

# New Model Course on Training in Operational Use of ECDIS

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## Abstract

The revision of SOLAS, Chapter V, which entered into force on 1 July 2002, has firmly established the electronic navigational chart as part of the international maritime safety system. Its possible recognition as a paper chart equivalent confirms the considerable safety benefits provided by the official Electronic Chart Display and Information Systems (ECDIS).

Elaborated by the Author IAMU Model Course on operational use of ECDIS aims to provide answers to some of the most commonly asked questions regarding various types of electronic charts (ENC, RNC, DNC) and electronic chart systems (ECDIS, RCDS, ECS).

Following the earlier adoption of the International Convention STCW 78/95 and IMO model training courses, e.g. IMO Model Course on ECDIS [2], to assist in the implementation of the Convention and the associated IMO Assembly resolutions, a number of IAMU Member Universities had suggested that IAMU should develop model training courses on higher academic level to assist in achieving a more rapid transfer of information and skills regarding new developments in marine technology. The provision of model courses could help instructors improve the quality of their existing courses and enhance their effectiveness in meeting the requirements of the IAMU.

In this paper the Author presents the results of two IAMU research projects sponsored by Nippon Foundation, titled 'IAMU Model Course on Training in Operational Use of ECDIS' and 'IAMU Handbook on ECDIS'.

**Keywords:** Navigation, GIS, ECDIS, Electronic Navigational Charts, Model Course, Maritime Education and Training, Simulator, Safety at Sea, IMO, IAMU, STCW.

## 1. Introduction

The main objective of the International Association of Maritime Universities (IAMU) Working Group III is to promote the global maritime excellence. WG-III is directed toward the establishment of the global standardization of the maritime education system. To achieve this purpose, the academic discussions should be carried out regarding with the improvement of the existing education and certification system. To initiate the newly developed international system IAMU members should analyse and assess existing education systems offered by maritime universities/faculties, including proposed model courses and academic handbooks.

The major role of the navigational faculties of IAMU member universities is to provide their students with effective and highly levelled maritime education and training. Standing at this point of view, the Author would like to consider in this paper the effective training methods for navigators in compliance with STCW'95 Convention and the set of IMO model courses. In addition, he would like to consider additional training programs which aim at higher competencies than the minimum requirements for the competencies shown in the STCW Convention.

Electronic navigation, although still relatively new and unfamiliar, is becoming increasingly more commonplace, particularly onboard commercial vessels.

The International Maritime Organization published in 2000 *IMO Model Course 1.27: The Operational Use of the Electronic Chart Display and Information System (ECDIS)* [2]. In the Author opinion this model course program could be arranged by IAMU members on higher (academic) level.

In 2003 the Author has worked out the IAMU Model Course: *The Operational Use of the Electronic Chart Display and Information System (ECDIS)* [7] - the first IAMU Model Course,

intended to be on higher level than STCW. Now the Author has made one more step forward, he had prepared to publish the first IAMU handbook on the base of elaborated IAMU Model Course on ECDIS [5]. Presentation of new approach to the maritime education and training MET in the field of ECDIS is the main subject of this handbook.

In an Author opinion IAMU should consider and make a decision to start forward with series of IAMU Model Courses on higher (academic) level than STCW convention which seems to be for maritime universities the 'minimum of minimum' only. IAMU model course on training in the operational use of the Electronic Chart Display and Information System (ECDIS) as a sample is the first on the long list of IAMU model courses to be elaborated in the near future.

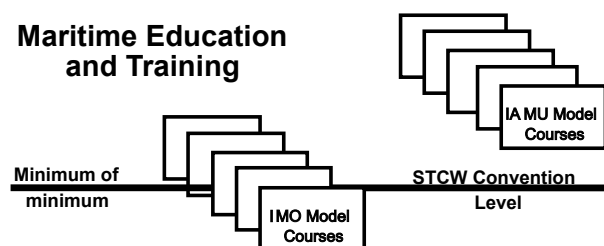


Figure 1. The first step – the set of IAMU model courses on the academic level, higher than STCW

## 2. Relevance to the Work of IAMU and IMO

The Handbook on ECDIS is based on IAMU model course on training in the operational use of the Electronic Chart Display and Information System (ECDIS) and the results of IAMU

research grant FY2003, sponsored by Nippon Foundation, received by Author in 2003 ([www.ecdis.am.gdynia.pl/iamu](http://www.ecdis.am.gdynia.pl/iamu) [7]). The Author presents IAMU model course on training in the operational use of the ECDIS based on simulators in written consolidated form.

In the handbook the Author presents his point of view on maritime navigation, simulation and technology in maritime education and training and the methods of maritime pedagogy, especially in the electronic chart systems field to be adopted by the IAMU member universities/faculties.

Research work was based on the results of Polish Working Group on ECDIS chaired by the Author. The Author presents Gdynia Maritime University (GMU) model course on training in the operational use of the Electronic Chart Display and Information System (ECDIS) based on simulators. Since 1996 he is the head of electronic chart and ECDIS laboratory in Navigational Department of Gdynia Maritime University, with 20 years experience in the field of electronic charts.

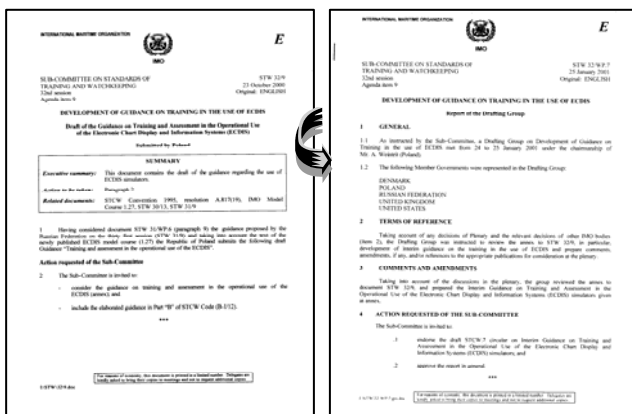


Figure 2. The active role of Poland in development of IMO guidance on training in the use of ECDIS

The IMO's Sub-Committee on Standards of Training and Watchkeeping at its thirty-second session (2001) developed Interim Guidance on Training and Assessment in the Operational Use of the Electronic Chart Display and Information System (ECDIS) Simulators prepared on the base of Polish document STW 32/9. The Author was the father of this document. He was the chairman of Polish Working Group which prepared Polish document submitted to IMO forum. He was the speaker of Polish delegation on 32 session and next the chairman of STW Sub-Committee Drafting Group on Development of Guidance which reviewed Polish document taking into account of discussions in the plenary session. The drafting group elaborated document STW 32/WP.7, which was approved at the NAV plenary. The Maritime Safety Committee, at its seventy-fourth session approved this interim guidance [3]. Since few years the Author regularly represents Poland at IMO Sub-Committee on Safety of Navigation (NAV), usually as a member of Technical Working Group on Navigational Aids and Related Matters. Between the NAV sessions he is active as a member of correspondence groups. Last two years he was a member of Correspondence Groups on ECDIS established in 2004 during 50th session of NAV Sub-Committee to prepare proposal for revision of IMO Performance Standards (PS) for ECDIS and a member of the Correspondence Groups on INS and IBS established during the same session of NAV Sub-Committee to elaborate proposal for revision of INS PS and IBS PS and a development of a PS for a Bridge Alarm Management System. One year before, he was a member of IMO Correspondence Group on Radar Performance Standards (2003/2004) and IMO Correspondence Group on Presentation of Navigation Related Information (2003/2004).

The IAMU model course on training in the operational use of the Electronic Chart Display and Information System, as a pioneer sample, is the first on the list of IAMU model courses. The IAMU handbook on ECDIS based on IAMU model course on training in the operational use of the Electronic Chart Display and Information System (ECDIS), as a pioneer sample, by analogy, is the first on the list of IAMU handbooks [5].

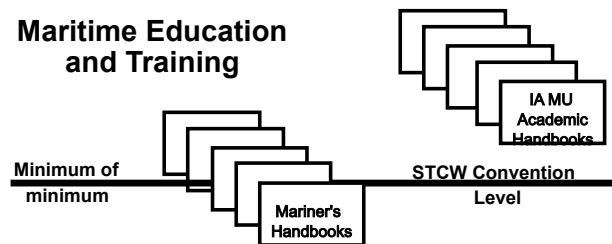


Figure 3. The second step – the set of IAMU handbooks on the academic level, higher than STCW

### 3. ECDIS Training Requirements

With the growing adoption of Electronic Chart Systems (ECS) there is an increasing number of Officers who need to be trained in their use. Given the flexibility of the labour market, it is highly likely that officers may arrive on board a ship without experience or training. The officer of the Watch (OOW) who has received recognised, formal training in the use of the bridge equipment at his disposal is, potentially, a safer OOW than his counterpart who has not received training.

A number of National Administrations have recognised the possible need for "type training". Commonsense and maritime expertise combined with the rules of the ISM Code clearly indicates that familiarisation training on such vital navigational equipment as an ECDIS is a necessity, considering that incompetent operation of ECDIS could impact adversely on the safety of life and protection of the marine environment.

In response to a UKHO Questionnaire on the use of vector charts the following questions and their responses were noted [1]:

- *Have you received training on using the ECDIS?*
- *Do you think training on the ECDIS and ENC's is necessary?*

Two-thirds of the respondents had received specific ECDIS and ENC training but only one mariner responded that he did not think that training was necessary. This emphatic endorsement of the need for specific training reflects the mariner's viewpoint that, in order to keep up with improving technology, it is essential to be trained in the use of new equipment. With the increasing adoption of ECS there will be an increasing number of Officers who will need to be trained in their use. Given the flexibility of the labour market, it is highly likely that officers may arrive on board a ship without experience or training and Masters are rightly concerned over this matter.

The provisions of STCW'95 are vague with respect to ECDIS although Table A-II/1, *Navigation at the operational level* requires:

*'Thorough knowledge of and ability to use navigational charts and publications. NOTE: ECDIS systems are considered to be included under the term "charts".'*

In Table A-II/2, *Navigation at the management level* requires:

*'3 using modern electronic navigational aids, with specific knowledge of their operating principles, limitations, sources of*

error, detection of misrepresentation of information and methods of correction to obtain accurate position fixing'.

While undoubtedly training should be the principal concern of the shipowner, there needs to be some consideration by Flag State administrations, Hydrographic Offices and others to the level of minimum training that should be undertaken before an Officer is permitted to keep a watch with an electronic chart system. The IMO have produced a 'model course' but, as far as is known, its availability is limited. It is envisaged that, in the absence of international agreement, Flag States may introduce their own national requirements for training in the use of ECS.

The maritime education and training (MET) institutions agree that they are able to provide training programmes for the shipowners' staff but they do not appear to be willing to provide this without cost to the shipowner. At the same time, the shipowner appears to be reluctant to invest in training, adopting the attitude of 'you'll be trained by using the equipment'. This is unsatisfactory and grossly inadequate. Where a system is fitted in a new building, the cost of training can, in many instances, be absorbed into the capital cost but it appears that where the equipment is to be retro-fitted, additional costs for training are unacceptable (the Hailwood Report [1]).

The majority of officers and masters interviewed are in favour of the development of Computer Based Training (CBT) programmes to cope with this lack of experience or training. In particular, until such time as statutory training requirements are introduced and enforced, CBT has significant potential for Officers joining the vessel for the first time with no previous experience in the use of ECS.

In the expectation that, in the near future, officers on ships fitted with ECDIS will be required, under possible amendments to STCW95 or under Flag State requirements, to complete an ECDIS training programme, the IMO ECDIS Model Course will serve as an ideal platform for such training. CBT has significant potential to deliver an appropriate training programme, in particular for Officers with little or no previous experience in the use of ECS.

ECDIS experts are invited to comment on these observations. They are also invited to suggest what should be incorporated into any revision of STCW95 and to suggest ways in which CBT can be developed to the benefit of all parties.

## 4. Course Outline

The course outline for the ECDIS training course is specified by:

- a list of the principal ECDIS subjects (training areas) including the area objectives and syllabus outline;
- a flowchart to illustrate the interrelationships between the principal ECDIS subjects;
- a suggested course timetables on a one week basis (a few options for different groups of trainees/users).

### 4.1 List of Principal ECDIS Subjects (Training Areas)

The area objectives for the principal ECDIS subjects (written in italics) are understood to be prefixed by the words:

*"The expected learning outcome is that the trainee is able to "*

Teaching staff should note that the times mentioned in timetable are suggestions only as regards sequence and length of time allocated to each objective. These factors may be adopted by lecturers to suit individual groups of trainees depending on their experience, specific character of their job, ability, equipment and staff availability for training.

Table 1. IMO Model Course on operational use of ECDIS

No.	Training Area	Les- sons	including:		
			L	D	E
1.	Legal aspects and requirements	½	½	-	-
2.	Principal types of electronic charts	¾	¾	-	-
3.	ECDIS data	2½	1½	½	½
4.	Presentation of ECDIS data	2	¾	1	¼
5.	Sensors	1½	1	¼	¼
6.	Basic navigational functions and settings	2¾	¼	½	2
7.	Specific functions for route planning	7½	½	1	6
8.	Specific functions for route monitoring	9½	½	1	8
9.	Updating	2	¾	¼	1
10.	Display and function of other navigational information	1¾	½	¾	½
11.	Errors in displayed data	1½	½	½	½
12.	Errors of interpretation	1½	½	½	½
13.	Status indications, indicators and alarms	1½	½	½	½
14.	Documentation	½	¼	¼	-
15.	Integrity monitoring	1¼	¼	½	½
16.	Back-up	1½	¼	¼	1
17.	Risk of over-reliance on ECDIS	1½	½	½	½
<b>Total</b>		<b>40</b>	<b>9¼</b>	<b>8¼</b>	<b>22</b>

Teaching staff should note that some Training Areas should be carried out on professional navigation and ECDIS simulators in regard to practical use in Route Planning and Route Monitoring processes.

## 4.2 Description

This course will give the trainee guidance and practice on the operational use of Electronic Chart Display and Information Systems (ECDIS) equipment in accordance with the requirements of the STCW Convention '78 as amended in 1995. The general objective of the ECDIS training course is to enhance navigational safety by the safe operation of ECDIS equipment, proper use of ECDIS related information and knowledge of the limitations of ECDIS equipment.

### Course Outline:

- History of electronic charts and ECDIS and process of international standardization;
- ECDIS - maritime application of GIS (Geographical Information System);
- Description of the structure of ECDIS and the ENC;
- Description of the structure of RCDS and the RNC;
- Description of the formats used for the database S-57;
- Description of digital vectorized charts;
- Description of the projections used for ENC;
- Performance standards for ECDIS (IMO Resolution 817(19)) and its revision (see: Figure 4);
- Revision of Chapter V SOLAS;
- International standards of IHO and IEC
- Raster Charts - limitations and comparisons;
- Cycle of operation of ECDIS;
- Route planning and route monitoring;
- Correction of ENC and methods used (updating system);
- Worldwide Electronic Navigational Chart Database (WEND);
- Regional Electronic Chart Co-ordinating Centres (RENC): Primar Stavanger, IC-ENC;
- Requirements for the carriage of ECDIS;

- Requirements for the carriage of back up systems;
- Appropriate Portfolio of Paper Charts (APC);
- Use of the chart catalogue;
- Possible errors in displayed data;
- Description of GPS / GLONASS / DGPS systems and their use in ECDIS;
- Input sensors to ECDIS;
- Description of the Radar and ARPA interface;
- Description of the AIS Transponders.



Figure 4. IMO Correspondence Group on ECDIS meeting held from 20th to 22nd of February 2006, hosted by the International Hydrographic Bureau in Monaco to prepare Draft Revised Performance Standards for ECDIS [NAV 52/5 (Norway)]

Practical exercises will involve hands on use of real ECDIS equipment with a variety of ENC's and sensors connected to bridge simulator equipment.

The ECDIS course should be open to masters, deck officers and trainee deck officers. The aim of the course is to enhance navigation safety and efficiency by training the Watch-keeping Officer in the safe operation of ECDIS. This will be achieved by developing an understanding of the generic principles of ECDIS and other electronic chart systems, and by understanding the capabilities and limitations of ECDIS. The course should also cover awareness of the potential errors and risk of over reliance on ECDIS, and understanding the regulatory requirements of the system. The updating regimes and differences between various systems will all be covered allowing future operators to fully appreciate the value of ECDIS and maximise its numerous safety benefits.

### 4.3 Entry Standards

With the development of modern and faster ships and a need to run them more economically, by reducing manpower, the number of marine casualties has increased in the recent past. These casualties can mainly be attributed to a human failure on the bridge of a vessel. The need to reduce such casualties is being felt by the entire maritime industry.

An ECDIS is one such navigational tool on the bridge, which would help the Master and the Officer of the Watch to navigate his ship safely and economically. The ECDIS with inputs from various sources like GPS/GNSS, Radar/ARPA, AIS, Echo Sounder, Log, Gyro, etc. would be ideal equipment providing all the data on one screen. This equipment amongst various other facilities would help in Route Planning, Route Monitoring and Executing, with voyage recording capabilities and anti-grounding functions.

## 4.4 Course Objective and Contents

Upon completion of the ECDIS course the participant will be able to:

- Get an overview of the ECDIS and understand the difference between a raster & vector chart;
- Appreciate the capabilities and limitations of an ECDIS;
- Operate an ECDIS and use its functions for safe navigation.

Key training factors for the use of the ECDIS:

- Guidance regarding ECDIS Simulators and ECDIS simulation equipment,
- Operational use of the ECDIS,
- Inclusion of the STCW Code (A + B1-12),
- Requirement for a prior completion of ARPA courses,
- Real-time operating environment,
- Creation of a realistic visual scenario,
- Simulation of "Own Ship" dynamics.

Course contents:

- Theory of ECDIS;
- International regulations and requirements governing the use of ECDIS;
- Knowledge of Raster and Vector Charts;
- Capabilities and limitations of ECDIS equipment;
- Capabilities and limitations of ECS equipment;
- Practical knowledge of the various features of the ECDIS;
- Practical passage planning on the ECDIS;
- Practical route monitoring on the ECDIS;
- Simulator exercises using the ECDIS.

## 5. IAMU Model Course 1.00 on Operational Use of ECDIS

Presented IAMU model course provides training in the basic theory and use of ECDIS, the theoretical aspects like all major characteristics of ECDIS data such as data contents and all major characteristics of the display of ECDIS data will be covered in sufficient depth.

Table 2. IAMU Model Course on operational use of ECDIS

No.	Training Area	Les- sons	including:		
			L	D	E
1.	Legal aspects, requirements and international standards	1½	1½	-	-
2.	Principal types of ECS and electronic charts	2	1	1	-
3.	ECDIS data	2	1	½	½
4.	Presentation of ENC/SENC data	3½	1	1½	1
5.	Main functions of ECDIS	3	½	½	2
6.	Route planning and special functions	7½	½	1	6
7.	Route monitoring and special functions	7½	½	1	6
8.	Data updating system	2½	½	1	1
9.	Additional navigation-related information sensors, display and functions	3	1	1	1
10.	Voyage data recording (documentation)	1½	½	½	½
11.	Errors, status indications, warnings and alarms	3	1	1	1
12.	Operational requirements	3	1	1	1
<b>Total</b>		<b>40</b>	<b>10</b>	<b>10</b>	<b>20</b>

L - Lecture,

D - Demonstration,

E - Exercise

For capabilities and skills, exercises are performed which will provide practice in setting up and maintaining an ECDIS display, in planning and monitoring a route, in using basic navigational functions and equipment in a real time navigational environment, in activating updates and in performing proper actions which are necessary for a safe navigational watch. This course is specially aimed for navigating officers of operation and management level. On successful completion of this course the trainees will be able to use ECDIS for his navigational watch. They will be able to operate ECDIS equipment, use the navigational functions of ECDIS, select and assess all relevant information and take proper action. Trainees will acquire and develop a knowledge and understanding of the basic principles governing the safe operation of ECDIS, including ECDIS data and their presentation, as well as system related limitations and potential dangers.

Trainees will be able to generate and maintain displays, to operate all basic navigational functions and all specific functions for route planning as well as route monitoring, to use and select proper navigational data and to display the data in the appropriate manner. They will also be able to perform updating.

Trainees will be able to analyze nautical alarms during route planning and route monitoring as well as sensor alarms. They will be able to assess the impact of the performance limits of sensors on the safe use of ECDIS and to appreciate that the back-up system is only of limited performance. They will be able to assess errors, inaccuracies and ambiguities caused by improper data management. Thus he will be aware of errors in displayed data, errors of interpretation and the risk of over-reliance on ECDIS and be able to take proper action.

## 5.1 Legal Aspects, Requirements and International Standards

Training area 1, titled 'Legal Aspects, Requirements and International Standards' covers the following items:

- 1.1. Introduction. GIS and ECDIS  
(Introduction • Geographical Information Systems • GIS - A Generic Definition • Overview of GIS System Applications • Marine GIS • Coastal GIS • GIS in Exploration and Production • Application of ENC's as GIS • GIS and ECDIS • Benefits of ECDIS • Conclusions • ECDIS - INS - IBS • Integrated Bridge Systems);
- 1.2. Carriage requirements for Nautical Charts and Publications  
(SOLAS Background • ECDIS in SOLAS • Clear waters ahead for ECDIS • Hydrographic data and charts • Consequences of new SOLAS V Regulations • Proposed changes to IMO Performance Standards on ECDIS • Conclusions of the CG on ECDIS (2004/2005) • Conditions for possible introduction of ECDIS carriage requirements • Proposal for modification of SOLAS Chapter V, Regulation 19 • Proposal for modification of HSC Code, Chapter 13 • Possible authorisation of use of ECDIS in RCDS mode without a requirement to carry an appropriate portfolio of paper charts • Indication of acceptance of RNCs by individual coastal States based on the survey to be conducted by IHO as requested by NAV 50 • Definition of, and/or criteria for, the term "appropriate portfolio of paper charts" when ECDIS is used in the RCDS mode and as ECDIS back up • Instruments required to monitor the promulgation of official digital charts and paper charts related to ECDIS operation, and provide this information to interested parties •

Consider possible implications for IMO instruments and submit a report of its deliberations to NAV 51 & NAV 52 • Mandatory ECDIS for high-speed craft • IHO online charts catalogue);

- 1.3. Definitions of main terms: ECDIS, ENC, SENC  
(The Importance of Electronic Charts • Electronic Chart Display and Information System (ECDIS) • Electronic Navigational Chart (ENC) • System Electronic Navigational Chart (SENC) • Display Base • Standard Display • All other information • Terminology related to ECDIS • Electronic Charts • What are the Electronic Charts Systems? • ECDIS • ECS);
- 1.4. Equivalency of ECDIS and conventional paper charts  
(ENCs the Only Route to Paperless Navigation • ENC Coverage • Requirements • Navigate on ECDIS • National Hydrographic Offices (NHO) and the Nautical Chart • Legal Issues: ECDIS & the User • Conclusion);
- 1.5. Performance standards for ECDIS IMO Resolution IMO A.817/19  
(ECDIS International Standards Description • Introduction • ECDIS Performance Standards);
- 1.6. Data procurement according to IHO standards and requirements  
(IHO S-57 - Data Transfer • IHO S-52 Colours, Symbols, Display Aspects • IHO Committee on Hydrographic Requirements for Information Systems (CHRIS) • CHRIS Terms of Reference • Rules of Procedure);
- 1.7. Technical standards and requirements (IEC, ISO)  
(IEC 61174 • Scope • Conclusion);
- 1.8. Training requirements  
(Training and assessment in operational use of ECDIS • *GENERAL*: The aim of the course • Real-time Training • Theory and demonstration • Simulator exercises • Principal types of ECDIS systems and their display characteristics • Risks of over-reliance on ECDIS • Detection of misrepresentation of information • Factors affecting system performance and accuracy • *PRACTICE*: Setting up and maintaining display • Operational use of electronic charts • Route planning • Route monitoring • Alarm handling • Manual correction of a ship's position and motion parameters • Records in the ship's log • Chart updating • Operational use of ECDIS with radar/ARPA connected • Operational use of ECDIS where AIS connected • Operational warnings, their benefits and limitations • System operational tests • Debriefing exercise • Training and Simulation).

## 5.2 Principal Types of ECS and Electronic Charts

Training area 2, titled 'Principal Types of ECS and Electronic Charts' covers the following items:

- 2.1. Characteristics of electronic chart systems and their different solutions  
(Electronic charts • Electronic Chart System • Components of ECS's and ECDIS's • Electronic chart systems. What are they and what do they do? • How should the mariner use the electronic charts? • Which type of electronic chart is the best for the navigators? • Electronic Charts as an Aid to Navigation);
- 2.2. Differences between ECDIS and ECS  
(Differences between ECDIS and ECS • Abstract • What is the navigator looking for? • Terminology etc. •

- ECS in use - Raster systems • ECS in use - Vector systems);
- 2.3. Differences between vector and raster charts (What are electronic charts? • Vector Chart System • Raster Chart System • Official Vector Data • Vector Data Formats other than IHO S-57 • Raster Data • The necessity for the “dual fuel” system • A BSB Story • The Two Types of Electronic Charts - Raster and Vector);
  - 2.4. Differences between ENC and RNC (Electronic Navigational Charts (ENCs) • ENC Production Status • The Admiralty ENC Service • ENC Distribution • Raster Navigational Charts (RNCs) • RNC Distribution • How to Use the Electronic Charts? • What are the Regulations? • The IMO requires that when using a type-approved ECDIS • Which type of electronic chart is best for navigator? • So What Does this Mean in Practical Terms? • Electronic Charts as an Aid to Navigation • The Future of Primary Navigation • ARCS and ENC);
  - 2.5. Admiralty Raster Chart Service (ARCS) (About Admiralty Charts • ARCS Data • ARCS Chart Service Levels • The Skipper service • The Navigator service • ARCS Navigator • The Skipper service • Electronic Chart System Compatibility • Chart Catalogue • A User's Unique Licence • Data updating system • Proven Benefits • ARCS and SOLAS Convention • ARCS for GIS in action • ARCS Compatible Display Systems);
  - 2.6. Differences between ECDIS and RCDS (Raster Chart Display System (RCDS) • ECDIS versus RCDS • Dual Fuelling and RCDS accepted by IMO);
  - 2.7. ENC versus privately manufactured data (Electronic Navigational Chart • ENC or Privately Manufactured Data? • Services available to Hydrographic Offices from the Electronic Chart Centre • Key features • ENC or Privately Manufactured Data • One or the other or both? • Sources of Data • Electronic Charts Coverage • Quality of Data • Assessment Standard • ISO 19379-2003 • Use of the Standard • Contents of the Standard • Present Status and the Future of Privately Manufactured Data • Filling the Gap? • Instead of ENC? • ENC and the Private Data Manufacturer • Replacing Paper Charts • One or the Other or Bath...? • The Solution: Public and Private Sectors Join Together • Collaborations Proven Successful • C-Map vector charts in format CM-93 • Transas Marine vector charts in format TX-93);
  - 2.8. Characteristics of the ECS/ECDIS systems for special purposes (Military ECDIS • The Digital Nautical Chart • Electronic Charts for VTS purposes • Ports and Waterways Safety System • Inland ECDIS);
  - 2.9. The failure of ECDIS versus the apparent success of ECS (RTCM ECS Standards • Electronic charts • ECDIS Course • Confusion over charts • Non-official charts • Licensing • A Chart Distributor Perspective • The failure of ECDIS versus the apparent success of ECS • Lack of Co-operation between HOs • Lack of Coverage in S-57 Format • What of SOLAS and National Obligations? • Data from Private Data Providers • Analogy with Official Paper Charts • What about the ship-owners?).

etc. training areas 3 - 12.

## 6. Conclusions

Presented in this paper the model course on training in the operational use of ECDIS, the first IAMU model course, may be used by staff and students of any maritime university, navigational faculty and training institution as alternative or supplement to IMO Model Course 1.27 [2]. ‘IAMU handbook on ECDIS’ [6] can assist in the training process.

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