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**Expanding Frontiers -
Challenges and Opportunities in Maritime Education and Training**

**ECDIS As New Competence For Deck Officers -
Questions And Answers**

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Abstract: The STCW Conference was held in Manila, June 2010. During the Manila Conference the STCW Convention and Code were fully adopted by Members of the Organization. Some of these amendments applied to matters regarding mandatory standards and provisions in order to effectively respond to changes in technology, operations, practices and procedures used on board ships. ECDIS training was not included in the STCW Convention and Code for a long time. With the changes to the STCW Convention and Code (the Manila Amendments), ECDIS training becomes an integral part of the nautical officers training scheme. Following the new STCW Convention and Code standards and provisions the new edition of IMO Model course 1.27 "Operational use of Electronic Chart Display and Information System (ECDIS), 2010 Edition" was approved by IMO Sub Committee STW 43/3/1 in May 2011. Entry standards for this Model course are equal to navigational cadets' second year education level. Currently about 200 000 licensed deck officers and masters work at sea and most of them sail on vessels fitted with ECDIS. What kind of training do they need in order to fully comply with new STCW requirements and standards? How can they achieve such training? The Manila Conference determined the transition period to be from 01.01.2012 until 01.01.2017 however, the new MET system should be established before 01.07.2013. That means that we have about one year for clarifying these questions.
Keywords: STCW Manila Amendments, IMO Model Course 1.27, MET System, SOLAS Convention.

1. International requirements

1.1 SOLAS Requirements

On 01.01.2011 the amendments to SOLAS, as adopted by IMO Resolution MSC.282(86), entered into force. These included a number of changes to SOLAS Chapter V "Safety of Navigation".

Regulation 19 has been revised to include Electronic Chart Display and Information Systems (ECDIS). New and existing vessels must be fitted with this system according to rolling timetables as detailed below.

SOLAS Chapter V Regulation 19/2.1.4, which concerned the carriage of charts, now reads as follows:

“All ships, irrespective of size, shall have nautical charts and nautical publications to plan and display the ship’s route for the intended voyage and to plot and monitor positions throughout the voyage. An electronic chart display and information system (ECDIS) is also accepted as meeting the chart carriage requirements of this subparagraph. Ships to which paragraph 2.10 applies shall comply with the carriage requirements for ECDIS detailed therein.”

Paragraph 2.10 sets out a timetable for vessels engaged on international voyages to be fitted with an ECDIS using Electronic Navigation Charts (ENCs):

- Passenger ships of 500 GT and upwards constructed on or after 1 July, 2012
- Tankers of 3,000 GT and upwards constructed on or after 1 July, 2012
- Cargo ships, other than tankers, of 10,000 GT and upwards constructed on or after 1 July, 2013
- Cargo ships, other than tankers, of 3,000 GT and upwards but less than 10,000 GT constructed on or after 1 July 2014
- Passenger ships of 500 GT and upwards constructed before 1 July 2012, not later than the first survey on or after 1 July, 2014
- Tankers of 3,000 GT and upwards constructed before 1 July, 2012, not later than the first survey on or after 1 July, 2015
- Cargo ships, other than tankers, of 50,000 GT and upwards constructed before 1 July, 2013, not later than the first survey on or after 1 July, 2016
- Cargo ships, other than tankers, of 20,000 gross tonnage and upwards but less than 50,000 GT constructed before 1 July, 2013, not later than the first survey on or after 1 July, 2017
- Cargo ships, other than tankers, of 10,000 GT and upwards but less than 20,000 GT constructed before 1 July, 2013, not later than the first survey on or after 1 July, 2018

The term “first survey” is defined in MSC.1/Circ.1290 as being ‘the first annual survey, the first periodical survey or the first renewal survey whichever is due first after the date specified in the relevant regulation or any other survey if the Administration deems it to be reasonable and practicable, taking into account the extent of repairs and alterations being undertaken. For a ship under construction, where the keel is laid before, but the ship is delivered after, the date specified in the relevant regulation, the initial survey is the first survey.’

It will be noted from the above schedule that there is no provision for cargo ships (other than tankers) of less than 10,000 GT to be fitted with ECDIS. Flag States may also exempt a vessel from complying with the requirements if it is to be taken out of service permanently within two years of the applicable implementation date.

1.2 STCW Convention and Code Requirements

Table A-II/1

Specification of minimum standard of competence for officers in charge of a navigational watch on ships of 500 gross tonnage or more.

Function: Navigation at the operational level

Competence	<p>Use of ECDIS to maintain the safety of navigation</p> <p>Note: Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS</p> <p style="padding-left: 40px;">These limitations shall be reflected in the endorsements issued to the seafarer concerned</p>
Knowledge, understanding and proficiency	<p>Navigation using ECDIS Knowledge of the capability and limitations of ECDIS operations, including:</p> <ol style="list-style-type: none"> .1 at thorough understanding of Electronic Navigational Chart (ENC) data, data accuracy, presentation rules, display options and other chart data formats .2 the dangers of over-reliance .3 familiarity with the functions of ECDIS required by performance standards in force <p>Proficiency in operation, interpretation, and analysis of information obtained from ECDIS, including:</p> <ol style="list-style-type: none"> .1 use of functions that are integrated with other navigation systems in various installations, including proper functioning and adjustment to desired settings .2 safe monitoring and adjustment of information, including own position, sea area display, mode and orientation, chart data displayed, route monitoring, user-created information layers, contacts (when interfaced with AIS and/or radar tracking) and radar overlay functions (when interfaced) .3 confirmation of vessel position by alternative means .4 efficient use of settings to ensure conformance to operational procedures, including alarm parameters for anti-grounding, proximity to contacts and special areas, completeness of chart data and chart update status, and backup arrangements .5 adjustment of settings and values to suit the present conditions .6 situational awareness while using ECDIS including safe water and proximity of hazards, set and drift, chart data and scale selection, suitability of route, contact detection and management, and integrity of sensors

Methods for demonstrating competence	Examination and assessment of evidence obtained from one or more of the following: .1 approved training ship experience .2 approved ECDIS simulator training
Criteria for evaluating competence	Monitors information on ECDIS in a manner that contributes to safe navigation Information obtained from ECDIS (including radar overlay and/or radar tracking functions, when fitted) is correctly interpreted and analyzed, taking into account the limitations of the equipment, all connected sensors (including radar and AIS where interfaced), and prevailing circumstances and conditions Safety of navigation is maintained through adjustments made to the ship's course and speed through ECDIS controlled track-keeping functions (when fitted) Communication is clear, concise and acknowledged at all times in a seamanlike manner

Table A-II/2

Specification of minimum standard of competence for masters and chief mates on ships of 500 gross tonnage or more.

Function: Navigation at the management level

Competence	Maintain the safety of navigation through the use of ECDIS and associated navigation systems Note: Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. This limitation shall be reflected in the endorsement issued to the seafarer concerned
Knowledge, understanding and proficiency	Management of operational procedures, system files and data, including: .1 manage procurement, licensing and updating of chart data and system software to conform to established procedures .2 system and information updating, including the ability to update ECDIS system version in accordance with vendor's product development .3 create and maintain system configuration and backup files .4 create and maintain log files in accordance with established procedures .5 create and maintain route plan files in accordance with established procedures .6 use ECDIS log-book and track history functions for inspection of system functions, alarm settings and user responses

Knowledge, understanding and proficiency (cont'd.)	Use ECDIS playback functionality for passage re- view, route planning and review of system functions
Methods for demonstrating competence	Assessment of evidence obtained from one of the following: .1 approved in-service experience .2 approved training ship experience .3 approved ECDIS simulator training
Criteria for evaluating competence	Operational procedures for using ECDIS are established, applied, and monitored Actions taken to minimize risk to safety of navigation

Table A-II/3

Specification of minimum standard of competence for officers in charge of a navigational watch and for masters on ships of less than 500 gross tonnage engaged on near-coastal voyages.

Function: Navigation at the operational level

Competence	Plan and conduct a coastal passage and determine position Note: Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fit- ted with ECDIS. These limitations shall be reflected in the endorsement issued to the seafarer concerned
Knowledge, understanding and proficiency	Thorough knowledge of and ability to use ECDIS
Methods for demonstrating competence	Examination and assessment of evidence obtained from one or more of the following: .1 approved training ship experience .2 approved ECDIS simulator training
Criteria for evaluating competence	

1.3 IMO Resolution A.741(ISM Code) Requirements

6.3 The Company should establish procedures to ensure that new personnel and personnel transferred to new assignments related to safety and protection of the environment are given proper familiarization with their duties. Instructions which are essential to be provided prior to sailing should be identified, documented and given.

1.4 IMO Model Course 1.27 “Operational use of Electronic Chart Display and Information System (ECDIS)”

The model course intends to provide the knowledge, skill and understanding of ECDIS and electronic charts to the thorough extent needed to safely navigate vessels whose primary means of navigation is ECDIS. The course emphasizes both the application and learning of ECDIS in a variety of underway contexts. This is achieved through sophisticated navigation simulation that provides each trainee with unrestrained access to ownship operations integrated with a complete type-approved ECDIS with numerous chart formats installed.

The course is designed to meet the STCW requirements in the use of ECDIS, as revised by the 2010 Manila Amendments, specifically as these apply to Tables A-II/1, A-II/2 and A-II/3, and also to revised guidelines pertaining to training and assessment in the operational use of ECDIS in Table B-I (paragraphs 36 through 66), assessment in navigational watchkeeping, and evaluation of competence, both in Table B-II.

The training equipment and method used, however, is just one step on the way to successful ECDIS training. Much also depends on the knowledge and teaching skills of the instructor and the quality of the courseware in use. Some ship owners have experienced problems with well-equipped training centers because the instructors are either too old, and have therefore never sailed with ECDIS before, or are young officers lacking training experience due to the fact that they are only filling in during their shore time. Course duration is 40.0 hours minimum

1.5 Flag State ECDIS training requirements

On modern ships, ECDIS systems have become extremely complicated and it is therefore necessary to have a user who is totally proficient. This fact has also been acknowledged by the IMO in the amended STCW Code, which now requires the user to have profound working knowledge of the ECDIS system. For some flag states, such as MCA (UK), MPA (Singapore) and Bermuda, the IMO’s implied terms are not sufficient. Flag states including the UK and Australia have already stipulated generic ECDIS training as a requirement when ECDIS is used as a primary means of navigation. They therefore issued national circular letters requiring that the ECDIS manufacturer or an approved training agent has to provide a type-specific ECDIS course for all navigation officers on-board a vessel flying these flags. ECDIS is also part of the relevant safety equipment for which, according to the ISM Code, a specific training for the crew is required. This will be checked not only through Vetting, but also by Port State Control.

2. ECDIS training

With the changes to the STCW Convention and Code (also known as the Manila Amendments), ECDIS training becomes an integral part of the nautical officer’s training scheme, starting in January 2012. Within the next five years, every officer serving on an ECDIS equipped vessel must have attended generic ECDIS training which is accepted by his home country and the Flag State of the ship in which he/she is serving.

Accidents involving vessels like the CFL Performer, Cosco Busan, LT Cortesia and the Pride of Canterbury, show the urgent need to not only to invest in the proper equipment and paper work, but to make sure that the crew really possess solid knowledge of the equipment in use. In some cases sailors get on-board training with an ECDIS(IMO Model Course 1.27) certificate but have never touched an ECDIS before. Also we can find training providers, who teach up to 30 students in a beamer equipped classroom with only one ECDIS, reading the manufacturer’s manual page-by-page.

The industry has emphasized the need for watch-standers to demonstrate all IMO identified competencies and to maintain these competencies – including familiarization with any updates or alterations. James Robinson, DSM FNI Irish Navy (Retired), President of The Nautical Institute, commented: “ECDIS is a complex system and will be one of the most essential tools for supporting mariners in their efforts to ensure the safety of navigation and protection of the marine environment. Shipowners must not assume that an ECDIS course certificate is enough to ensure safety and masters should work with their bridge teams to ensure that ECDIS best practice and company procedures for familiarization and use of the ECDIS are continually maintained”. The guidance also makes recommendations to ensure that officers in charge of a navigational watch remain competent and that other industry stakeholders such as trainers, inspectors and auditors are capable of assessing such competence.

The “Human Element” aspects of ECDIS introduction and operation should not be ignored. This includes:

- roll-out risk assessment
- effective training
- effective communication/feedback on ECDIS operation
- effective navigational auditing
- effective ECDIS near miss collection and analysis
- effective ECDIS assisted accident investigation – learning from mistakes

The introduction of a complex system such as ECDIS requires a high standard of training and understanding.

2.1 Generic ECDIS Training

Generic ECDIS training should follow the provisions of the IMO-approved standardized Model Course 1.27, which lays down the minimum training and knowledge requirements for a navigation officer to operate ECDIS equipment. It is the objective of IMO that the model course will provide flag states and training companies with a standardized competency level for training navigation officers.

This course should cover all relevant safety aspects regarding ECDIS including operational functionality, maintenance and limitations of electronic chart navigation. The generic training should include a thorough understanding of the basic principles of electronic chart navigation and include but not be limited to:

- legal background and requirements of ECDIS
- theoretical background information, including knowing limitations of ECDIS
- types of electronic charts (ENC and RNC)
- functions and settings, including familiarity of different alarms and sensors
- types of display and orientation
- operating basic navigational functions
- understanding route planning functions with particular emphasis on route checking and monitoring

- updates and maintenance of ECDIS software and electronic charts
- knowing what back-up systems are required and necessary updates/maintenance
- knowing the risks – overreliance on ECDIS

The IMO Model Course suggests 40 hours of training (minimum) to be carried out over a five-day period. However, flag states including the UK have permitted a three-day training course as fulfilling the IMO model requirements. The IMO model course is seen by many as fulfilling the absolute basic requirements for generic ECDIS training. It is recommended that an effective generic ECDIS course is undertaken rather than simply fulfilling the basic statutory requirements. A full understanding of ECDIS is very important.

Flag states, such as Norway, have stipulated that they may allow generic ECDIS training to be conducted in the form of computer-based training (CBT). Certain private navigation specialists are in the process of creating and introducing a product-specific computer-based ECDIS training programme, which will have two separate CBT programmes for generic and type specific ECDIS training. However, most flag states have rejected this programme as concern over the effectiveness of generic CBT fulfilling IMO Model Course 1.27 requirements may prove inadequate and substandard compared to a college-based training course.

2.2 Type specific ECDIS Training

Type/model specific ECDIS training is a requirement of the International Safety Management (ISM) Code under section 6: *“The Company should establish procedures to ensure that new personnel and personnel transferred to new assignments related to safety and protection of the environment are given proper familiarization with their duties. Instructions which are essential to be provided prior to sailing should be identified, documented and given.”* Under the terms of the ISM Code, all officers must be familiar with the equipment they are expected to use; this includes ECDIS equipment.

Type specific training should be based on the actual equipment installed onboard and be provided before the officer is expected to use the equipment, for example, prior to sailing. The general consensus from the IMO is that officers who have undergone ECDIS generic training may not be familiar or be able to fully and confidently operate an ECDIS model that they have never used or trained on before. However, debate remains within the industry on acceptable forms of providing type/model specific training. STCW does not make type/model specific training a mandatory requirement and it is very much left open to the interpretation of flag states to determine training requirements.

The UK’s MCA has issued Marine Information Notice 405(M+F) ‘Training for ECDIS as Primary Means of Navigation’, stating that masters and navigational officers using ECDIS as their primary means of navigation are required to have completed both generic and type specific ECDIS training. The MCA requires training to relate to the make and model of the equipment fitted on the ship and to be delivered by *“the manufacturer; the manufacturer’s approved agent or a trainer who has attended such a programme, trickle down training (that is, one officer training another) is not acceptable”*. This implies that the MCA requires type specific training to be carried out in a training establishment ashore before a navigational officer joins a ship as opposed to an onboard training course.

However, certain flag states have now stipulated in their merchant shipping notices that, depending on flag state approval, a computer-based training course may be acceptable in fulfilling requirements of type specific training. Bermuda Shipping Notice 2011-010 has agreed that “*a manufacturer’s computer based training package can be accepted for this purpose*” as it is widely seen as the most practical and easily facilitated type specific training course available. Isle of Man’s Merchant Shipping Notice 026 “*Replacing Paper Charts with ECDIS*” also agrees that ‘this may be in the form of computer based training’. It is clear that differing views of flag states on type specific training makes it difficult to explain what kind of training would be acceptable and, more importantly, how it can be delivered. Not all flag states may accept computer-based training (CBT) and the ones that do will require their approval.

Companies should be aware that learning to be competent in the use of electronic chart navigation takes time; generic and type specific training only provides the minimum amount of knowledge necessary to operate ECDIS equipment and does not take into account the experience factor.

3. The 43rd Session IMO’s Sub-Committee on Standards of Training and Watchkeeping

The IMO’s Sub-Committee on Standards of Training and Watchkeeping held its 43rd Session at IMO Headquarters on Monday 30 April through Friday 4 May 2012 under the Chairmanship of Rear Admiral Peter Brady (Jamaica).

Three working groups were convened to consider:

1. The Development of an E-Navigation Strategy Implementation Plan,
2. The Development of Guidance for the Implementation of the 2010 Manila Amendment, and
3. Role of the Human Element.

In view of the large number of model courses submitted for validation, the Sub Committee established two drafting groups to finalize them. Following is a short summary of salient points emanating from the meeting on items of greatest interest to Intermanager members:

Consideration of model courses following manila 2010 Spearheaded by the USA, there was vigorous and unanimous agreement in Plenary that:

- the contents of the model courses submitted lacked consistency and did not comply with the 2010 Manila Amendments;
- model courses should facilitate career progression where required and there was a need to avoid duplication or redundancy of course content;
- the process to develop model courses needs to be completely reviewed under a structured programme with proper terms of reference and this was beyond the scope of a drafting group;
- the 2010 Manila Amendments entered into force on 1 January 2012 and bearing in mind that there was an urgent need for the updated model courses, the proposal to develop them in accordance with the proposed philosophy at this stage was not practical;

- there is a need to provide appropriate guidance to maritime education and training providers on the preparation of training programmes to address the 2010 Manila Amendment in a timely manner; and
- the model courses should follow the knowledge, understanding and proficiency (KUPs) in the tables of competence.

3.1 Revised model course on the operational use of Electronic Chart Display and Information

Systems (ECDIS)

3.1.1 The Sub-Committee gave preliminary consideration to the draft model course on the operational use of Electronic Chart Display and Information Systems (ECDIS) (STW 43/3/1).

3.1.2 GlobalMET (STW 43/3/9), ICS et al. (STW 43/3/10), Finland and Germany (STW 43/3/11) and Poland (STW 43/3/19) commented and proposed amendments to the above-mentioned model course.

3.1.3 The United Kingdom (STW 43/3/20) identified aspects of the revised draft model course on the operational use of Electronic Chart Display and Information Systems (ECDIS) that may pose problems for both administrations and training establishments in its implementation and proposed amendments to demonstrate an alternative approach.

3.1.4 The United Kingdom (STW 43/3/21), commenting on the revised draft model course on the operational use of Electronic Chart Display and Information Systems (ECDIS), expressed the view that the mariner should be fully aware of the potential pitfalls within ECDIS as a generic system and particularly the overall reliance on correct software installation maintenance and updating and the possibility that ECDIS may contain display anomalies.

3.1.5 In the ensuing discussion, the following views were expressed that the ECDIS model course:

- was for global use and should contain generic references and terminology, focus on clear training objectives and guidelines, relevant teaching facilities and appropriate equipment;
- should form a template for training in operational and management levels and retain assessment at individual levels rather than in groups;
- should not be too prescriptive but be functional and flexible;
- should specify that the qualifications of trainers should include that they have had ECDIS training;
- onboard training and familiarization for trainers at regular intervals was impractical; and
- meets the knowledge, understanding and proficiency (KUPs) in the tables of competence.

- 3.1.6 After some discussion, the Sub-Committee referred the above documents to Drafting Group 1 to be established on validation of model courses for finalization of the model course, with a view to validation by the Sub-Committee.

Meanwhile, Drafting Group 1 considered a Revised Model Course on the operational use of ECDIS. They recommended that the model course should not be too prescriptive, agreed that it is primarily a technical course designed to teach proper operation of an ECDIS and should be delivered by trainers with relevant management level qualifications and experience ‘at the discretion of the administration approving the course’. Because ECDIS is subject to ‘anomalies’, it was agreed to address how to cope with this inherent weakness within the detailed teaching syllabus. Terms specific to a manufacturer’s product would be revised to follow generic terminology. In the light of their discussions, the Drafting Group prepared amendments to the ECDIS model course in a 153 page amendment document (STW 43/WP.6/Add 1 dated 3 May 2012).

3.2 Electronic Chart Display and Information System (ECDIS) Training

- 9.17 ICS and ISF (STW 43/9/6) commented on ECDIS training requirements wherein they have identified a training gap when implementing the ECDIS carriage requirements and the transitional arrangements of the 2010 Manila Amendments to the STCW Convention and proposed a way forward.
- 9.18 In the ensuing discussions, the following views were expressed that:
- clarification was needed for the application of training requirements for navigating officers serving on ships fitted with ECDIS;
 - equipment-specific ECDIS training courses were not practical;
 - regulation I/14.1.5 includes familiarization training; and
 - there was a need to consider, if there was a need to issue guidance to port State control authorities relating to ECDIS training.
- 9.19 After some discussion, the Sub-Committee referred this document to the Working Group for detailed consideration and advice, as appropriate.

4. Conclusion

It is important that traditional navigation skills are not forgotten or lost. Navigators should become confident, but not overconfident, in the use of ECDIS. There is a danger that some navigation officers will increasingly trust what is displayed on the screen without question, which could lull them into a false sense of security. As with all electronic equipment, ECDIS is an aid to navigation, albeit a very significant one, but it is not a substitute for maintaining a proper lookout at all times.

With the increasing reliability of GPS as a primary means of position fixing using ECDIS, traditional navigational skills using terrestrial based position fixing should not be overlooked as an important cross check of the ship’s position. Additionally, in the event of GPS failure, a suitable back-up procedure should be in place to utilize traditional position fixing directly onto the ECDIS. GPS failure drills have been identified within military navies as an effective training tool ensuring navigators are fully familiar with traditional position plotting tech-

niques. The introduction of GPS failure drills onboard ships using ECDIS as primary means of navigation will ensure that, in the event of position input failure from GPS, navigators are experienced in using traditional position plotting techniques for the safe takeover of navigation.

The understanding of the STCW Manila Amendments has caused confusion within the industry, particularly with respect to the transitional provisions for deck officers who already possess (or are due to revalidate) their watch-keeping certification and who have not undergone ECDIS training. It is of course left to flag states to interpret the code and clearly define what training and certification requirements they will specifically impose.

ECDIS training is changing today: in the age of electronic communications and games, the teaching methods need to move with the skill set of those coming into the industry. In the end, it will certainly become more professional and the officer on-board will feel more confident using ECDIS to its full potential

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