

# **The Research and Prospects of Electronic Display and Information System (ECDIS) in China**

**Zhao Depeng   Sun Wenli   Li Yuanhui**

The Dalian Maritime University, China

## **Abstract**

This paper describes the research and development of the Electronic Chart Data Base and the Electronic Chart Display and Information System (ECDIS) based on the Draft Specification for ECDIS of IHO by the Research Group on ECDIS of the Ministry of Communications of China. The paper also briefly introduces the system configuration, basic function, electronic chart data base of China and the future prospects.

**Key word:** ECDIS, ECDB

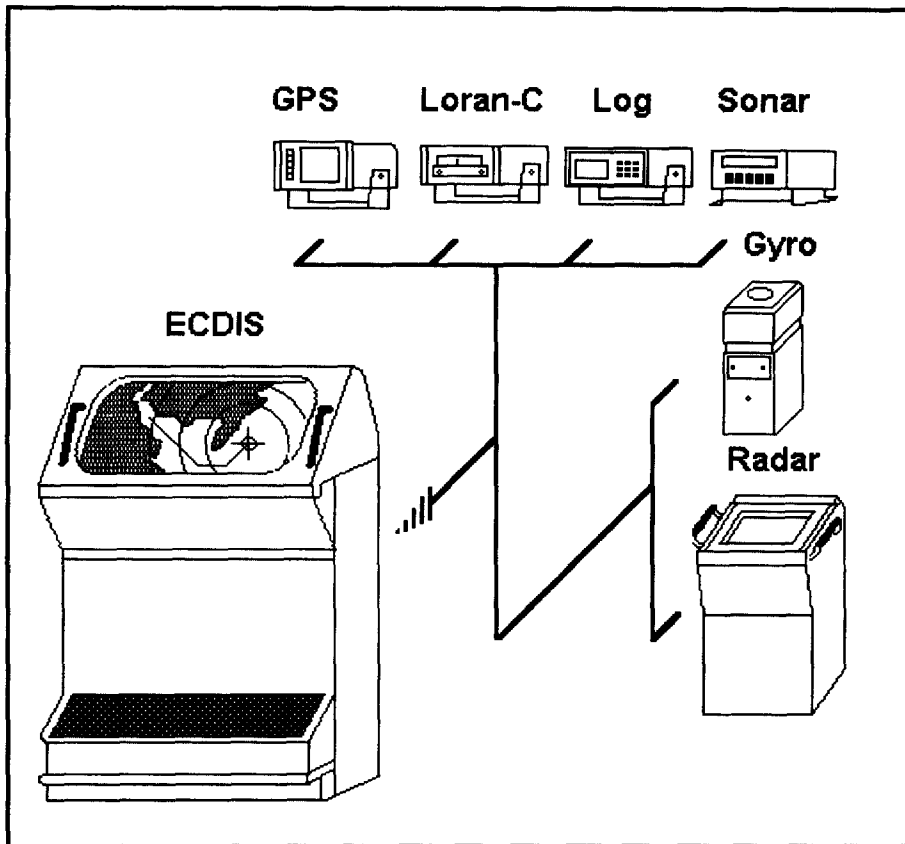
## **1. Preface**

Over recent years, ECDIS develops at a high speed. It will likely replace the paper chart. China started research on ECDIS at the eighties, but in 1990s, China, as a member of COE, founded the research group on ECDIS (RGE) to organize the study of ECDIS in China, which will be in conformity with the international requirement of ECDIS specification ( Third draft ). Over a few years striving, RGE of the Ministry of the Communications of PRC has make considerable headway in developing the ECDIS and building up ECDB. In accordance with the requirement of draft specification for ECDIS, the RGE established the system of ECDIS. In order to test and verify Various performance indexes of this system, tests were conducted on board in Sept. 1991 and June. 1994 respectively. The test results show that the system works stable, the external device interface equipment works reliably, and the system can basically meet the user's requirement.

## **2. The research of ECDIS in China**

### **2.1 The system outline**

In compliance with the requirement of minimum configuration in the third draft specification for ECDIS, the RGE established the system of ECDIS. The graphic display, whose resolution is 1280x1024, is used to control and display chart information, position information and radar information. To obtain the position information and radar information during sailing, the system connected with the navigation equipment and radar separately by means of interface of navigation equipment and radar signal converting. The external equipment of the whole system is composed of navigation equipment and radar, including GPS, Loran-C, Log, Sonar, Gyro, and Radar. Information can be gained from this external equipment and displayed at real time after processing. (Fig.1)



**Fig.1** Constitution of ECDIS

Such information as ship's position, ship's course and ship's speed needed by the electronic chart system for displaying the ship's positions and wake comes from ship's navigation equipment. To materialize this, we specially designed a navigation interface, an intelligent piece made of a sub-micro-computer system for collecting information from the navigation equipment and producing navigation data after processing. The data are transmitted to the main microcomputer at every set interval. The interface is arranged on an enlarged standard board that is inserted into the enlarged groove in the main microcomputer. This ensures convenience for use and performs reliably.

The radar video-picture is important information in the electronic chart system. The interface of radar includes mainly the processing of the radar video signals, the transformation of radar bearing signals, the hardware and software of the radar picture transmission. The radar picture transmitted from the interface to main micro-computer memory are stored in order of the polar coordinate. The scanning line corresponding to the North (zero degree) is stored upper most. The display range of radar is composed of three ranges of 3, 6, 12 miles. Relevant quantified unit of distance is 23.3m, 46.6m and 93.3m respectively, and the quantified unit of bearing is 0.3515 degree. After a set of radar image is sent to the memory, the computer will read the data as required, calculate orthogonal coordinates (x, y) of the quantified unit, regulate the meridian part for spheroid and add it there after to chart.

## **2.2 The system functions**

ECDIS is used to display charts at different scales, chart-retrieval, chart work, position track presentation and so on . It works in absolute and relative movement mode. The function of ECDIS is as follows:

### **(1) Hierarchy displaying**

It divides chart information into 10 layers and displays them by layer according to requirement. The 10 layers are terrain information, 2m contour line, 5m contour line, 10m contour line, 20m contour line, 30m contour line, depth point, symbol, Chinese characters and track line.

### **(2) Hierarchy flashing**

In the above 10 layers of information, apart from the terrain information, all the others can be displayed with layer flashing on demand.

### **(3) Display of ship position and track**

When connected with navigation equipment such as GPS, Loran-C, Compass, Log, it can automatically locate own ship's position and display its track automatically.

### **(4) Zoom in and Zoom out**

It can enlarge chart step by step on high-resolution graphic display.

### **(5) Provision of Navigation Information**

The date, time, own ship position, heading and speed can be displayed on the CRT with digital number.

The Chart work module in ECDIS is designed by taking into account of to all the routine work procedures currently done manually on paper chart in chart work as listed in the third draft specification for ECDIS ( OCT.1988 ), and based on the primary role of ECDIS. It has the following functions: chart sorting, route planning, navigational displaying, plotting, calculating, fixing and labeling etc. The ECDIS should be able to perform one of the principal functions of renewing and correcting the displayed electronic charts in conformity with article 20 of Chapter 5 of the SOLAS 1974 as amended. For this purpose, there is a sub-system of chart correction specifically designed for correcting the electronic charts. At present, we are undergoing the research on the transmission format of the data with the requirement of SP57 DX90 format.

## **2.3 Onboard testing**

Testing was carried out on board the training vessel Yu Long ( 10000 ton general cargo ship ) of the DMU , following the completion of the ECDIS research program in the laboratory. The object was to test and verify the performance of the system and its operational reliability in a practical application. The results confirm that the system can meet the users' basic requirements, that the interfaces to the external devices are stable and reliable, and that the overall system operates satisfactorily.

## **3. Prospects for the future**

The standard of ECDIS that prospected by the international electronic committee is hoped to be passed at the IMO assembly in 1995. At that time it will give great impetus to the processes of the ECDIS studies all over the world. The widespread acceptor and use of ECDIS have been a trend that can not be reversed. Although at present there are some concrete problems remained to be solved, all sorts of situations show that ECDIS will go into the practical stage in a short time.

### 3.1 China electronic chart database

China electronic chart database began with 15 digitized charts (The scale is 1:250000). The job was completed in 1994. On the base of this, now setting up a complete China electronic chart database become a pressing task. The digitizing charts are about 100 maps from 1:6400,000 to 1:10,000. Using those charts can create a china marine area electronic chart database. The whole china electronic chart database is yearned for completed in 1996. It can be displayed in the following ways: Display unrestricted area; Display in unrestricted ratio; display related information according to the use. The China electronic chart database will be storied in the CD-ROM and will be practiced and commercialized.

The data format of the electronic chart database is to digitize the paper chart through the digitizing instrument at first, create a ECDB data file described in the form of latitude and longitude, then engage in data processing to the file to create a ECDB data file used in vessels described by X-Y coordinate. The file can be read by the ECDIS software directly to create an electronic chart wanted by user and it can be displayed on the time. The ECDIS data file is made up of the following 7 files: header file; topoasc file; soundasc file; spotsasc file; linesasc file; symbase file and canmesc file, the structure is:

#### 12100head.asc

```
250000 0 0
12133333 3625000
12408333 3625000
12408333 3781666
12133333 3781666
```

#### 12100tp.asc

```
5M 12252345 3694397
-12250650 -3689161 1
12250658 3689147 1
.
.
.
12250637 3689163 1
12250649 3689161 1
999999999 999999999 1
```

#### 12100sou.asc

```
300 1 12184670 3642427
320 1 12184979 3634960
320 1 12184762 3628188
128 1 12184696 3672098
255 1 12185513 3653960
260 1 12191208 3651297
```

#### 12100spo.asc

```
COTPTX 339 12242976 3727332 12243339 3727398 553
COTPTX 339 12217806 3732495 12218168 3732562 483
COTPTX 339 12239482 3688294 12239844 3688361 411
COTPTX 339 12228468 3685347 12228831 3685414 539
COTPTX 339 12231440 3684787 12231802 3684854 431
COTPTX 337 12213064 3753176 12213426 3753242 293
```

**12100lin.asc**

TCCU 32768 0  
-12147718 -3647745  
12147547 3647420  
12147910 3647627  
12147713 3647583  
12147718 3647745  
999999999 999999999

**12100sym.asc**

NPL1R 12204405 3685872 182 7679  
NPL1R 12212835 3692673 181 7182  
NPL1R 12224117 3746066 180 7081  
NPL1R 12186135 3691571 181 7185  
NPL1R 12225750 3675108 182 7829

**12100nam.asc**

荣成湾 12259622 3735201 449 黑右斜宋  
12259622 3735201 荣 60  
12261660 3735219 成 60  
12263696 3735240 湾 60  
999999999 999999999 99 99

After processing, the format of ECDB data file used it in sailing is as follows:

**12100tp.loc**

5M 12252345 3694397  
-346 -606 1  
346 606 1  
.  
.  
346 606 1  
346 606 1  
9999 9999 1

**12100sou.loc**

300 1 1 910  
320 1 2 958  
320 1 1 1002  
128 1 1 717  
255 1 5 835  
260 1 35 852

**12100spo.loc**

COTPTX 339 306 357 308 356 553  
COTPTX 339 174 323 176 322 483  
COTPTX 339 287 612 289 611 411  
COTPTX 339 230 631 232 631 539  
COTPTX 339 245 635 247 634 431  
COTPTX 337 149 187 151 187 293

### **12100lin.loc**

TCCU  
-330 -875  
329 877  
331 876  
330 876  
330 875  
9999 9999

### **12100sym.loc**

NPL1R	104	628	182	7679
NPL1R	148	583	181	7182
NPL1R	207	234	180	7081
NPL1R	8	590	181	7185
NPL1R	216	698	182	7829

### **12100nam.dat**

荣成湾	449	BLACK
393	305	荣 60
403	305	成 60
414	305	湾 60
9999	9999	99 99

### **3.2 Automatic updating of electronic chart**

The job of updating electronic chart has changed from handle way to automatic way. The transmission experiment of DX-90 pattern has been set up. The experiment will be underway in 1996.

### **3.3 The avoiding collision function of ECDIS**

The functions of ECDIS in respect of avoiding collision remain to be completed. In order to complete the avoiding collision function better, the studies of connecting ARPA with ECDIS are doing. The preparatory work has been started.

### **3.4 The realization of electronic chart**

China has about 1000 ship, 200,000 fishing ship and other sorts of special ship. The electronic charts used in small vessels have been in the practical stage. The ship owners welcome them and need them eagerly. In order to solved those requirements, the production base of electronic chart equipment has been setting up. The output will increase every year from 1000 per year step by step. The electronic chart system used in big ship remains to be perfected further.

### **3.5 Electronic Chart and Marine Information Infrastructure**

The society of the 21st Century is an informational society, the appearances of the National Information Infrastructure mean that the information society is coming. Marine Information Infrastructure, being an important component of the national information infrastructure, not only can change the traditional navigation way continued for one hundred years fundamentally, but also will be a new milestone in navigation history and become the basis of the modern navigation.

With the development of the science and technology some new nautical instruments and systems in the nautical technology fields are produced, for example: Global Positioning System (GPS), Global Maritime Distress and Security System (GMDSS), Electronic Chart

Display and Information System (ECDIS), Vessel Traffic System (VTS) and so on. Because of the distinguishing feature of the navigation itself and of the being limited situation at present, the utilizing of the information sources of the navigation and the sharing in this field always lie the lower level, these systems and devices still are used in one of the kinds of navigation information separately, but all of the information sources of the navigation can't be shared in and be used .

Nautical information base is foundation of the marine information Highway, It is composed of Huge Data-base, literary-base and picture-base. The expansion and development of the Electronic chart Data Base will become the main component of the Data base of the Nautical information Base. The necessary paper chart that has being used in navigation for many years, will be placed of the Electronic Chart Display and Information System. Then it may get the electronic Chart data from the nautical information base by the marine information highway not in direction and display them. Traditional Chart working, marking and drawing and so on may be all finished automatically by the computer. The expansion and development of the electronic chart information System will become the main components of the literary base of the nautical information base, at this time, some traditional nautical materials, for example, nautical route guide book, tide table and so on, will be place of the information of the nautical information base, of the driver may get some information in the terminal of the computer on the vessel by the marine information infrastructure net, such as, nautical route information, port information summarily, the expansion and development of the data and information of the electronic chart Display and Information System is be coming nautical information base may replace completely the data base of the electronic chart display and information system.

Owning the nautical information base may make full use of Global Maritime Distress and Security System (GMDSS) and may set up the position report about the navigating vessel by the Marine information infrastructure net, We may share in the information of the navigation by the nautical information base in order to make the most effective dispatching and management ; Owning the nautical information base, around the central of the reasonable using and sharing of the nautical information sources, applying the modern high-new technology, can develop the new navigating and collision avoidance system, which can be working anywhere in the world 24 hours a day. The further development of the electronic chart display and information system will lay a foundation of the establishing nautical information base and marine information highway, and will put a great impact on the shipping of the 21st century.

#### **4. Conclusion**

Through hard work over past few years, steady progress has been made in the research of ECDIS in China, particularly the research of ECDB has gained many achievements. We will speed up the digitization of paper charts and establish a complete ECDB of China. The transfer test of data is pending. We will further verify the performance of this system and probe the standardization and applicability of ECDIS.