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STATUS OF ECDIS TYPE SPECIFIC TRAINING AND GAP IN THE RULES

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Abstract: Introduction of the Electronic Chart Display and Information System as the main navigation system on board a ship is one of the most significant developments in the maritime industry in recent years. Training of deck officers for its use is a key element for safe and effective work. According to international requirements, two types of training for covering the system are required – Operational Use of Electronic Chart Display and Information System and Type Specific training. Due to a lack of clear regulations for conducting Type Specific training, the producers apply their own training regulations for issuing certificates. Because of this, many seafarers face problems during their type specific training. The article examines and analyses different practices implemented by the producers regarding their Type Specific training for seafarers, the advantages and disadvantages of the above-mentioned procedures and training centre requirements as well. Examples of incidents resulting from improper use of ECDIS are provided. The authors present their experience as lecturers and instructors at the Nikola Vaptsarov Naval Academy training centre in respect to ECDIS type specific training.

Keywords: ECDIS, type specific training, risk assessment.

1. INTRODUCTION

The process of introducing the Electronic Chart Display and Information System (ECDIS) as a basic navigational system ended on 1 July 2018, and after that date, the system has been mandatory for [SOLAS 2014]:

- all new and existing passenger ships of over 500 GT;
- new and existing tankers of over 3,000 GT;
- new cargo ships of over 3,000 GT and existing cargo ships of over 10,000 GT.

The introduction of this system for various types of ships was performed according to a schedule starting from 2012 (Fig. 1). As a result of the schedule, a large number of the ships use ECDIS today as their basic navigational system.



Fig. 1. ECDIS carriage mandatory period

Source: ECDIS Questions / ECDIS [<http://www.ecdis-info.com/question.html>].

The main reason for such a major transformation is the opinion of a large number of IMO member states that ECDIS will contribute to safer and more efficient shipping. These benefits result from a better understanding of the navigational situation by the watchkeeping officer due to a more effective display of their own ship's position thanks to the GPS information, the introduction of alarms that warn of different navigational hazards, entry into prohibited areas, etc., as well as the automation of a number of activities and processes which take some time when working with paper charts [IHO S-66 2018].

2. RISK ASSESSMENT IN USING ECDIS

Despite all the advantages listed above, it is important to point out that, like any other type of technical equipment, there are certain risks associated with the operation of this particular system [Dachev and Panov 2017]. This can best be illustrated by identifying the groups of hazardous situations that may arise on a particular ship, namely:

- **Hardware-related risk** – ECDIS Terminal failure; a problem with signals from ship sensors; loss of ship electrical power;
- **Software-related risk** – computer virus infection; old software or a software problem; problems with installing and amending electronic charts; problems with data synchronisation between several ECDIS terminals;
- **Risk related to system operation** – incorrect or inappropriate safety settings; errors in plotting and/or checking the route; incorrect assessment of the approaching hazards by the operator; hidden navigation information or cluttered information on the display; misinterpreted information; misunderstanding and handling of alarms; overreliance on the equipment.

The risk associated with system operation is most common and is usually caused by ignorance or so-called "human error" [Lusic, Bakota and Mikelic 2017]. The ECDIS itself is a useful navigation tool, but the risk of serious navigational incidents increases significantly if it is not properly used. With the rapid development of computer technology in recent years, there is a tendency for people to rely too much on computers. The problem is that computers use programs to perform calculations that are based on the input data, after which they simply display the result of these calculations, i.e. they cannot estimate whether the data entered is correct or not [Dachev 2014]. Therefore, when working with such a system and incorrect data is entered, the result displayed after the calculation will be based on this erroneous data. For this reason, training related to the use of ECDIS is of key importance, and as such, it needs to be performed with extreme precision.

The use of the system by a person who is not well-trained is likely to lead to the occurrence of a hazardous situation. Since 2008, the UK Marine Accident Investigation Branch (MAIB) has investigated a number of grounded ships equipped with ECDIS: m/v "Ovit", which ran aground on Varne bank on 18 September 2013 [MAIB 2014], m/v "Commodore Clipper" [MAIB 2015], which ran aground at the entrance to the Port of Saint Peter on 14 July 2014, m/v "Muros", which ran aground on the "Haisborough sand" on 03 December 2016 [MAIB 2017]. In all three reports, similar omissions and deficiencies were registered:

- improper safety contour adjustment;
- all audio alarms had been switched off due to disturbance to Watchkeeping officers;
- improper safety check of the planned route;
- overreliance on ECDIS;
- inability of the Watchkeeping officers to assess the risky situation.

The conclusion following the above-mentioned investigations indicates that the main causes of the accidents were the low level of competence of the Watchkeeping officers and a lack of knowledge on how to operate the system properly.

3. TYPES OF TRAINING FOR WORKING WITH ECDIS

According to the Manila 2010 amendments of STCW, all Masters and Watchkeeping officers onboard ECDIS-equipped ships must be trained according to IMO Model Course 1.27 (Operational use of ECDIS) and hold the respective certificate.

The main objective of this course for the trainees is to understand the capabilities, characteristics and limitations of ECDIS, as well as to learn how to use it properly. The course content is based on the operations carried out on board the ship and include course training objectives for officers both at the operational and management level.

For successful completion of the training course, the Watchkeeping officers must confirm that they understand and can use the information provided by the system in a navigational context and can demonstrate all competences contained in STCW [Dachev 2017].

Specific training in the use of ECDIS (type specific training) is regulated by the following IMO document requirements:

- STCW, Regulation I-14, Item 5 states that “the company is responsible for ensuring that crew members are familiarised with their specific duties, as well as with any ship-specific regulations, facilities, equipment and procedures that concern their responsibilities in routine and emergency situations” [STCW 2017].
- ISM Code, Sections 6.3 and 6.5, states that “companies must establish procedures to ensure that the crew are properly familiarised with their duties, as well as identify the availability of any training which may be required in order to provide the safety system and that this training has been provided to all crewmembers whose responsibilities are directly related with it” [ISM Code 2018].

The primary purpose of the specific training is to familiarise the Watchkeeping officer with all the capabilities of the particular system, including the backup system, which he will need before taking over the navigation watch [Broster 2016]. An important part of this process is the study of how it is integrated with the other bridge equipment. This also includes sensors, backup systems, access to emergency power, etc.

For this purpose, it is recommended to draw up a diagram with the connections between the different components. It can be illustrative only, but it will nevertheless be of great help in troubleshooting a problem through a signal coming from a sensor.

4. ANALYSIS OF THE EXISTING METHODS OF ECDIS TYPE SPECIFIC TRAINING

All that has been said so far undeniably confirms the need for such training, and here it should be pointed out that the methodology of specific training is not strictly regulated. It allows ECDIS type specific training to be performed in different ways, such as:

- by the system manufacturer;
- by an instructor approved by the manufacturer;
- by an instructor who has passed an instructor course on board a ship or on shore;
- Computer Based Training (CBT) on board a ship or on shore.

The major drawback of the training provided by the system producer is the greater amount of time that it will take compared to other training methods. It is also more expensive than the other training methods. Last but not least, the fact that there

is a large number of manufacturers on the market means that if a ship owner has ships with several types of ECDIS, the Watchkeeping officers should receive training from all manufacturers, who are most likely located in different places around the world. Undoubtedly, the advantage of this training method is that Watchkeeping officers have become familiarised with the system manufacturer and have been trained before the system has been installed on board a ship.

The training carried out by a manufacturer-approved instructor was introduced as a result of the need for more global representation of a company and its product. The aforementioned inconveniences associated with travelling and waste of time make this option preferable, as training can be done directly on board the ship. The disadvantage of this option is the engagement of the crew with the cargo handling activities, as well as the other obligations that must be fulfilled during the ship's stay in a port.

Training by an instructor who has taken an instructor course is also a common method. The main advantage of this option being that the Watchkeeping officer becomes familiar with the system before boarding the ship. It is important to note that this method of training is good in case there is a training centre with such an instructor nearby. Otherwise, when it is necessary to travel to another country, we revert to the shortcomings listed in the section on training by the manufacturer – a journey that increases time, costs and so on.

Computer-based training with licensed software can be accomplished in several ways:

- by software provided by the manufacturer and installed at a training centre. This procedure may also be carried out on board the ship;
- by registering on the manufacturer's website;
- using an Internet platform in which different types of ECDIS are available. The German company Safebridge, which has more than 10 manufacturers and more than 20 ECDIS models, is a typical example of this type of training.

Each of these methods uses webcams that are designed to prevent potential cheating.

The main advantage of computer-based training is the chance to learn at any time and in any location, except when it is at a training centre. Another thing to note is that the learners usually have enough time to prepare, and only when they think they are ready can they proceed to the test procedure.

In comparison, training by an instructor at a training centre or on board is limited in time, with different manufacturers having different requirements for doing this.

Table 1 provides information regarding the duration of training according to system manufacturers [Brcic and Sabalja 2013].

Table 1. Duration of ECDIS specific training according to system manufacturers

Producer	Duration of training, in hours
SIMRAD	8
KELVIN HUGHES	8
SAM ELECTRONICS	8
KONGSBERG	16
TRANSAS	16
JRC	16
RAYTHEON ANSCHUETZ	16
JEPPENSEN	16
SPERRY MARINE	16
FURUNO	16
IMTECH MARINE	16
DANELEC MARINE	16
CHART WORLD	16
TOTEM PLUS	16
NACOS PLATINUM	16
TOKYO KEIKI	16
MARIS 900	16

Source: own study.

As can be seen from the table, the duration of the training at training centres varies between one and two days, which is incomparable with the time the learner has if he uses a computer. The greater amount of time allows for multiple practicing of each element of using the system.

Self-training, on the other hand, deprives the learner of the opportunity to ask questions, i.e. if an element of the system has not been understood by watching the video that explains it, he must rely on his experience, knowledge and skills for its proper interpretation and application in practice. It should also be pointed out that despite the availability of cameras recording the learner's actions, it is not impossible to use "external" assistance so that he/she can perform better on the final exam and obtain a certificate.

For this reason, some Flags, as well as some companies, do not accept certificates obtained after computer-based training, as shown in Table 2.

Table 2. Approval of ECDIS specific training according to Flag State requirements

State	Producer approved On-board/shore Instructor	Computer-based training
UK Maritime and Coast Guard Agency, MPA Singapore, US Coast Guard, Gibraltar Maritime Administration, Bahamas Maritime Authority, St. Vincent and Grenadines	YES	NO
Bermuda Maritime Administration, Australian Maritime Safety Authority, Panama Maritime Authority, Marshall Islands, Cyprus Maritime Authority, Bulgarian Maritime Administration, German Maritime Administration	YES	YES

Source: own study.

From everything that has been said so far, it becomes clear that the options for undergoing ECDIS specific training are many, which is a prerequisite for significant discrepancies in the knowledge and skills of Watchkeeping officers. An additional drawback is also the fact that to date, there are more than 35 officially approved ECDIS systems that can be used as a basic navigation system [Approved ECDIS Systems]. Each of these models complies with MSC Resolution.232 (82) of the International Maritime Organization, which should offer uniformity in operating them, as this was the primary objective for developing these standards. In practice, however, this is achieved only to a certain extent, namely in the part concerning the availability of certain options, i.e. the resolution postulates what these systems must necessarily do and what functions they should have, but how these mandatory elements are implemented in every single system is an entirely different issue. It is quite normal to expect that with such a large number of approved systems, we will also have significant differences in operating them.

5. SPECIFIC DIFFERENCES BETWEEN ECDIS MODELS

Some ECDIS models (FURUNO FMD 3100, DANELEC, IMTECH) operate on LINUX OS, while others (NAVI-SAILOR 4000 TRANSAS, FURUNO FEA 2107/2807, CHARTWORLD) use WINDOWS OS.

The next very important element is the system's interface, and here the diversity is extremely large and is a serious cause for difficulties in working with each different console. It should be noted here that there are models by the same manufacturer which have significant interface differences (FURUNO FEA – FURUNO FMD, JRC JAN 2000,901B, 701B - JRC 9201), to say nothing about the models of different manufacturers.

Table 3. Duration of ECDIS specific training at some training centres

Training centre	Models	Duration
ECDIS Ltd Whiteley UK	Sperry Marine Vision Master FT; Transas Navi-Sailor 4000; JRC; OSI ECPINS; Kelvin Hughes Manta Digital; Kelvin Hughes Manta Digital Widescreen; PC Maritime Navmaster; Simrad; Totem ECDIS.	8 hours
Wilhelmsen	JRC JAN-701/901/2000, JRC JAN-7201/9201, Simrad MARIS ECDIS900, Transas Navi-Sailor 4000, Kelvin Hughes Manta Digital ECDIS, ChartWorld eGlobe G2	3 days
Wilhelmsen	Furuno FMD, Highlander 100 ECDIS, Highlander 600 ECDIS	2 days
Glasgow Maritime Academy	Transas, Sperry Marine, JRC, Raytheon Anchütz, Maris, Imtech, Consilium, ChartWorld, SAM Electronics, Ceat seven c's, Kelvin Hughes – Manta digital Ecdis, Simrad E5024, Martek Marine – iecdis	14 hours
Anglo-Eastern Maritime Training Centre	JRC, Maris 900, Transas 4000, Furuno FEA; FMD	1 day
Anglo-Eastern Maritime Training Centre	Chartworld e-globe, Headway HMT E-100	2 days

Source: own study.

Significant differences can also be found with regard to the configuration of the consoles used by the ECDIS system, in particular the keyboard differences. Because of a lack of standardisation, the available keyboards are extremely diverse. There are keypads with just a few buttons used for day-to-day routine functions (zoom in / out, day / night, etc.), others with some additional features (MOB, MENU, AIS / TT etc.), as well as examples of an almost complete computer keyboard with buttons added to it that are specific to the ECDIS system.

Last but not least, there are significant differences in the functionality of individual systems. With some, the execution of simple routine tasks is a serious challenge, which is a prerequisite for the occurrence of potentially dangerous situations.

This list can be extended, but it is sufficient to understand how important the role of ECDIS training is. Here we have to point out that many education centres provide ECDIS type specific courses with duration, different than manufacturer's

requirements (Table 3) [Anglo-Eastern 2019; Glasgow 2019; Whiteley 2019; Wilhelmsen 2019].

6. CONCLUSIONS

The statement above clearly shows that there are significant differences in the type specific training when working with ECDIS. A summary of the practical experience at the Nikola Vaptsarov Naval Academy training centre leads to the conclusion that the lack of a standard allows for broad improvisation in ECDIS familiarisation requirements. In this way, seafarers waste time adapting to the specific training course with each ECDIS model. Thus, a different level of knowledge of the performance of the system after completion of training can be expected.

Taking into account the above-mentioned computer training, it is necessary to conclude that there is a need to introduce standards for specific ECDIS training.

Our vision is that IMO Resolution A.817(19) can be supplemented properly with guidance to the producers. As the type specific training methodology is created following the manufacturer's requirements, their proposals in this respect are of priority.

Each of the ways of training mentioned in the survey has positive aspects. Having these in mind and amending their negative aspects help to create uniform training rules. All this needs to be done to reduce the number of incidents that arise due to improper operation of ECDIS systems.

In conclusion, it can be assumed that the number of ECDIS models is likely to increase rather than decrease in the coming years and that the number of paperless ships will also increase. This tendency makes the role of training essential. It is too reckless to leave it simply to the trainees' conscience.

The pragmatic solution is to introduce minimum training standards to ensure that each trainee who meets these standards will be able to work with the particular ECDIS model, will be aware of its specific features that distinguish it from other similar models and will know the indicators of system well and all specific settings that would guarantee safer navigation.

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