movement, relative to the chart based hydrographic and topographic constellation.

It need not be said that this development makes new demands on the traditional chart makers and users. Both the International Hydrographic Organization (IHO) and the International Maritime Organization (IMO) are deve-

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loping standards for ECDIS. These standards are to ensure that functionality, reliability and integrity of these systems (in hardware, software and chartware) are at least equivalent to the paper chart.

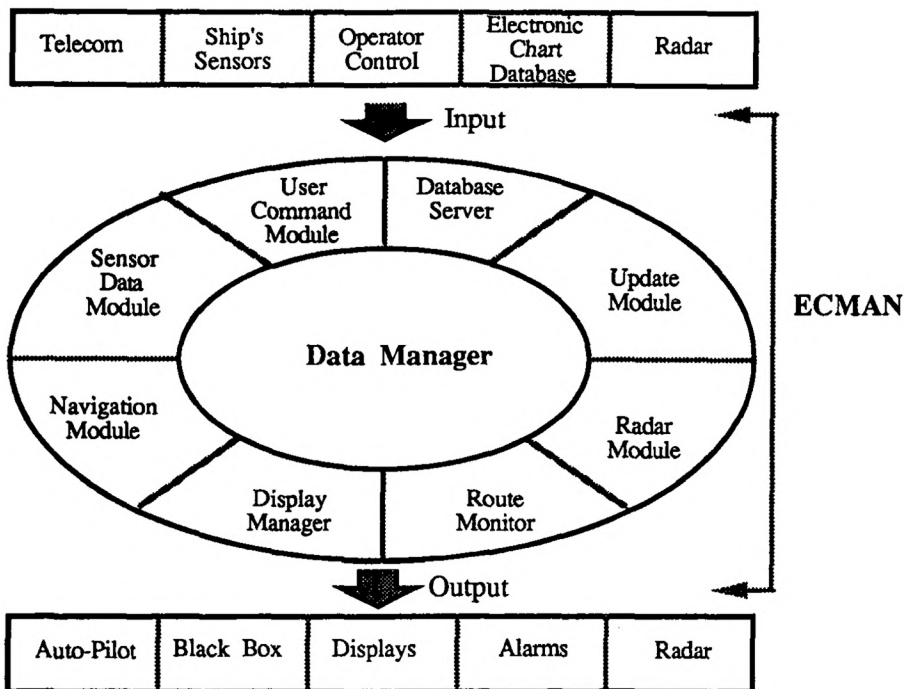
To gain insight into providing 'Electronic Navigational Chart Databases' as opposed to paper charts, and to assist IHO and IMO in developing standards, the Canadian Hydrographic Service contracted Universal Systems Ltd. to build an 'Electronic Chart Testbed'.

Universal Systems Ltd. accomplished this task, using the advanced technology of its Geographic Information System 'CARIS'.

In order to provide useful information, the Testbed had to fulfill and perform variances from the given standards, and therefore had to be completely flexible. For that purpose, it was designed as a group of functional parts, or modules.

A number of practical evaluations were carried out. Through demonstrations to the international marine community, the Testbed became a standard of its own. Universal Systems perfected and packaged the Testbed software into a general data management system for ECDIS: the ECDIS Manager, or 'ECMAN'.

Thus, ECMAN manages collection, storage, analysis, integration, and output of static and dynamic data.



The General Data Manager for ECDIS or ECMAN.

ECMAN is the kernel software around which marine equipment manufacturers and system integrators can develop their own computer aided navigation systems.

ECMAN FUNCTIONS

ECMAN modules are capable of performing standard ECDIS functions as specified by IHO and IMO. They also provide for output to extended functions, such as map matching, optimum routing and other expert system applications.

Database

ECMAN accepts electronic navigational chart information in the IHO adopted data format, which is designed for storing and transferring chart data. In order to use the data for selective searches and retrievals, it is more efficiently stored in ECMAN's internal format. Graphical features have their own data labels and can be selected as groups or tagged for individual selection. Graphical features can also be linked to other information, which may be an alphanumeric file or a key to an optional relational database.

Information can be requested by feature description or by a position. For instance:

- A request can be made for all soundings that are deeper than 10 meters.
- The database can return a feature or features that are located within a specified tolerance of a given position.

In this way, vital information can be presented automatically relative to the ship's present or predicted position. For example:

- An alarm will be triggered when the ship gets within a specific distance of a danger (shoal, wreck, shoreline, etc.).

The database is capable of handling multiple scales of data and data from multiple sources. A request can be made to find out what scales are available.

The ECDIS manufacturer can optionally produce and include additional information in separate database layers or a separate relational database. This information might include whereabouts of service centres or private information for an end user, such as fishing areas, survey data, or military data. Information for expert systems functions or other types of information processing might also be included in this way.

Updates

Updates of the chart database can be entered automatically from tape, diskette, and telecommunication link, or interactively. Updates are stored in a separate database layer and can be added and removed from the displayed chart without affecting the original chart data.

Sensors

Sensor input includes any information that can be used by the positioning process and to predict future positions. This information can also be used to predict counter-measures in order to maintain a desired course. Simple sensor input consists of only course and speed information. Information such as current, wind and tide may be incorporated if it can be made available.

Sensor input software depends upon standard hardware connections to sensor equipment. In many cases, a customised interface to the sensor hardware and processing of the raw information is required to obtain usable data.

Positioning

The positioning module uses input from electronic positioning systems, such as GPS or LORAN, and provides the ship's position to the chart display system. Positions are verified against tolerances to filter out obviously bad data.

Chart Work

Commands are available to allow execution of all standard functions currently done on the paper chart. Route planning includes waypoint editing with graphic display of intended route, and ability to move, delete, or add waypoints anywhere along the route. This allows the ECMAN software to calculate ranges and bearings along the route and to provide estimated arrival times and cross track errors. Distances, positions, ranges and bearings can be measured as separate functions.

Route Monitor

The Route Monitor package checks the current position against the intended position and calculates how far off course the ship is, what course to take to get back on course, when to initiate turns, and how long it will take to get to a certain point along the route. This package can also be used to output course correction information to an auto-pilot computer.

Radar

The Radar Module receives information from a real time radar digitizer or it may receive target information from an 'intelligent' radar (ARPA). This information is then processed, if necessary, and passed to the Display Module.

Display

The Display Manager enables the display equipment to display all information required for route planning, navigation, route monitoring and supplementary tasks. When first switched on, the system will present the IMO-specified standard display (default display), as appropriate to the chart scale. Other information can be displayed 'on demand'.

The display consists of a number of layers, which may be assigned priorities. ECMAN provides a set of default colours as specified by the IHO. The symbols used on the chart display are provided by a separate IHO-symbol file.

Similar to paper charts, ECDIS contains chart data sets for a number of chart scales. The display software allows multiple scales of chart data to be loaded for fast scale changes. Charts can be zoomed in or out for displaying intermediate scales. When a chart is viewed at an improper scale, or when larger scale data is available in the database the user will be notified of 'overscale' or 'underscale' condition. The ship's symbol is moved with respect to the position, course and course-made-good data. A history of the display may be stored and protected ('Black Box').

User Command Interface

The User Command Interface is a process that handles the direct communication with the user regarding system controls. Menus or touchpads may be used for this purpose.

As each manufacturer will want to create his own interface, ECMAN will provide the tools. That is, commands and formats that ECMAN can process.

CONCLUSIONS

Marine equipment manufacturers have been watching the developments of ECDIS. They have been waiting for standards to be set and data to become available. With the ever increasing popularity and acceptance of this new technology, marine equipment manufacturers are faced with a formidable task of developing their own customized electronic chart display, information and database management system. A solution to this problem is a software package that can handle the database management and display criteria and allow the individual manufacturer the freedom of using his own hardware and user interfaces to provide a customized product. This would free the marine equipment manufacturer from the complexities of handling the massive amounts of intricate chart data.

ECMAN is a possible solution for marine equipment manufacturers who are faced with an increasing demand for an ECDIS product.