

IAMU Model Course on 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 (IAMU research project FY 2003) 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. [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 a higher academic level. This would 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 the paper, the Author presents the results of IAMU research project FY2004 sponsored by Nippon Foundation, entitled 'IAMU Handbook on ECDIS'.

Keywords: Navigation, GIS, ECDIS, ECS, Electronic Navigational Charts, Safety at Sea, Simulator, Model Course, Training, MET, IAMU, IMO, 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 towards the establishment of the global standardization of the maritime education system. To achieve this purpose, 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 departments of IAMU member universities/faculties is to provide their students with effective and highly levelled maritime education and training. With 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.

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's opinion, IAMU members on a higher level could arrange this model course program.

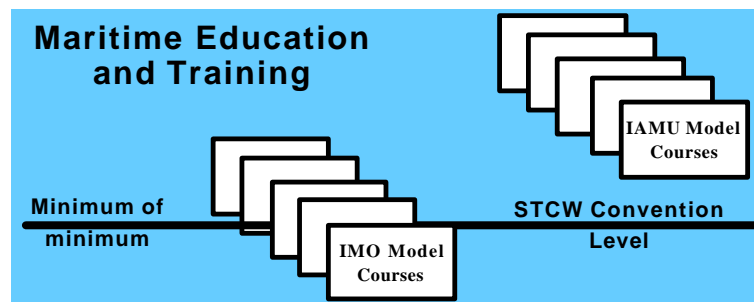


Fig.1. The first step – the set of IAMU model courses on the academic level, higher than STCW

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 the opinion of the Author IAMU should consider and make a decision to start forward with series of IAMU Model Courses on a 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.

2 Relevance to the work of IAMU and IMO

Proposed Handbook 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 the Author in 2003 (www.ecdis.am.gdynia.pl/iamu [7]). The Author presented an IAMU model course on training in the operational use of the ECDIS based on simulators in written consolidated form.

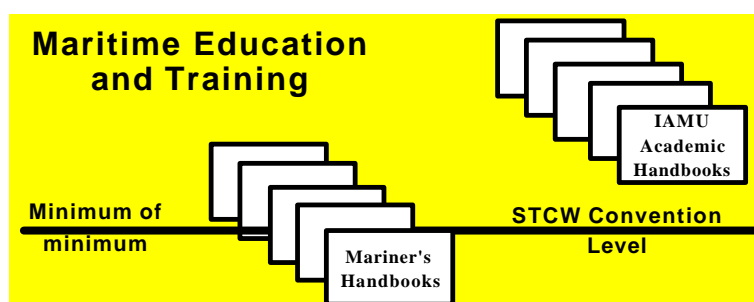
In the handbook, the Author presents his point of view on maritime navigation, simulation and technology in maritime education and training and the methods of maritime pedagogy, especially in the electronic chart systems field to be adopted by the IAMU member universities/faculties.

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

The IMO's Sub-Committee on Standards of Training and Watch keeping 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 chairperson of the Polish Working Group, which prepared a Polish document submitted to the IMO forum. He was the speaker of the Polish delegation at the 32 session and next the chairman of STW Sub-Committee Drafting Group on Development of Guidance which reviewed Polish documentation taking into account discussions in the plenary session. The drafting group expanded 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]. For the past few years, the Author has regularly represented Poland at the IMO Sub-Committee on Safety of Navigation (NAV), usually as a member of the Technical Working Group on Navigational Aids and Related Matters. Between sessions, he is active as a member of correspondence groups. Previously he was a member of Correspondence Groups on ECDIS established in 2004 during the 50th session of NAV Sub-Committee in order to prepare a proposal for revision of IMO Performance Standards (PS) for ECDIS. He was also a member of the Correspondence Groups on INS and IBS established during the same session of the NAV Sub-Committee to elaborate a proposal for revision of INS PS and IBS PS and a development of a PS for a Bridge Alarm Management System. A year before, he was a member of the IMO Correspondence Group on Radar Performance Standards (2003/2004) and the 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 (ECDIS), 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 1: The second step – the set of IAMU handbooks on the academic level, higher than STCW

3 ECDIS training requirements

With the increasing use of Electronic Chart Systems (ECS), there is an increasing number of Officers who require training. 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". Common sense 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, especially when bearing in mind that incompetent operation of ECDIS could influence 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:

- *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 use of ECS, there will be an increasing number of Officers requiring training. 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 given by Flag State administrations, Hydrographic Offices and others to the level of minimum training, which 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 CBT programmes to cope with this lack of experience or training. In particular, and 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.

Members of the discussion group 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 as follows:

- 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 weekly course timetable (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 timetables are suggestions only regarding 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.

Teaching staff should note that some Training Areas should be carried out on professional navigation and ECDIS simulators about 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 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)).
- Revision of Chapter V SOLAS.
- Raster Charts - limitations and comparisons.
- Cycle of operation of ECDIS.
- Correction of ENC and methods used (updating system).
- Worldwide Electronic Navigational Chart Database (WEND)
- Use of the chart catalogue.
- Possible errors in displayed data.
- Requirements for the carriage of ECDIS.

- Requirements for the carriage of back up systems.
- Appropriate Portfolio of Paper Chart.
- 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.

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 the work force, 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, Monitoring and Executing, with voyage recording capabilities and anti-grounding functions.

4.4 Course Objective and Contents

Upon completion of this 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

The model course presented 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 1: IAMU Model Course on operational use of ECDIS (FY2004)

No.	Training Area	Lessons	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
Total		40	10	10	20

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 on their navigational watch. They will be able to operate ECDIS equipment, use the navigational functions of ECDIS, select, 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, they 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.

This paper presented 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 an alternative or supplement to the IMO Model Course. '*IAMU handbook on ECDIS*' and can assist in the training process.

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