

Updating the Electronic Chart Display and Information System (ECDIS) data rendering software

— A mandatory requirement under the *lex lata*? —

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Submission deadline: 1 November 2016

Number of words: 16.900 (max. 18.000)



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Table of Abbreviations

AIS	Automatic Identification System
AMSA	Australian Maritime Safety Authority
ARPA	Automatic Radar Plotting Aid
BIMCO	Baltic and International Maritime Council
BSH	Federal Maritime and Hydrographic Agency of Germany
Circ.	IMO circular
CJEU	Court of Justice of the European Union
CLIA	Cruise Lines International Association
DG MOVE	European Commission Directorate-General for Mobility and Transport
DNV-GL	Det Norske Veritas – Germanischer Lloyd Classification Society
ECDIS	Electronic Chart Display and Information System
IMO	International Maritime Organization
ECS	Electronic Chart System
EEA	European Economic Area
ENC	Electronic Navigational Chart
RNC	Raster Navigational Chart
EU	European Union
HSSC	Hydrographic Services and Standards Committee
IALA	International Association of Lighthouse Authorities
ICS	International Chamber of Shipping
IEC	International Electro-technical Commission
ICS	International Chamber of Shipping
IHO	International Hydrographic Organization
CIRM	Comité International Radio-Marine
MED	European Union Marine Equipment Directive
MSC	Maritime Safety Committee of the International Maritime Organization
NAV	IMO Sub-committee on Safety of Navigation
NCSR	IMO Sub-committee on Navigation, Communications, Search and Rescue
NI	Nautical Institute
NTM	Notice to Mariners
PS	Performance Standards
PSSA	Particularly Sensitive Sea Areas
ASL	Archipelagic Sea Lanes
SENC	System Electronic Navigational Chart
SHOM	Service Hydrographique et Océanographique de la Marine
SOLAS	International Convention for the Safety of Life at Sea
STCW	International Convention on Standards of Training, Certification and Watch-keeping for Seafarers
UKHO	United Kingdom Hydrographic Office
USCG	United States Coast Guard
VTS	Vessel Traffic Service
WWNWS	World-Wide Navigational Warning Service sub-committee

Introduction

1. Thesis statement

At a maritime law conference I attended in Bremen in 2015 I heard a phrase that intrigued me: *shipping is the most analog business in the world*. Even though there is some truth to this statement, it is evident that the shipping industry today, both afloat and ashore, is increasingly dependent on sophisticated IT and electronic operational tools. One of the first such truly technologized devices installed on vessels is the Electronic Chart Display and Information System (ECDIS). The ECDIS is a computer-based and satellite-guided navigation information system that can be used as an alternative to traditional paper nautical charts.

The International Maritime Organization (IMO) requires that all vessels engaged in international voyages carry nautical charts¹ on board. This dissertation will focus on the question of what constitutes an ‘up-to-date navigational chart’ as per SOLAS V/27, in the context of ECDIS equipment used to comply with the chart carriage requirement of SOLAS V/19.2.1.4. This topic was put forward to the Nordisk Institutt for Sjørett by the classification society Det Norske Veritas – Germanischer Lloyd (DNV-GL), and I took up the challenge of answering this question in the hereby LL.M. in Maritime Law dissertation.

In order to give an answer to this question, the main part of this dissertation will provide an in-depth analysis of the *lex lata* – in particular the legal obligations stemming from the International Convention for the Safety of Life at Sea (SOLAS) and several IMO instruments regarding ECDIS. Towards the end, this dissertation will also contemplate what the *lex ferenda* should be regarding ECDIS software updating.

2. The Electronic Chart Display and Information System

An ECDIS comprises of three main elements: a) hardware, b) data rendering software (henceforth ECDIS software), and c) data. The hardware (a) consists of a computer and a display. The application software (b) is installed on the ECDIS computer and instructs the drawing engine of the ECDIS on how to interpret and display the electronic navigational charts (ENC). The data (c) is the set of ENC’s required for the voyage in question. An Electronic Navigational Chart is a digital navigational chart in a vector format. In a vector chart, each point is digitally mapped, which allows for sophisticated ways of interacting with the map. For instance, it is possible to click on a feature of the map (e.g. a lighthouse) to display all the details of that feature.² Moreover, ENC’s in vector format allow for zooming without any loss of quality.³ This contrasts with Raster Navigational Charts (RNC), which are basically just digital scans of paper charts, displayed on an electronic screen.⁴ For this reason, RNC’s do not permit zooming without loss of quality.

¹ Nautical charts are maps specifically designed to meet the requirements of marine navigation, showing amongst other things depths, nature of the sea-floor, elevations, configuration and characteristics of the coast, dangers and other aids to navigation.

² International Maritime Organization, ‘Navigation Charts’

<<http://www.imo.org/en/OurWork/Safety/Navigation/Pages/Charts.aspx>> accessed on 18 May 2016.

³ United States National Oceanic and Atmospheric Administration (NOAA), Office of Coast Survey ‘Differences between RNC’s and ENC’s’ <http://www.nauticalcharts.noaa.gov/mcd/learn_diffRNC_ENC.html> accessed on 19 May 2016.

⁴ *ibid*.

Introduced in the early 1990's, the ECDIS has been referred to as the 'mariner's window to the world'.⁵ In an article from 1995, B. Riches from the Australian Maritime Safety Authority noted that 'ECDIS is more than merely a paper chart portrayed on a screen, ECDIS is a real-time, automated decision-aid that is capable of continuously determining a vessel's position in relation to land, charted objects, aids to navigation and unseen hazards.'⁶ Thus, in addition to displaying the navigation charts, the ECDIS allows the mariner to display other essential information for navigation (weather, marine traffic conditions, radar overlay, etc.). Mariners can program these parameters into the ECDIS's system, which can then produce visual and audible alarms to warn of impending dangers.⁷ In addition, the ECDIS can model tidal heights for any given time and place, which is a considerable aid for the mariner compared to printed tide tables.⁸

Today, ECDIS is a central component of the e-Navigation strategy⁹ developed by the IMO in collaboration with a number of intergovernmental and non-intergovernmental organizations.¹⁰ With regard to ECDIS, the aim of the e-Navigation strategy is to evolve from the simple display of electronic charts to complete 'situational awareness'¹¹ – derived from the harmonious and error-free integration of all the electronic navigational tools on-board, such as the Automatic Identification System (AIS), Vessel Traffic Service (VTS), Automatic Radar Plotting Aids (ARPA), etc.

However, despite the multiple advantages that the ECDIS brings to the bridge, the United Kingdom Hydrographic Office (UKHO) reported, for example, that in 2015 over 46% of the global fleet of tankers (over 4,000 vessels) was not yet using an ENC service.¹² This is a rather low number when considering the potentially disastrous environmental effect that a tanker casualty could have. In order to improve this situation, the SOLAS Convention has been amended in 2009 (as per Resolution MSC.282(86)), and now requires mandatory carriage of ECDIS for all vessels engaged in international voyages. A rolling timetable for the installation of ECDIS was fixed in SOLAS V Reg 19.2.10, which established a staged entry into force between 1 July 2012 and 1 July 2018 of the obligativity to have ECDIS installed on-board. The deadlines fixed in Regulation 19.2.10 are based on the type of vessel and on gross tonnage, as shown in the table below.

⁵ Wan Xiaoxia and Gan Chaohua, 'Electronic Chart Display and Information System' (2002) Vol. 5, Issue 1, Geo-spatial Information Science Quarterly 7, 8.

⁶ Riches B, 'ECDIS – its impact today' (1995) Vol. 48, Issues 2, Journal of Navigation, 234.

⁷ United States NOAA website, Office of Coast Survey 'Differences between RNC's and ENC's'.

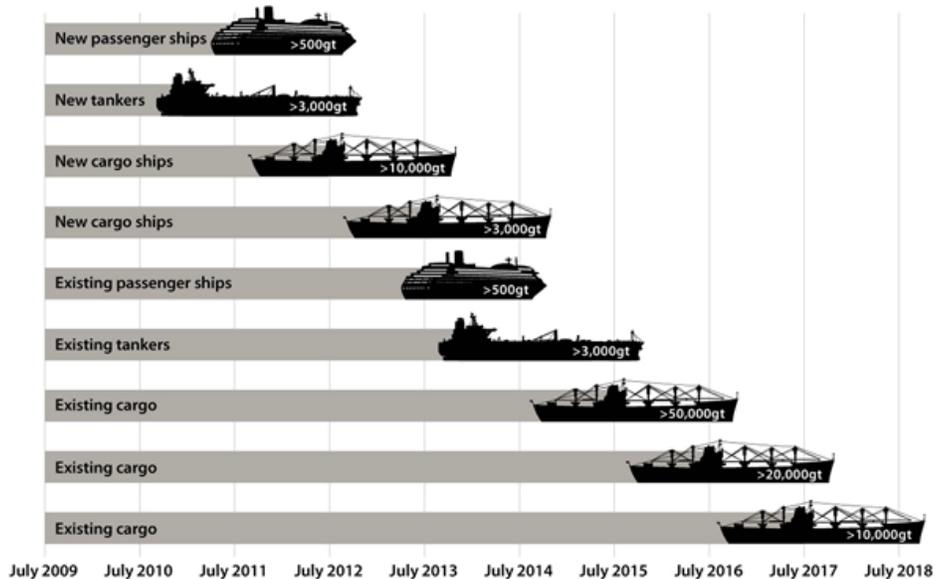
⁸ Pillich B, 'Tidal Overlay and Dynamic ECDIS – a giant step from paper charts and tide tables' (1997) Oceans '97 MTS/IEEE: Conference Proceedings, 967.

⁹ The definition of e-Navigation (approved at MSC 85/26 Annex 20) is: '*e-Navigation is the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment.*'

¹⁰ These organizations are: the International Hydrographic Organization (IHO), the Comité International Radio-Maritime (CIRM), the International Association of Lighthouse Authorities (IALA), the International Chamber of Shipping (ICS), the Baltic and International Maritime Council (BIMCO), and the International Electrotechnical Commission (IEC).

¹¹ Bergmann M, 'Integrated Data as backbone of e-Navigation' (2013) Vol. 7, No. 3, International Journal of Marine Navigation and Safety of Sea Transportation, 371.

¹² Over 4,000 tankers not ready for upcoming ECDIS mandate (2016) <<http://gcaptain.com/over-4000-tankers-not-ready-for-upcoming-eccdis-mandate/>> accessed on 1 August 2016.



3. The legal dispute

In short, the legal dispute is whether there exists a legal obligation to update the ECDIS application software for vessels relying on ECDIS as the primary means of navigation. While this may seem a trifle problem, it is significant as far as it holds great practical importance for the shipping industry. Firstly, since updating the ECDIS application software is generally out of the control of the ship-owner, this generally requires the vessel to be in a specific port in order for a representative of the ECDIS manufacturer to come on-board and update the application software. This requires time and money.

Secondly, it may be that the hardware is too old to be capable of running the updated version of the application software. This would require updating or replacing the hardware (i.e. the ECDIS itself), which often-times is not an easy task because the ECDIS is integrated into the bridge systems. Again, this requires more time and money.

Thirdly, this legal uncertainty poses a problem from a regulatory point of view: should Flag Administrations require its vessels to update the ECDIS software?; and could Port State Authorities detain a vessel simply because the ECDIS application software is not up-to-date, even though the ENC's displayed by the ECDIS are up-to-date?

It is thus easy to see why it is important to know with certainty whether such a legal obligation to update the ECDIS application software exists under the *lex lata*. The following is a condensed *exposé* of the legal dispute:

SOLAS Chapter V/27 establishes that '*nautical charts [...] shall be adequate and up to date*', but gives no further details as to what 'up-to-date' means for ENC's and for paper charts. A strict interpretation of this provision would be that only the ENC's themselves have to be updated – an action which is similar with the replacement of paper charts with up-to-date ones. However, the authority of this strict interpretation is quickly eroded when the following aspect is taken into

account: if the ECDIS machine is running an older application software, the up-to-date ENC's may be displayed with errors. As learned from several surveys which are referred to later in this work, there could be many different types of errors, each with a different degree of seriousness – for instance, newer features like Particularly Sensitive Areas (PSSA) and Archipelagic Sea Lanes (ASL) may not be displayed at all by ECDIS machines running older application software.¹³

In trying to combat this growing phenomenon, the IMO has adopted performance standards for ECDIS systems, most recently through Resolution MSC.232(82) from 2006. These performance standards were made mandatory by direct reference in SOLAS V/18.4.¹⁴ Further, the IMO has adopted two (non-mandatory) guidance circulars, in an attempt to further clarify the requirements for maintenance of ECDIS software: IMO SN.1/Circ.266/Rev.1 (2010) and IMO MSC.1/Circ.1503 (2015). The latter instrument, for instance, states that '[...] *ECDIS software should be kept up to date such that it is capable of displaying up-to-date electronic charts correctly according to the latest version of IHO's chart content and display standards.*'

The issue is that although the language used in the latter circular is very strong, the instrument itself is a mere guidance and hence not legally binding – unless it is voluntarily made mandatory by Flag Administrations. For this reason, it cannot simply be concluded that 'up-to-date navigational charts' (as per SOLAS V/27) implies that the ECDIS software has to be updated as well in order to correctly display the ENC's, because such an interpretation would clash with the requirement in SOLAS V/18.4.¹⁵

From this provision it seems that an ECDIS having a valid type approval certificate at the date of installation will continue to comply with the carriage requirement of regulation SOLAS V/19.2.1.4 also when the relevant ECDIS software is updated afterwards. To put it more simply, this means that even in the absence of any software update for the entire life of the vessel, the ECDIS would still comply with SOLAS. Of course, since vessels have a rather long life-cycle, and computer technology has seen a sharp increase in the last two decades (trend which is likely to continue at an exponential rate), one can reasonably expect the hardware – let alone the software – installed when the vessel was launched to become obsolete well before the vessel is taken out of service.

Having set the background of the legal dispute, the legal question that this dissertation will seek to answer is: *in the international legal framework as it stands today, is there an unambiguous obligation to update the ECDIS software in order to correctly display the up-to-date ENC's?* The research question will be answered in Chapter 1. Upon answering the main research question, Chapter 2 will discuss the differences between *integrated* and *non-integrated* ENC updates. In the end, Chapter 3 will conclude this dissertation by attempting to portray the *lex ferenda* – focusing primarily on whether such an unambiguous obligation to update the ECDIS software should exist from the point of view of safety of navigation.

¹³ See section 1.4.

¹⁴ SOLAS contains the following mandatory language in V/18.4: '*for an electronic chart display and information system (ECDIS) to be accepted as satisfying the chart carriage requirement of regulation 19.2.1.4, that system shall conform to the relevant performance standards not inferior to those adopted by the Organization in effect on the date of installation [...]*'.

¹⁵ *ibid.*

Chapter 1 – *Lex Lata*

In order to answer the research question, it is necessary to examine *lex lata* in-depth. The following sections will outline and analyse the law as it stands, while the final section of this chapter will draw the conclusions based on the knowledge gathered.

1.1 What is governed by SOLAS Chapter V regarding ECDIS?

This section will spell-out the provisions of SOLAS which are relevant with regard to the implementation and operation of ECDIS. The first relevant provisions are found in Regulation 18 (as per SOLAS Consolidated edition 2014),¹⁶ which deals with ‘approval, surveys and performance standards of navigational systems and equipment’:

Regulation 18.2:

*Systems and equipment, including associated back-up arrangements, where applicable, installed on or after 1 July 2002 to perform the functional requirements of regulations 19 and 20 shall conform to appropriate performance standards not inferior to those adopted by the Organization.**

The asterisk indicates that reference has to be made, *inter alia*, to several IMO-adopted recommendations and performance standards, among which the Recommendation on Performance Standards for electronic chart display and information systems (ECDIS) (Resolution A.817(19), as amended).

Regulation 18.4:

*[...] However, for an electronic chart display and information system (ECDIS) to be accepted as satisfying the chart carriage requirement of regulation 19.2.1.4, that system shall conform to the relevant performance standards not inferior to those adopted by the Organization **in effect on the date of installation**, or, for systems installed before 1 January 1999, not inferior to the performance standards adopted by the Organization on 23 November 1995.**

The asterisk indicates that reference has to be made, *inter alia*, to the (revised) Performance Standards for Electronic Chart Display and Information Systems (ECDIS) (Resolution A.817(19), and Resolution MSC.232(82)).

Regulation 18.4 represents the legal basis for ECDIS installations already in operation on board, which have to be type-approved in order to meet the required IMO performance standards in effect on the date of installation. The conclusion can thus be drawn that an ECDIS having a valid type-approval certificate at the ‘date of installation’ will continue to comply with the carriage requirement of regulation SOLAS V/19.2.1.4 also when newer ECDIS software standards come into force, and the ECDIS in question is not updated to these latest standards. This is a crucial qualification to which reference will be made very often in this dissertation.

¹⁶ It is important to note that a revised Chapter V (Safety of Navigation) of SOLAS was adopted by the IMO’s Maritime Safety Committee at its 73rd session (see IMO Resolution MSC.99(73)). This came into force on 1 July 2002, and is hence included in the 2014 Consolidated version of SOLAS used in this dissertation.

Regulation 18.7

When equipment, for which performance standards have been developed by the Organization, is carried on ships in addition to those items of equipment required by regulations 19 and 20, such equipment shall be subject to approval and shall, as far as practicable, comply with performance standards not inferior to those adopted by the Organization'

Although this provision does not specifically refer to electronic charts systems, such equipment is covered by this provision because the IMO has in fact adopted performance standards for electronic chart systems (as per Resolution A.817(19) and Resolution MSC.232(82)). This provision thus requires that all electronic chart systems (ECS) installed on-board have to comply with performance standards not inferior to Resolution A.817(19) or Resolution MSC.232(82), depending on their date of installation. In essence, this means that all ECS installations on-board must comply with the requirements to be qualified as an ECDIS, regardless of whether they are the primary means of navigation or not.

Regulation 19 – Carriage requirements for shipborne navigational systems and equipment Regulation 19.2.1.4

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) may be accepted as meeting the chart carriage requirement of this subparagraph. Ships to which sub-paragraph 2.10 applies shall comply with the carriage requirements for ECDIS detailed therein;'

This provision establishes that ship-owners can choose to rely either on paper charts, or on a type-approved ECDIS (as per Regulation 18.4) to fulfill the nautical chart carriage requirement of this regulation. There is no obligation to use the ECDIS as the primary means of navigation, which would require that the ECDIS (rather than paper charts) has to be used in order to comply with the chart carriage requirement in Regulation 19.2.1.4. This means the ship-owner is free to determine the form of navigational chart to be used on-board as the primary means of navigation – paper charts or ECDIS.¹⁷

Notwithstanding, it is evident from Regulation 18.7 that ship-owners choosing to use paper charts as the primary means of navigation on vessels which are required to have ECDIS fitted (as per subsection 19.2.10), must install electronic chart display systems which comply with the performance standards adopted by the IMO in Resolution MSC.232(82). In order for an electronic chart system to be considered an ECDIS, it must comply with these IMO Performance Standards. To use the terminology of the IMO, any electronic chart system which does not comply with the IMO Performance Standards shall be referred to simply as ECS (Electronic Chart System), and since such systems are not type-approved they cannot be considered ECDIS systems.¹⁸

¹⁷ Note that when relying on ECDIS as the primary means of navigation, the vessel needs to have at least one redundant ECDIS system (two independent ECDIS computers, databases, and screens). If they meet this requirement, then are they not required to carry paper charts at all. However, it is required that all ENC's (and any RNC's) must be of the latest available edition and be kept up to date using both the electronic chart updates (e.g. ENC updates) and the latest available notices to mariners.

¹⁸ Wan Xiaoxia and Gan Chaohua, *ECDIS* (2002), 7.

As noted by Øvergård, the main difference between an ECS and an ECDIS is that ‘the hydrographical information used in ECDIS has to be officially approved, and the system has to fulfill specific standards – with IMO, IHO (International Hydrographical Organization) and IEC (International Electro-Technical Commission) as the main technical standard providers. There are also certain requirements for back-up, power supply redundancy, sensor inputs (position, speed and heading) and training which have to be fulfilled by an ECDIS.’¹⁹

To put it succinctly, any electronic chart display system installed on-board must be a type-approved ECDIS, regardless of whether it is used as primary or secondary navigational equipment (i.e. supplementary to paper charts). Accordingly, any electronic chart system which is not an ECDIS will be considered below the SOLAS-compliant level.

Regulation 27 – Nautical charts and nautical publications

*Nautical charts and nautical publications, such as sailing directions, lists of lights, notices to mariners, tide tables and all other nautical publications **necessary for the intended voyage, shall be adequate and up to date.***

With regard to ECDIS installations, Regulation V/27 requires that such systems must be fitted with up-to-date editions of ENC’s, or Raster Navigational Charts (RNC) where ENC coverage is not available. The crux of the problem is that Regulation V/27 does not differentiate between an up-to-date ENC and an up-to-date paper chart. In principle, the action of updating ENC’s is very similar to the action of updating paper charts, the copying of a new ENC digital file on the ECDIS being analogous with the replacement of paper charts with newer ones.

The issue arises when the ECDIS is not able to correctly display the updated ENC’s because the ECDIS software is not up-to-date. The only solution in this case is to update the ECDIS software.²⁰ However, the scope of application of SOLAS V/27 does not extend to ECDIS software-updating in addition to ENC data-updating because this would discriminate between updating ENC’s and updating paper charts – i.e. it would impose a more onerous burden on the ship-owners who rely on ECDIS to comply with the chart carriage requirement of SOLAS compared to those who rely on paper charts.

To put this into perspective, there could be situations in which there are no new ENC’s available for the journey to be performed, and also no new printed paper charts. This could be the case of a vessel sailing on a fixed route in a limited geographical area (e.g. a ferry). Accordingly, the ECDIS installed on-board, which is running older software, will nonetheless be capable of correctly displaying the latest available ENC’s necessary for the ship’s intended voyage. Since there have been no navigational modifications, the charts applicable to the vessel’s ‘intended voyage’ will undoubtedly be up-to-date for the purposes of complying with the requirement in SOLAS V/27. Thus, if a ship operating on this fixed route and which is relying on ECDIS as the primary means of navigation would be forced to update the ECDIS software even though there are no new ENC’s which require or benefit from the newer ECDIS software, this would be discriminatory compared

¹⁹ Øvergård K and Smit P, ‘The Effects of Sea Experience and Computer Confidence on ECDIS Training’ (2014) Vol. XI, No. II, Journal of Maritime Research 25, 26.

²⁰ As it will be explained in Chapter 2, making corrections manually on the SENC (SystemENC) is not a legally acceptable workaround for the need to update the ECDIS software.

to vessels relying on paper charts as the primary means of navigation. This is because the vessels relying on paper charts do not have to do anything else to comply with the chart carriage requirement of SOLAS (as there are no new printed paper charts available), while the ships using ECDIS would be forced to update the data rendering software, even though this update would bring no benefit whatsoever for the purposes of displaying the already up-to-date ENC's.

In addition, such an expansive interpretation of Regulation V/27 (extending the scope of 'nautical publications' to also include ECDIS data rendering software) would directly clash with Regulation V/18.4.²¹ It is thus not possible to read an obligation to update the ECDIS software in Regulation V/27 as it stands today.

As the fruit of an e-mail exchange I had with Mr. David Medhaug from the Norwegian Maritime Authority (Sjøfartsdirektoratet), the Norwegian interpretation of 'adequate and up-to-date' as per Regulation V/27 is 'charts which can be read for the planned voyage ahead on the dedicated ECDIS'. From this rather vague formulation, one can only infer that the Sjøfartsdirektoratet requires that the ECDIS should not only be able to decrypt and display the ENC's, but to do so correctly and free of errors. Of course, this implies that the ECDIS should be running a software version which is capable of correctly displaying the ENC's necessary for the planned voyage.²²

1.2 What is governed by the STCW Code regarding ECDIS?

The STCW Code (Standards of Training, Certification and Watchkeeping)²³ puts the responsibility firmly on the ship-owner to ensure that seafarers on their vessels are competent to carry out the duties they are expected to perform. Thus, if a ship is fitted with ECDIS, the ship-owner has a duty to ensure that all officers who carry out navigational tasks are properly trained in the operation and use of electronic charts, and are familiar with the shipboard ECDIS equipment before using it operationally at sea.²⁴ Although the provisions of STCW are vague with respect to ECDIS, the following are relevant:

- STCW Code, Table A-II/1 *Navigation at the operational level* requires:
"Thorough knowledge of and ability to use navigational charts and publications."²⁵
- STCW Code, Table A-II/2, *Navigation at the management level* requires:
"[...] 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".

However, in practice it is not uncommon for Masters and bridge crew to be untrained or simply unwilling to rely on ECDIS. For instance, in May 2016 a bulk carrier was detained after it was

²¹ To remind the reader, SOLAS V/18.4 provides that an ECDIS having a valid type-approval certificate 'at the date of installation' will continue to comply with the carriage requirement of SOLAS V/19.2.1.4 also when newer ECDIS software standards come into force, and the ECDIS in question is not updated to these latest standards.

²² However, there is no requirement that this has to be the latest version available.

²³ International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW) as amended, including the 1995 and 2010 Manila Amendments. It is understood that the ECDIS training and certification requirements, as per the 2010 Manila amendments to the STCW code will enter into force on 1 January 2017.

²⁴ Weintrit A, *The Electronic Chart Display and Information System (ECDIS) – an operational handbook* (CRC Press 2009), 1013.

²⁵ The definition of nautical chart in SOLAS V/2 includes a special-purpose map or book, or 'a specially compiled database'. For the purposes of reading this provision of STCW, ECDIS systems are considered to be included under the term 'navigational charts'.

found that the crew was not trained in the operation of the ship's ECDIS.²⁶ This is rather disquieting considering that the STCW Code establishes – by analogy with paper charts – that for vessels relying on ECDIS as the primary means of navigation, it is the Master of the vessel who has the duty to implement the applicable ENC updates and to consider the latest available Notices to Mariners prior to commencing the voyage. This provision is found in Section A-VIII/2 – Watchkeeping arrangements and principles to be observed:

Section 5

*'Prior to each voyage, the master of every ship shall ensure that the intended route from the port of departure to the first port of call is planned using adequate and appropriate charts and other nautical publications necessary for the intended voyage, containing accurate, complete and **up-to-date information** regarding those navigational limitations and hazards which are of a permanent or predictable nature and which are relevant to the safe navigation of the ship.'*

1.3 The ECDIS Performance Standards adopted by the IMO

Before delving into the analysis of the Performance Standards themselves, it is important to spell out the different types of instruments used in practice by the IMO, and how these instruments are implemented and enforced at both the national and international levels.

1.3.1 Implementation and enforcement of the various IMO instruments

The IMO was established to develop technical, safety, security and pollution prevention standards related to maritime transport, but the IMO Convention does not contain any provision that gives the Organization enforcement and compliance monitoring powers.²⁷ It is the contracting governments which have the duty to implement and enforce these standards. When a Government accepts an IMO Convention it essentially agrees to make it part of its own national law and to enforce it just like any other law.²⁸

However, this *modus operandi* – with the IMO making the decisions at the top and flag states, port states and ship operators implementing them – is a major structural weakness of the implementation system.²⁹ In practice, the performance of the governments responsible with implementing the IMO legislation 'varies enormously from flag to flag'.³⁰ This disparity is a vicious-circle which often leads to the IMO aiming for the 'lowest common denominator'³¹ in order to ensure that a proposed regulation will actually be implemented in practice by the contracting governments. It should thus not come as a surprise that commentators by-and-large

²⁶ Crew unable to operate the ship's ECDIS <<http://gcaptain.com/australia-finds-detained-bulk-carriers-crew-was-unable-to-operate-the-ships-ecdis/>> accessed on 12 August 2016.

²⁷ IMO Resolution A.1054(27) 'Code for the Implementation of Mandatory IMO Instruments (30 November 2011), preamble <[http://www.imo.org/en/KnowledgeCentre/IndexofIMOResolutions/Documents/A%20-%20Assembly/1054\(27\).pdf](http://www.imo.org/en/KnowledgeCentre/IndexofIMOResolutions/Documents/A%20-%20Assembly/1054(27).pdf)> accessed on 10 May 2016.

²⁸ *ibid.*

²⁹ Nonetheless, as observed by Kiriaki Mitroussi, 'most of the key players in shipping recognise in the Organisation the authority to set safety and quality standards to be achieved and be applicable to all, thus ensuring not only an acceptable level of safety, but also fair competition.' In Mitroussi K, 'Quality in shipping: IMO's role and problems of implementation' (2004) Vol.13, No.1, Disaster Prevention and Management Journal, 50.

³⁰ *ibid.* 56.

³¹ *ibid.*

agree that ‘perhaps the greatest limitation of IMO is its inability to actually enforce the regulations it adopts’.³²

It is important to emphasize here the role played by classification societies in the implementation system of IMO decisions. As Olav Knudsen and Björn Hassler wrote in an article from 2011, ‘classification societies serve ship-owners, insurance companies and flag states as technical experts to whom much of the flag state’s authority is delegated. To perform their function the classification societies need to “translate” IMO decisions into concrete technical or operative standards to be effected on-board every vessel they certify for new-building or retrofitting, regardless of the flag state concerned.’³³

On this background, it is appropriate to spell-out the characteristics and legal-bindingness of the different instruments used by the IMO in exercising its functions. These instruments are conventions, resolutions, recommendations and guidelines.

a) Conventions

Conventions are the primary instrument of the IMO in regulating the maritime sphere. An IMO convention is a binding agreement between states, which comes into force after it is adopted by the IMO and subsequently ratified by the contracting governments. Once a convention is adopted by the IMO, ‘the states party to the convention are obliged to enforce it and non-parties are obliged to keep from actions that may undermine it.’³⁴

In order to make it easier to amend conventions, the IMO introduced a system called ‘tacit acceptance procedure’ which virtually created a quasi-legislative power for the organisation.³⁵ Through the ‘tacit acceptance procedure’, amendments to Conventions come into force after a certain period if a certain number of State parties do not oppose the adoption of the amendment within that period.³⁶ Member states which oppose the amendment are requested to voice their opinion. In simpler language, ‘tacit acceptance means accepted unless objected’.³⁷

b) Resolutions

IMO Resolutions can be issued either by the Assembly, the Council or by each of the IMO Committees (e.g. the Maritime Safety Committee).³⁸ Resolutions amend a part of an IMO convention with which they are associated, and are widely used in practice because drafting, ratification, and implementation of a new convention is a tedious and time-consuming process. Resolutions are generally not binding, but they can become binding by specific reference in the convention with which they are associated. However, this typically mandates an amendment to the convention itself.

³² Olaf Knudsen and Björn Hassler, ‘IMO Legislation and its implementation: Accident risk, vessel deficiencies and national administrative practices’ (2011) Vol.35, Issue 2, Marine Policy Journal 201, 203.

³³ *ibid.* 202.

³⁴ *ibid.*

³⁵ Karim S, *Prevention of Pollution of the Marine Environment from Vessels: the potential and limits of the International Maritime Organization* (Springer, 2015), Chapter 2, 31.

³⁶ *ibid.* 36.

³⁷ Olaf Knudsen and Björn Hassler, *IMO Legislation* (2011), 202.

³⁸ International Maritime Organization, ‘Index of IMO Resolutions’

<<http://www.imo.org/en/KnowledgeCentre/IndexofIMOResolutions/Pages/Default.aspx>> accessed on 20 May 2016.

c) *Guidelines and Recommendations*

Guidelines and recommendations are non-mandatory instruments which contain more details than normally contained in a convention. They provide guidance to the member States on the drafting of legislation on a specific subject. Although guidelines and recommendations are not themselves legally binding at the international level, it is common that these instruments are incorporated into national law because they are treated as international standards.³⁹ If this is the case, the national legislation implementing the IMO guidelines or recommendations can be applied with binding effect to both national and foreign ships.⁴⁰

Besides this, the IMO can, in principle, make guidelines and recommendations mandatory at the international level by incorporating them into a relevant Convention. This could be done by means of an express reference that uses mandatory language – e.g. ‘such requirements shall be treated as mandatory’.⁴¹

1.3.2 Resolution A.817(19) Performance Standards for ECDIS, as amended by Resolution MSC.232(82) – Revised Performance Standards for ECDIS

These performance standards are by themselves non-mandatory, but have been made mandatory by an express reference into SOLAS V/18.4 – as per Resolution A.911(22) paragraph 7. As stated in the preamble of Resolution A.817(19), the IMO adopted the performance standards for ECDIS ‘in order to ensure the operational reliability of such equipment, and to ensure that the information provided and displayed electronically is at least equivalent to that of up-to-date paper charts’.⁴² The purpose of Resolution MSC.232(82) was to improve upon resolution A.817(19), ‘in order to ensure the operational reliability of such equipment and taking into account the technological progress and experience gained’.⁴³

It is of great relevance for the purpose of answering the legal question to emphasize that these Performance Standards do not contain any provision which stipulates an obligation to update the ECDIS software. Instead, MSC.232(82) paragraph 4.1 merely states that:

The chart information to be used in ECDIS shall be the latest edition, as corrected by official updates, of that issued by or on the authority of a Government, government authorized Hydrographic Office or other relevant government institution, and conform to IHO standards.

Further, Appendix 1 of Resolution MSC.232(82) makes reference to the technical standards and specifications adopted by the International Hydrographic Organization (IHO) through several publications. These standards are meant to be used in conjunction with the IMO Performance Standards for ECDIS, which are laid out in Appendixes 2, 3, 4, 5, 6, 7 of Resolution MSC.232(82).

³⁹ Karim S, *Prevention of Pollution of the Marine Environment from Vessels* (2015), 21.

⁴⁰ *ibid.* 35.

⁴¹ See Resolution A.911(22) ‘Uniform Wording for Referencing IMO Instruments’ (29 November 2001), para 3.

⁴² IMO Resolution A.817(19) ‘Performance Standards for Electronic Chart Display and Information Systems (ECDIS)’ (23 November 1995), Preamble <[http://www.imo.org/blast/blastDataHelper.asp?data_id=22622&filename=A817\(19\).pdf](http://www.imo.org/blast/blastDataHelper.asp?data_id=22622&filename=A817(19).pdf)> accessed on 6 May 2016

⁴³ IMO Resolution MSC.232(82) ‘Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS)’ (5 December 2006), Preamble <http://www.imo.org/blast/blastDataHelper.asp?data_id=17269> accessed on 20 May 2016.

1.3.3 The role of the IHO in developing ECDIS technical standards

As seen in the previous section, the ECDIS Performance Standards adopted by the IMO make direct reference to the IHO's technical standards governing the display of the electronic chart information within ECDIS. This is because in developing the Performance Standards for ECDIS, the IMO worked closely with both the IHO and the IEC (International Electro-Technical Commission). Thus, the IMO has essentially delegated authority to the IHO and IEC for certain aspects relating to the technical functioning of ECDIS. The IMO is thus in charge of standards related to safety at sea, while the IHO defines the standards for hydrography and nautical charting.⁴⁴

Nonetheless, it is important to emphasize that the IMO Performance Standards are considered the umbrella standards because they make reference to the standards developed by the IHO, and not the other way around.⁴⁵ The main IHO technical standards which are used in conjunction with the IMO Performance Standards for ECDIS are the following:

- IHO S-52 *Specifications for Chart Contents and Display Aspects of ECDIS* – Ed. 6.1.0 (October 2014)
- IHO S-52 (*Annex A to S-52*) *Presentation Library for ECDIS* – Ed. 4.0.1 (October 2014)
- IHO S-57 *IHO Transfer Standard for Digital Hydrographic Data*
- IHO S-63 *IHO Data Protection Scheme* – Ed 1.2.0 (January 2015)
- IHO S-64 *IHO test data Sets for ECDIS* – Ed. 3.0.0

Of the above, only S-52 Specifications for Chart Contents and Display Aspects of ECDIS and S-52 Annex A – Presentation Library for ECDIS are relevant for answering the legal question. As a matter of fact, the 'ECDIS software' referred to so-far in this dissertation is this S-52 special publication. Nonetheless, for the purposes of consistency I will primarily continue using 'ECDIS software' rather than S-52.

To put it succinctly, the S-52 is responsible for the portrayal of the ENC's on the ECDIS screen. It contains software instructions for the drawing engine of the ECDIS computer on how to display symbols, colours and line styles on the screen of the ECDIS.⁴⁶ With the latest version of the S-52 from October 2014, the IHO ensured that the modifications reflect lessons learned from earlier reports of unexpected chart behaviour in some ECDIS devices, and that all identified ambiguities and inconsistencies relating to the display of ENCs in ECDIS have been resolved.⁴⁷ Hence, upon updating to the October 2014 version of the S-52, the ECDIS should function without errors, regardless of the ENC's used. The IHO alleges that the latest version of the S-52 display standard 'entered into force' on 1 August 2015, but this statement has no legal weight from the point of

⁴⁴ Déniel Jean-Luc, 'Electronic Navigational Chart Data' (1994) *Oceans '94. Oceans Engineering for Today's Technology and Tomorrow's Preservation: Proceedings*, 541.

⁴⁵ Gonin I, 'Electronic Navigational Chart (ENC) Updating Study: Final Report' (1998) United States Coast Guard Research and Development Center, Prepared for the U.S. Department of Transportation, 2.

⁴⁶ Note that the ECDIS display of information is not only specified by the S-52 standard but also by the IEC 61174 standard. The S-52 specifies the rules for SENC display while IEC 61174 deals with the representation of navigation related information (i.e. radar). See IEC 61174 International Standard 'Maritime navigation and radio-communication equipment and systems: Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results' Ed. 4.0.0 (Genève, 2015). See also Weintrit A, *ECDIS – an operational handbook* (2009), 198.

⁴⁷ IHO Press release 'New normative references for type approval of ECDIS' (Monaco, June 2015) <https://www.iho.int/mtg_docs/misc_docs/NewReleasesForECDIS_PressRelease.pdf> accessed 10 April 2016.

view of SOLAS or the IMO. Accordingly, previous versions of the S-52 remain legally compliant, and there is no obligation to update to the latest version available.

1.4 The 59th session of the IMO sub-committee on Safety of Navigation (NAV 59)

One of the most important points on the agenda of NAV 59 (September 2013) was to discuss the necessity to have unambiguous rules regarding the maintenance of ECDIS software up-to-date to the latest IHO standards. The starting point of the discussions regarding ECDIS was the *Report on operating anomalies identified within ECDIS* (NAV 59/12), submitted by BIMCO and the Kingdom of Denmark. This report presented the results of a survey conducted jointly by BIMCO and Denmark, in which 613 responses have been received from ships flying various flags.

The results of the survey showed, *inter alia*, that 73,6% of all respondents indicated that the ECDIS on-board was updated to the latest IHO standards.⁴⁸ However, the IHO examined the answers given by the participants for this question and concluded that many respondents actually interpreted this question as meaning ‘updating the ENC data’ rather than ‘updating the ECDIS software’.⁴⁹ This of course means that in reality the percentage of ECDIS installations running the latest version of the (S-52) software is considerably lower than 73%.

Further, the BIMCO / Denmark survey showed that 35% of all respondents indicated that they had experienced anomalies when using ECDIS,⁵⁰ and 17,5% of respondents had experienced problems during an update of an ENC, in which the ECDIS system failed to display a navigational feature correctly.⁵¹ Examples of such errors are: pilot boarding points, depths in dredged channels, anchorage swinging circles not being shown, features disappearing when the display is zoomed out and difficulty in accessing some information such as magnetic variation.

Along with the BIMCO / Denmark survey, the IHO presented a *Report on monitoring of ECDIS issues* (NAV 59/12/1). This report identified, *inter alia*, that one of the most frequent ECDIS anomalies was the inability to correctly display the latest approved chart symbols, as recognized by the IMO (e.g. Particularly Sensitive Sea Areas (PSSA) and Archipelagic Sea Lanes (ASL)). Over 40% of the reports indicated such an anomaly.⁵² If an ECDIS is unable to interpret and draw any newly introduced chart symbol it will display a question mark (‘?’) instead. Additionally, there is a possibility that alarms and indications for these newly introduced features may not be activated even though they have been included in the ENC.

In trying to combat this growing phenomenon, the IHO presented their conclusions to the NAV sub-committee and recommended that ‘all ECDIS should be up-to-date so as to conform to the latest edition of the relevant IHO standards reported to IMO, whatever their date of installation.’⁵³ The IHO motivated that this is a necessary pre-condition for enabling the ENC’s to be ‘adequate

⁴⁸ IMO Meeting Document NAV 59/12 ‘Operating anomalies identified within ECDIS – submitted by BIMCO and Denmark’ (23 May 2013), 2 <<https://docs.imo.org/Shared/Download.aspx?did=79142>> accessed on 10 May 2016.

⁴⁹ IHO Report on the results of the ECDIS survey conducted by BIMCO and Denmark (February 2014), para 29 <https://www.iho.int/mtg_docs/enc/IHO_Bimco_Report_final.pdf> accessed on 18 March 2016.

⁵⁰ IMO Meeting Document NAV 59/12, 4.

⁵¹ *ibid.* 5.

⁵² IMO Meeting Document NAV 59/12/1 ‘Report on monitoring of ECDIS issues – submitted by the IHO’ (25 June 2013), 2 <<https://docs.imo.org/Shared/Download.aspx?did=79301>> accessed on 10 May 2016.

⁵³ *ibid.* 3.

and up-to-date’ (as required by SOLAS regulation V/27), and thus in conformance with the ECDIS Performance Standard which stipulates that ‘the chart information to be used in ECDIS should be the latest edition of information originated by a government-authorized hydrographic office, and conform to IHO standards’ (as per Resolution MSC.232(82) paragraph 4.1).

1.4.1 NAV 59/13 – Proposal for a clarification of SOLAS V/27

The co-sponsors of NAV59/13 – Australia, the United Kingdom, the IHO, the Nautical Institute (NI) and the Comité International Radio-Marine (CIRM) – identified that although SOLAS V/27 requires that nautical charts and nautical publications be ‘adequate’ and ‘up-to-date’, there is no further guidance explaining what the implication of these terms is regarding ECDIS software.

Accordingly, a proposal was put forward before the NAV sub-committee for an explanatory footnote be inserted in SOLAS Regulation V/27 in order to explain what is meant by ‘adequate’ and ‘up to date’ in relation to the use of ECDIS, particularly when ECDIS is used to meet the chart carriage requirement in SOLAS V/19.2.1.4. The co-sponsors of NAV 59/13 held that ‘an explanation is required for instances when ECDIS is used to meet the chart carriage requirements and is therefore the primary means of navigation. ECDIS software must be updated so that it is capable of displaying charts correctly using the latest version of the IHO’s chart content and display standards (the Presentation Library from IHO Publication S-52).’⁵⁴

The text proposed for inclusion in SOLAS V/27 by means of a footnote in SOLAS V/27 reads: *‘When ECDIS is used to meet the chart carriage requirements, its software must be up to date such that it is capable of displaying up to date electronic charts correctly according to the latest version of the International Hydrographic Organization’s chart content and display standards. Refer also to SN.1/Circ.266/Rev.1, [as amended].’*⁵⁵

1.4.2 NAV 59/13/1 – Comments on the proposal to clarify SOLAS V/27

This document submitted by the the International Chamber of Shipping (ICS) and Cruise Lines International Association (CLIA), emphasized the practical difficulties that might arise from the proposed explanatory footnote to SOLAS V/27. The co-sponsors of NAV 59/13/1 emphasized that in contrast to the use of paper charts, where updates are provided regularly and new chart editions are printed and made available when issued, ‘the application of ECDIS software updates will be generally out of the control of the ship-owner.’⁵⁶ They further argued that ECDIS software updates generally cannot be installed by the ship’s crew, and this entails that a representative of the ECDIS manufacturer will need to visit the vessel while in port in order to install the software update.⁵⁷

It was also drawn to the attention of the NAV sub-committee that since SOLAS V/27 refers to navigational charts for the ‘intended voyage’, this should have been recognized more clearly in the

⁵⁴ IMO Meeting Document NAV 59/13 ‘Proposal for a clarification of SOLAS regulation V/27’ (31 May 2013), para 7 <<https://docs.imo.org/Shared/Download.aspx?did=79165>> accessed on 12 May 2016.

⁵⁵ *ibid.* para 10.

⁵⁶ IMO Meeting Document NAV 59/13/1 ‘Comments on the proposal to clarify SOLAS V/27’ (11 July 2013), para 6 <<https://docs.imo.org/Shared/Download.aspx?did=79590>> accessed on 12 May 2016.

⁵⁷ *ibid.* para 7-8.

proposed footnote to SOLAS V/27.⁵⁸ This is an essential qualification because, as the co-sponsors of this document noted, ‘a new standard might not necessarily introduce new chart content and display standards applicable to a ship’s intended voyage.’⁵⁹ Indeed, as previously mentioned in section 1.1, there could be situations in which there are no new ENC’s available for the journey to be performed, and also no new printed paper charts. This could be the case of a vessel sailing on a fixed route in a limited geographical area (e.g. a ferry). Accordingly, the ECDIS installed on-board which is running older software, will nonetheless be capable of correctly displaying the latest available ENC’s necessary for that particular ship’s intended voyage. In this situation, the navigational charts and display standards applicable to the vessel’s ‘intended voyage’ will undoubtedly be up-to-date for the purposes of complying with the requirement in SOLAS V/27.

1.4.3 Failure of the proposal to clarify SOLAS V/27 by means of an explanatory footnote

The proposal put forward by the co-sponsors of NAV 59/13 to insert an explanatory footnote in SOLAS regulation V/27 did not materialise. While a number of delegations supported in principle the inclusion of the proposed footnote, the delegation of Norway, supported by others, expressed the view that such a footnote would be in conflict with the existing requirements in SOLAS Regulation V/18.4.⁶⁰ In addition, a number of delegations shared the concerns expressed in NAV 59/13/1 regarding the practical difficulties and unintended consequences that might arise from the proposed footnote.⁶¹

Accordingly, after much discussion the sub-committee could not agree whether the proposed footnote offered a viable solution or whether there was need to amend SOLAS regulation V/18.4. The member states were thus invited to submit papers to the first session of the new Sub-Committee on Navigation, Communications and Search and Rescue (NCSR).⁶² When this issue was raised at NCSR 1 in 2014, it was concluded that ‘*the best way forward (...) would be to amend the relevant SOLAS regulation*’, and the sub-committee invited ‘interested member Governments to submit proposals for a new unplanned output on the development of draft SOLAS amendments.’⁶³

1.4.4 NAV 59/11 – consolidation of ECDIS-related IMO circulars

Although NAV 59 failed to clarify the ambiguity in SOLAS V/27 regarding what is meant by ‘adequate’ and ‘up to date’ in relation to the use of ECDIS, some progress was made towards clarifying when there is a need to update ECDIS software and when not. This progress came in the form of a proposal to consolidate all the ECDIS-related information contained in several IMO

⁵⁸ *ibid.* para 13.

⁵⁹ *ibid.*

⁶⁰ NAV 59/20 ‘Report to the Maritime Safety Committee’ (1 October 2013), para 13.5 <<https://docs.imo.org/Shared/Download.aspx?did=82883>> accessed on 12 May 2016.

⁶¹ *ibid.*

⁶² *ibid.* para 13.7.

⁶³ NCSR 1/28 ‘Report to the Maritime Safety Committee’ (16 July 2014), para 7 <<https://docs.imo.org/Shared/Download.aspx?did=88409>> accessed on 16 May 2016.

circulars into a single IMO circular. The co-sponsors of this proposal⁶⁴ attached an annex containing the draft of the proposed consolidated circular titled ‘ECDIS – Guidance for Good Practice’. This proposal eventually materialised into MSC.1/Circ.1503 ECDIS – Guidance for Good Practice, approved at the 95th session of the Maritime Safety Committee in June 2015.

1.5 MSC.1/Circ.1503 ECDIS – Guidance for Good Practice

As explained in the previous section, this Guidance draws together relevant guidance from seven previous ECDIS circulars into a single, consolidated document. This Guidance primarily builds upon an IMO circular from 2010 – SN.1/Circ.266/Rev.1: *Maintenance of ECDIS software*.⁶⁵ The latter instrument highlighted the importance of keeping ECDIS software up-to-date and operating fully in accordance with the performance standards. Although it indirectly set out a requirement that the ECDIS software should be kept up-to-date, SN.1/Circ.266/Rev.1 was a non-mandatory instrument. This instrument was revoked and replaced by MSC.1/Circ.1503.⁶⁶

1.5.1 Appendix 1 of MSC.1/Circ.1503: List of ECDIS display anomalies

An important section of this Guidance is a comprehensive list of apparent operating and display anomalies within ECDIS, along with possible workarounds for these anomalies as identified by the IHO. For instance, this list indicates that a frequent anomaly is the inability of ECDIS equipment which is not updated to the latest version of the IHO Presentation Library to correctly display IMO-approved symbols for new features such as ASL’s (Archipelagic Sea Lanes) or PSSA’s (Particularly Sensitive Sea Areas). Thus, instead of displaying the correct chart symbol, an ECDIS which is not up-to-date will either display a question mark (‘?’), or nothing at all. What is more, it was determined that in some cases the ECDIS may even fail to load ENC’s that include such data.⁶⁷ The proposed workaround for the question-mark anomaly is to either interrogate the (‘?’) symbol using the ‘pick report’ function, or to refer to paper charts and publications.⁶⁸ The existence of such anomalies highlights the importance of maintaining ECDIS software updated, thus ensuring the correct display of the up-to-date electronic navigational charts.

1.5.2 The requirement to update ECDIS software established in MSC.1/Circ.1503

It is important to state from the onset that MSC.1/Circ.1503 ECDIS – *Guidance for Good Practice* is a non-mandatory instrument, being merely complementary to the mandatory IMO Performance Standards for ECDIS. However, in its introductory paragraphs MSC.1/Circ.1503 claims that ‘such consolidation of information offers clear and unambiguous understanding of the carriage requirements and use of ECDIS.’⁶⁹ The present section will show that this is not the case.

⁶⁴ Australia, Canada, Germany, the Republic of Korea, Singapore, the United Kingdom, the International Hydrographic Organization (IHO), the Nautical Institute (NI), the International Chamber of Shipping (ICS), and the Comité International Radio-Maritime (CIRM).

⁶⁵ IMO circular SN.1/Circ.266/Rev.1 ‘Maintenance of ECDIS software’ (7 December 2010)

<<https://docs.imo.org/Shared/Download.aspx?did=45381>> accessed on 18 March 2016.

⁶⁶ In fact, MSC.1/Circ.1503 revoked and replaced several other ECDIS-related IMO instruments: MSC.1/Circ.1391, SN.1/Circ.207/Rev.1, SN.1/Circ.276, SN.1/Circ.312, STCW.7/Circ.10 and STCW.7/Circ.18.

⁶⁷ IMO circular MSC.1/Circ.1503 ‘ECDIS – Guidance for good practice’ (24 July 2015), Appendix 1, para 1

<<https://docs.imo.org/Shared/Download.aspx?did=93372>> accessed on 18 March 2016.

⁶⁸ *ibid.*

⁶⁹ *ibid.* Introduction, Section A, para 5.

It will thus be argued that since MSC.1/Circ.1503 is a non-mandatory instrument, the strong language used in this guidance actually exacerbated the uncertainty regarding whether there exists a legal requirement to update ECDIS software to the latest IHO standards. The following paragraphs excerpted from MSC.1/Circ.1503 represent the crux of the problem:

Section A – Chart Carriage Requirement of SOLAS

*A.5 [...] Essentially, where an ECDIS is being used to meet the chart carriage requirements of SOLAS, it **must**: [...] be maintained so as to be compatible with the latest applicable International Hydrographic Organization (IHO) standards [...]; (emphasis added)*

*A.9 As per SOLAS regulation V/27, all nautical charts necessary for the intended voyage shall be adequate and up to date. **For ships using ECDIS to meet the chart carriage requirement of SOLAS**, all ENC's and RNC's must be of the latest available edition and be kept up to date using both the electronic chart updates (e.g. ENC updates) and the latest available notices to mariners. Additionally, ECDIS software **should** be kept up to date such that it is capable of displaying up-to-date electronic charts **correctly according to the latest version of IHO's chart content and display standards**. (emphasis added)*

Section B – Maintenance of ECDIS software

*B.11 It is important for the safety of navigation that the application software within the ECDIS works fully in accordance with the Performance Standards and is capable of displaying **all** the relevant digital information contained within the ENC. (emphasis added)*

*B.12 ECDIS that is not updated to the latest version of the IHO Standards **may not** meet the chart carriage requirements as set out in SOLAS regulation V/19.2.1.4.*

B.14 Any ECDIS which is not upgraded to be compatible with the latest version of the IHO ENC Product Specification or the Presentation Library may be unable to correctly display the latest charted features. Additionally, the appropriate alarms and indications may not be activated even though the features have been included in the ENC. Similarly, any ECDIS which is not updated to be fully compliant with the latest version of the IHO Data Protection Standard may fail to decrypt or to properly authenticate some ENC's, leading to failure to load or install.

Paragraphs A.5 and A.9 from *Section A – Chart carriage requirement of SOLAS* both contain strong modal verbs such as ‘must’ and ‘should’, which convey that there is a duty to update ECDIS software to the latest IHO standards when ECDIS is used to meet the chart carriage requirement of SOLAS. Although the IMO used strong language in drafting these paragraphs, there are also clear indications in MSC.1/Circ.1503 that it remains a non-mandatory instrument. The most evident is its title: *Guidance for good practice*, which indicates that it is simply a non-mandatory guidance on all ECDIS-related matters, including the need to update the ECDIS software. This is further highlighted in the seventh introductory paragraph of MSC.1/Circ.1503, which reads: ‘Members of the Organization and all Contracting Governments to the SOLAS Convention are invited to bring this circular to the attention of all entities concerned. In particular, port States are invited to make the guidance available to their port State control inspectors, and flag States to ship-

owners, masters, recognized organizations, flag State control inspectors and surveyors'.⁷⁰ From the wording of this provision, it is clear that there is no strict legal obligation on the contracting States to implement any of the requirements in this ECDIS Guidance.

Paragraph B.14 from *Section B – Maintenance of ECDIS software* of MSC.1/Circ.1503⁷¹ describes very well what the practical consequences of not updating the ECDIS to the latest version of the IHO S-52 could be. However, it is evident from the language of this paragraph that these consequences could only arise if new charted features have been included in the ENC's necessary for the voyage in question. As a consequence, a logical conclusion can be drawn that if no new charted features are included in the ENC's necessary for a particular voyage, an ECDIS which is not updated to the latest version of the S-52 will still be able to correctly display all the charted features. Such an ECDIS will thus be fully in line with the requirement in paragraph B.11 of this circular, that an ECDIS has to be capable of displaying all the relevant digital information contained within the ENC.⁷²

As we shall now see, this logical conclusion is essential when interpreting paragraph B.12 of Circ.1503 – which states that an ECDIS which is not updated to the latest version of the IHO S-52 *may not* meet the chart carriage requirements as set out in SOLAS regulation V/19.2.1.4. This paragraph was originally introduced in SN.1/Circ266/Rev.1, and has been re-included in MSC.1/Circ.1503 with no language modification. One probable reason why this paragraph has not been re-written using stronger language (i.e. 'shall not meet' instead of 'may not meet') is that such a modification would have led to a direct conflict with SOLAS V/18.4.⁷³ Another probable reason why the language has not been changed is that the 'may not' wording is intended to suggest that there may be two different types of situations:⁷⁴

- a) New features have been included in the ENC's necessary for the voyage in question, and the ECDIS is not able to correctly display all the relevant information contained in the ENC because it is not updated to the to the latest version of the IHO standards. In this situation the chart carriage requirement of SOLAS regulation V/19.2.1.4 will not be met.
- b) No new features have been included in the ENC's necessary for the voyage in question, and the ECDIS is able to correctly display all the relevant information contained in the ENC for the voyage in question although it is not updated to the to the latest version of the IHO standards. In this situation the chart carriage requirement of SOLAS V/19.2.1.4 will be met.

Although both these situations can be inferred from a semantic interpretation of this provision, the conclusion in situation a) is not legally sound because it is directly at odds with with SOLAS V/18.4. Since MSC.1/Circ.1503 is a non-mandatory instrument, it cannot trump a legal requirement of SOLAS.

⁷⁰ *ibid.* para 7.

⁷¹ This paragraph is the same as paragraph 5 of SN.1/Circ.266/Rev.1, which preceded MSC.1/Circ.1503.

⁷² See section 1.1.

⁷³ To remind the reader, as per SOLAS V/18.4, an ECDIS having a valid type-approval certificate at the 'date of installation' will continue to comply with the carriage requirement of regulation SOLAS V/19.2.1.4 also when newer ECDIS software standards are released by the IHO, and the ECDIS in question is not updated to these latest IHO standards.

⁷⁴ Note that this paragraph does not contain further guidelines for assessing when an ECDIS which is not updated to the latest version of the S-52 will meet the chart carriage requirement of SOLAS and when it will not.

1.6 Concluding section – *lex lata*

The previous sections have analysed in great detail all the legal provisions regarding ECDIS contained in SOLAS Chapter V and the relevant instruments IMO instruments – in particular the mandatory Performance Standards and the non-mandatory Guidance in MSC.1/Circ.1503. Based on this analysis, the answer to the legal question of this dissertation is that under the law as it stands, there is no unambiguous obligation to update the ECDIS software so as to correctly display the up-to-date ENC's. The following is a summary of the all the reasons why this is the case.

Firstly, an obligation to update the ECDIS software cannot be read in SOLAS V/27 because this provision does not differentiate between up-to-date ENCs and up-to-date paper charts. For this reason, the scope of application of SOLAS V/27 cannot extend to require updating the ECDIS software in addition to updating the ENC data because this would discriminate between updating ENC's and updating paper charts. This could thus potentially impose a more onerous burden on the ship-owners who rely on ECDIS to comply with the chart carriage requirement of SOLAS compared to those who rely on paper charts. Moreover, such an expansive interpretation of SOLAS V/27 is *contra legem* because it leads to a direct clash with Regulation V/18.4.

Secondly, MSC.1/Circ.1503 *ECDIS – Guidance for good practice* is a non-mandatory instrument, and thus its provisions are not directly legally binding. While the strong language used in MSC.1/Circ.1503 does unambiguously instruct that when ECDIS is used to meet the chart carriage requirements of SOLAS the ECDIS software must be up-to-date to the latest IHO standards, this requirement would only be binding if made mandatory by a Contracting Government (i.e. Flag State or Port State)⁷⁵ on a voluntary basis. So far, only the Republic of the Marshall Islands⁷⁶ and the Cayman Islands⁷⁷ have made mandatory the requirement to maintain ECDIS software updated to the latest applicable IHO standards.⁷⁸ Anyhow, this requirement is solely applicable to Marshall Islands and Cayman Islands ships engaged in international voyages, and not to foreign ships visiting Marshall Islands or Cayman Islands ports. From my research, no Port State has so far implemented the ECDIS software updating requirement of MSC.1/Circ.1503 in its national legislation so that it could be applied with binding effect to foreign flagged ships.⁷⁹

Thirdly, it has to be considered that even if MSC.1/Circ.1503 becomes mandatory through incorporation into SOLAS by reference,⁸⁰ its requirement to maintain ECDIS software up-to-date would come against SOLAS V/18.4. For this very important reason, in order for an unambiguous

⁷⁵ Of course, a Port State may simultaneously also be a Flag State. Nevertheless, a State may consider one of these roles more important than the other due to its economic, geographical and environmental interests, hence the distinction.

⁷⁶ The Republic of the Marshall Islands Maritime Administrator, Marine Notice No. 7-041-6 'Nautical Chart and Publication Carriage and ECDIS Requirements' (January 2016) <<https://www.register-iri.com/forms/upload/MN-7-041-6.pdf>> accessed on 14 May 2016.

⁷⁷ Maritime Authority of the Cayman Islands, Shipping Notice 03/2015 Rev 1 'ECDIS on Cayman Islands Ships and Yachts' (August 2015) <http://www.cishipping.com/system/files/notices/documents/2015-03%20ECDIS%20Guide_0.pdf?download=1> accessed on 3 July 2016.

⁷⁸ Similarly, the Australian Maritime Safety Authority (AMSA) expects ECDIS software to be up-to-date and, within reason, to comply with the latest versions of applicable IHO standards. This, however, is not a legal obligation.

Australian Maritime Safety Authority, ECDIS Frequently Asked Questions, Version 2 (October 2012) <https://www.iho.int/mtg_docs/industry/ECDIS_workshop_12-3/AU%20ECDIS_FAQ.pdf> accessed on 12 July 2016.

⁷⁹ Karim S, (2015) 35.

⁸⁰ MSC.1/Circ.1503 could be incorporated into SOLAS V/27 by means of a footnote similar to that proposed in NAV 59/13.

requirement to maintain ECDIS software to be compatible with SOLAS, an amendment to SOLAS Chapter V is necessary. The same conclusion was reached at NCSR 1 in 2014, where it was agreed that ‘the best way forward (...) would be to amend the relevant SOLAS regulation’. Although the NCSR sub-committee invited the interested Governments to submit proposals of draft SOLAS amendments,⁸¹ no such proposals have been submitted for the 96th session of the Maritime Safety Committee which took place in May 2016.

⁸¹ NCSR 1/28 *Report to the Maritime Safety Committee*, para 7.

Chapter 2 – Updating ECDIS software: manual vs. automatic

It is a legal obligation of SOLAS that navigational charts have to be maintained so that they are fully up-to-date with the latest safety-critical navigational information.⁸² The responsibility for maintaining the charts up-to-date lies with the user – i.e. the ship-owner. This holds true for both paper charts and electronic charts.⁸³ As explained in Chapter 1, in order to be legally equivalent with the up-to-date paper charts as per SOLAS V/19.2.1.4, ECDIS must use up-to-date ENC's. In principle, the action of updating ENC's is very similar to the action of updating paper charts – the copying of a new ENC digital file on the ECDIS being analogous with the replacement of paper charts with new ones. However, in practice, the necessity to keep the ECDIS software updated translates into more onerous legal obligations for the ship-owners relying on ECDIS as the primary means of navigation compared to those relying on paper charts as the primary means of navigation.

2.1 Updating paper charts

There are two complementary processes for updating paper charts, both of which are legally acceptable. The first constitutes of replacing the older charts with officially updated ones, while the second is manual updating by the users.⁸⁴ Of course, the first method is only available when hydrographic organizations publish new editions of the paper charts needed for the voyage in question. This usually occurs when there are numerous content changes which cannot be addressed through notices to mariners (NTM). Naturally, the new editions put out of force all previous editions of the paper charts.⁸⁵ Charts which have been withdrawn will thus no longer meet the carriage requirements.⁸⁶

The second procedure entails performing manual corrections to the paper charts, based on the latest information published in official notices to mariners.⁸⁷ These corrections have to be performed in order to keep charts up-to-date before a new edition of the chart in question is published. It is essential to emphasize that these manual corrections based on NTM's are inherent in the chart carriage requirement of SOLAS V/19.2.1.4 – and are hence mandatory.

2.2 Updating Electronic Navigation Charts

The basics of the procedure for updating ENC's are found in the section titled *Module A – Database: Provision and Updating of Chart Information* of the IMO Revised Performance Standards Resolution MSC.232(82).⁸⁸ However, before listing the relevant paragraphs from MSC.232(82) it is important to point out that 'system electronic navigational chart' (SENC) means a database, in the ECDIS manufacturer's internal format, resulting from the lossless transformation of the entire ENC contents by the ECDIS for appropriate use. This allows different ECDIS

⁸² See SOLAS V/27.

⁸³ Gonin I, *ENC Updating Study* (1998) 1.

⁸⁴ Kasun J *et al*, 'Accuracy of sea charts and navigational publications and the influence of printing' (2003) Vol.15, No 2, *Acta Graphica: Journal for Printing Science and Graphic Communications*, 73, 75.

⁸⁵ *ibid.* 76.

⁸⁶ Weintrit A, *ECDIS – an operational handbook* (2009), 1003.

⁸⁷ Kasun J *et al*, (2003), 76.

⁸⁸ IMO Resolution MSC.232(82) 'Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS)' (5 December 2006), Section 4, Page 4.

manufacturers to have different graphic layouts of the navigational charts. It is this database that is accessed by the ECDIS for the display generation and other navigational functions, and it is the digital equivalent of an up-to-date paper chart. The SENC may also contain information added by the mariner and information from other sources.⁸⁹

Brought about by the legally mandatory practice of manually updating paper charts, the key question that Chapter 2 will seek to answer is whether the practice of performing manual updates on the System-ENC (SENC) is a legally acceptable method of circumventing the need to update the ECDIS software to the latest IHO standards. The following sections from Resolution MSC.232(82) deal with the procedures for maintaining ENC data up-to-date on the ECDIS:

Section 4: Provision and Updating of Chart Information

4.1 The chart information to be used in ECDIS shall be the latest edition, as corrected by official updates, of that issued by or on the authority of a Government, government authorized Hydrographic Office or other relevant government institution, and conform to IHO standards.

4.2 The contents of the SENC (SystemENC) should be adequate and up-to-date for the intended voyage to comply with regulation V/27 of the 1974 SOLAS Convention as amended.

4.3 It should not be possible to alter the contents of the ENC or SENC information transformed from the ENC.

*4.5 ECDIS shall be capable of accepting official updates to the ENC data provided in conformity with IHO standards. **These updates shall be automatically applied to the SENC. [...]** (emphasis added)*

*4.6 ECDIS shall also be capable of accepting **updates to the ENC data entered manually with simple means for verification prior to the final acceptance of the data. They shall be distinguishable on the display from ENC information and its official updates and not affect display legibility.** (emphasis added)*

Section 5: Display of SENC information

5.1 ECDIS should be capable of displaying all SENC information. An ECDIS should be capable of accepting and converting an ENC and its updates into a SENC. [...]

Paragraph 4.5 and paragraph 4.6 describe two complementary mechanisms through which ENC data can be updated on the ECDIS. The mechanism in paragraph 4.5 relies on official updates of the ENC data which are received in digital format and automatically applied to the SENC. The mechanism in paragraph 4.6 is complementary because it establishes that in addition to the digital updating procedure described in paragraph 4.5, ECDIS shall also be capable of accepting updates to the ENC data entered manually. These two procedures for updating ENC data will be analysed in more detail in the next two sections.

⁸⁹ Ibid. Section 3, Para 3.3.

2.2.1 The ‘primary’ procedure for updating ENC data – digital and automatic

The mechanism for updating ENC’s established in paragraph 4.5 of the IMO Performance Standards Resolution MSC.232(82) is the primary mechanism to be used with ECDIS. This mechanism relies on a digital ENC update-package which is the digital equivalent of NTM for paper charts. Generally, licenses for ENC’s include access to these digital update-packages for the duration of the licence.⁹⁰ The distribution scheme for these digital update-packages may vary, but in general they are transmitted via the Internet, as this is faster and more cost effective compared to using traditional CD’s or DVD’s. Once received, these ENC update-packages are then moved to the ECDIS and automatically applied to the chart database to produce an up-to-date ENC.⁹¹

As it can be seen, this mechanism for updating ENC’s is digital in every step and often fully automatic – i.e. it requires no human intervention whatsoever, except for an acknowledgement or acceptance of the updating procedure. This allows quick implementation of the latest updates to the ENC’s necessary for the voyage to be performed.⁹² Note that ECDIS was designed with this capability in mind, primarily because this saves a great deal of time and hassle for the seafarers compared to manually effecting chart corrections. It can thus be safely concluded that this digital ENC-updating procedure is the norm, as it is one of the *raison d’être* of ECDIS.

It is important to emphasize that an essential prerequisite for the correct functioning of this fully-digital ENC-updating procedure is that the ECDIS software is up-to-date. As was explained at length in Chapter 1, if the ECDIS software is not updated to the latest edition of the IHO standards, the ECDIS may display the up-to-date ENC’s incompletely or with errors. This will typically be the case when the updated ENC’s contain new symbols and features which are not contained in the version of the S-52 presentation library installed on the ECDIS. However, many of these inconsistencies can be corrected manually by the seafarer.

2.2.2 The ‘secondary’ procedure for updating ENC data – manual corrections

The manual ENC data-updating mechanism specified in paragraph 4.6 of the IMO Performance Standards Resolution 232(82), states that in addition to the digital updating procedure from paragraph 4.5, ECDIS shall also be capable of accepting updates to the ENC data entered manually. Manual updating consists of a human operator entering information manually into the SENC, based on official correction documents, but which are not machine-readable: e.g. printed Notices to Mariners and radio communication.

In consequence, the SENC update module on all ECDIS systems is designed to include the ability to manually create or modify objects.⁹³ This is achieved by means of a graphic editor capable of creating and editing objects on the active user chart, whose display is superimposed on the electronic chart without changing the latter.⁹⁴ This means that the seafarer can make any changes to the SENC without modifying the base ENC data itself. These manual corrections and additions made by the seafarer to the SENC are in principle similar to the corrections manually applied to

⁹⁰ Déniel Jean-Luc, *Electronic Navigational Chart Data* (1994) 544.

⁹¹ Weintrit A, *ECDIS – an operational handbook* (2009), 607.

⁹² Of course, this automatic and fully-digital ENC updating mechanism is considered an official update as per SOLAS V/27.

⁹³ Gonin I, *ENC Updating Study* (1998) 37.

⁹⁴ Weintrit A, *ECDIS – an operational handbook* (2009), 607.

paper charts, based on official updates received through Notice to Mariners. However, these manual corrections to the SENC are not similar to the automatic updates of the ENC's.

The distinction between manual and automatic updates to the ENC data is highlighted and explained in the *IHO Guidance on updating the Electronic Navigational Chart*. This document thereby distinguishes between 'integrated' and 'non-integrated updates'.⁹⁵ Automatic updates are considered 'integrated updates' because upon implementation they become indistinguishable from the ENC data. Automatic updates supersede the information contained in the previous SENC, and thus they appear as regular ENC data to the seafarer.

By contrast, updates entered manually are considered 'non-integrated'. This is because IHO S-52 *Specifications for Chart Content and Display aspects of ECDIS* requires that manual updates shall always be distinguishable from the ENC data and automatic updates.⁹⁶ Thus, all manually updated ENC corrections have a small orange identifier, which is used to distinguish hand-entered chart corrections, which are subject to human error, from corrections entered automatically by digital means.⁹⁷ It is also important to note that when the seafarer applies such corrections manually, he or she will be modifying the SENC and not the ENC data itself. This is because MSC.232(82) and the IHO S-52 standards specifically require that it should not be possible to overwrite ENC information by removing or altering objects.⁹⁸ In short, manual updating is simply a correction or an addition of information on the SENC.

2.2.3 Are manual corrections effected on the SENC considered official updates?

It is important to note that the manual correction mechanism can be used to fix chart display errors caused by the fact that the ECDIS software is not updated to the version of the IHO presentation library required by the ENC's in question. For instance, manual corrections could be used to repair errors of the type 'unknown object vector format symbol'. As noted in section 1.5.1, this error occurs when the symbol for an object is not listed in the ECDIS software S-52 presentation library. The ECDIS will nonetheless read the object in question and display its geographical position correctly, but since the object is not listed in the Presentation Library, the ECDIS will symbolize such unknown objects with a question mark symbol ('?').⁹⁹ In such situations, it is possible to manually replace the question mark symbol directly on the SENC, based on official updates such as NTM. This, however, is not a recommended workaround as identified by the IHO in Appendix 1 of MSC.1/Circ.1503.

The key question thus becomes whether such manual corrections performed on the SENC can be considered official chart updates, in a similar fashion to the acceptance of manual updates to paper charts. From my research, it seems that opinions are somewhat split in the shipping industry as to whether these manual corrections are a legally acceptable mechanism for updating the navigational

⁹⁵ IHO Publication S-52 Appendix 1, 'Guidance on Updating the Electronic Navigational Chart' Ed. 4.0.0 (Monaco, April 2012) Section 3.4.1, Paragraph (c).

⁹⁶ IHO Publication S-52 'Specifications for Chart Contents and Display Aspects of ECDIS' Ed. 6.1.0 (Monaco, October 2014), Section 2.3.4, Page 25; <http://www.iho.int/iho_pubs/standard/S-52/S_52_Edition_610_Oct2014.pdf> accessed on 19 April 2016

⁹⁷ *ibid.* Section 3.2.3, Page 36.

⁹⁸ *ibid.* Section 2.3.1b, Page 19. See also IMO Resolution MSC.232(82) 'Revised Performance Standards for ECDIS, para 4.3.

⁹⁹ IHO Publication S-52 Annex A 'Presentation Library for ECDIS' Ed. 4.0.1 (Monaco, October 2014), page 12 and 58. <http://www.iho.int/iho_pubs/draft_pubs/PresLib_e4.0.0/Part_1/S-52_PresLib_e4.0.0_Part%20I_Clean_Draft.pdf> accessed on 19 April 2016.

charts of the ECDIS or not. On one hand, it is rather evident that an ECDIS which cannot display the ENC's correctly and completely, and which has not received any manual corrections on the SENC to mitigate the improper reading of the ENC's, will not fulfill the 'adequate and up-to-date' navigational chart requirement of SOLAS V/27. On the other hand, it is not evident whether an ECDIS which has received extensive manual amendments to the SENC in order to mitigate the effects of the improper reading of the ENC's will comply with the requirement in SOLAS V/27.

Under the *lex lata* the only condition is that the ECDIS is able to display all the SENC information based on the latest (up-to-date) ENC's. The IMO Performance Standards do not specify whether the ECDIS software (i.e. presentation library) has to be able to automatically display the ENC for the voyage in question with no errors, or whether such errors could be corrected manually on the SENC by the mariner before the start of a voyage. From a strictly legal point of view, there is nothing to indicate that such manual corrections on the SENC would not be considered official updates – provided, of course, that they reflect official updates issued by or on the authority of a Government authorized Hydrographic Office or other relevant government institution. In principle, such manual updates to the SENC should satisfy the 'adequate and up-to-date' requirement in SOLAS V/27. However, as the following examples will show, the prevailing understanding in the expert circles of marine navigation seems to be that manual corrections on the SENC are generally not considered official ENC updates,¹⁰⁰ and are thus not a legally acceptable workaround for the need to update the ECDIS software to the latest IHO standards.

In an e-mail exchange I had Mr. Mathias Jonas – Vice-President of the *Bundesamt für Seeschifffahrt und Hydrographie* (BSH)¹⁰¹ and Chair of the IHO Hydrographic Services and Standards Committee (HSSC) – he explained that manual entries concerning local announcements or NAVTEX messages or other official navigational information which arrives to the vessel faster and earlier than the respective digital ENC update will certainly be accepted as official updates. However, Mr. Jonas' personal point of view is these are the only circumstances in which such manual corrections could be considered official updates.

A similar stance is taken by Mr. Yves Le Franc from the *Service Hydrographique et Océanographique de la Marine* (SHOM), and chair of the IHO Correspondence Group for Navigational Warnings (NW)¹⁰². Mr. Le Franc's personal point of view is that only digital updates are official updates. Manual updates not prescribed by the ENC manufacturer are not considered official updates, with the exception of the situation when the navigator knows navigational information not provided in the digital updates, and manual updating is thus the only way to keep the chart up-to-date.¹⁰³

By the same token, in the landmark work 'ECDIS – an operational handbook', to which reference has often been made in this dissertation, Prof. Adam Weintrit writes that 'manual updating should be used only when Automatic Updating cannot be effected in a timely manner (e.g. for transient, preliminary updates such as radio navigational warnings affecting chart information).'¹⁰⁴

¹⁰⁰ With the exception of certain temporary situations, in which manual corrections are considered official ENC updates.

¹⁰¹ Federal Maritime and Hydrographic Agency of Germany.

¹⁰² A subsidiary of the World-Wide Navigational Warning Service sub-committee (WWNWS).

¹⁰³ These are the only situations in which manual updates are in conformance with Resolution MSC.232(82), section 4.6; IHO Publication S-52 ed 4.0.1, Annex A with addendum, Appendix 1; and IEC 61174 ed 4.0.0.

¹⁰⁴ Weintrit A, *ECDIS – an operational handbook* (2009), 607.

Further, Mr. Tom Mellor – Head of OEM Technical Support and Digital Standards at the United Kingdom Hydrographic Office (UKHO) – is also of the opinion that such manual corrections carried out by the crew are not an official ENC update. As the fruit of an e-mail exchange I had with Mr. Mellor, he made it clear that the UKHO considers that ‘any data which is navigationally significant must be contained in the official ENC updates from the Hydrographic offices which are sent to the ships weekly’. Mr. Mellor further held that in situations where the ENC data is up-to-date, yet the presentation library in use in the ECDIS software is not capable of displaying this data, the UKHO is definitely ‘not in favour of the crew inserting manual updates to circumvent the need to update the ECDIS software to the latest IHO standards’.

There are several good arguments in support of this stance, and most of them revolve around the practical difficulties arising from manually updating electronic charts. To begin with, the library of symbols in the most recent version of the IHO S-52 presentation library (v4.0) contains a number of new symbols which do not exist in older versions of the presentation library. As a result, an ECDIS running an older version of the presentation library will display the ‘unknown symbol’ message upon reading ENC’s which contain such symbols. When seafarers will try to manually correct these errors, they will have to designate another symbol to represent the feature in question, since the official symbol recognized by the IMO is not available in the presentation library of the ECDIS. What is more, an insurmountable difficulty could be the sheer number of errors that would have to be manually corrected by the seafarer if the ECDIS software is unable to adequately display the up-to-date navigational charts. Of course, whether this is actually the case depends on the factual situation, and in particular the number of new symbols which the ECDIS software cannot read.

With the most recent version of the S-52, the IHO claims to have also addressed the problem of frequent audible alarms and alerts, which has been a constant complaint received from seafarers ever since ECDIS was implemented.¹⁰⁵ Of course, this functional improvement can only be implemented by updating the ECDIS software, and cannot be effectuated manually. For this particular example, it is self-evident that manual updating cannot be used to circumvent the need to update the software.

The above examples serve to show that over-reliance on manual corrections goes against the very *raison d’être* of the Electronic Chart Display and Information System. To put it into perspective, MSC.232(82) states in the introductory section titled *Scope of ECDIS* that ‘ECDIS should facilitate simple and reliable updating of the electronic navigational chart’¹⁰⁶ and ‘ECDIS should reduce the navigational workload compared to using paper charts’.¹⁰⁷ The practice of manually correcting display errors due to inadequacy of the ECDIS software is neither simple nor reliable, and nor does it reduce the workload compared to using paper charts.

Having said this, the interpretation that manual updates to the SENC should not be considered official updates seems to be the most accurate, because it is in line with the IHO *Guidance on updating the Electronic Navigational Chart*. The most compelling argument is that when referring to updates applied to the SENC, this instrument contains the following statement: ‘Those updates

¹⁰⁵ IHO Press release ‘New normative references for type approval of ECDIS’ (Monaco, June 2015), 3.

¹⁰⁶ MSC.232(82) *Revised Performance Standards for ECDIS*, para 1.4.

¹⁰⁷ *ibid.* para 1.5.

are either an **Official** ENC Update integrated into the SENC display or **temporary** information that was entered manually.¹⁰⁸ This statement highlights the temporary and possibly non-official nature of manual corrections applied to the SENC. It should thus be evident that the manual updating procedure was never meant to be an alternative to the automatic procedure. Manual updating should thus be reserved for temporary corrections of inaccuracies, or for situations when essential navigational updates are made known through regular NTM, and the ENC provider has not yet issued a digital update package for that respective ENC.

To conclude, it is the position of this dissertation that manual updating should not be used to circumvent the need to update the ECDIS software to the latest IHO standards. After all, it is the *raison d'être* of ECDIS that it should be capable of displaying the ENC data correctly and completely. Situations in which the ENC data is up-to-date but the software of the ECDIS is not capable of displaying it adequately should be considered below the SOLAS compliant level, as per SOLAS V/19.2.1.4 and SOLAS V/27.

2.3 Consequences of a failure to update ECDIS software

As explained at length in Chapter 1, under the *lex lata* there is no unambiguous obligation to update the ECDIS software so as to correctly display the up-to-date ENC's. As a result, there are also no legal consequences for failing to update the ECDIS software.

Hypothetically, if a Port State voluntarily implemented in its respective national law the requirement from MSC.1/Circ.1503 that ECDIS software should be kept up-to-date, this could be applied with binding effect to foreign ships calling at its ports.¹⁰⁹ This could potentially lead to Port State Control detainment of visiting vessels whose ECDIS is not capable of displaying up-to-date electronic charts correctly according to the latest version of IHO's chart content and display standards. However, from the perspective of international legislation this would probably not be a valid ground for detention because this requirement is outside the scope of SOLAS. Visiting vessels which have a type-approved ECDIS as per SOLAS V/18.4 will be meeting the chart carriage requirement in SOLAS V/19.2.1.4, and thus cannot be detained. Nonetheless, the Port State in question could still have recourse to other mechanisms for penalizing vessels which do not respect this national requirement.

2.4 Postponing the withdrawal of the validity of the previous editions of ECDIS software (particularly S-52 and S-64)

Upon releasing the latest versions of the S-52 and S-64 software for ECDIS, the IHO declared that they would 'enter into force' on 1 August 2015, and that all the previous versions of this software would cease to be legally compliant as of 31 July 2016. The rationale of the IHO was that a 12 month transitional period would be sufficient for ECDIS manufacturers and national authorities to move towards type approval of new ECDIS systems based on the revised standards, and to enable ship-owners and operators to update existing systems to conform with the new standards.¹¹⁰ Thus, the IHO envisaged that for the duration of this 12-month transition period ending on 31 July 2016,

¹⁰⁸ IHO Publication S-52 Appendix 1, 'Guidance on Updating the Electronic Navigational Chart', Section 3.4.1, Paragraph (b).

¹⁰⁹ Karim S. (2015) 35.

¹¹⁰ IHO Press release 'New normative references for type approval of ECDIS' (Monaco, June 2015).

the previous editions of S-52 and S-64 would remain valid along with the latest versions. However, as mentioned previously in this dissertation, this implementation schedule adopted by the IHO of its own accord has no legal weight from the point of view of SOLAS or the IMO. For this reason, there is no international legal provision that prevents the previous versions of the S-52 from remaining legally compliant, and there is also no legal obligation to update to the latest version available.

Even though there are no legal consequences for failing to update ECDIS software, the deadline for updating to the latest IHO standards has been extended. In November 2015 views have been expressed by the industry that this 12-month transition period is too short to enable ship-owners and operators to update existing systems to conform with the guidelines of IMO circular MSC.1/Circ.1503.¹¹¹ Accordingly, in December 2015 the IHO sent a document to the IMO's NCSR sub-committee in which it reported the request of the industry to extend the transition period for upgrading existing ECDIS systems to meet the revised set of IHO standards until 31 August 2017.¹¹²

At its session in March 2016, the NCSR sub-committee accepted the IHO's proposal to extend the period in which the previous editions of S-52 and S-64 would be kept valid until 31 August 2017.¹¹³ This gives ship-owners using ECDIS more time to update existing systems to the new IHO standards, in hopes of ensuring compliance with the guidelines on maintenance of ECDIS software contained in MSC.1/Circ.1503 by the end of August 2017.¹¹⁴ However, this extension is rather inconsequential considering that there is still no strict legal obligation to update ECDIS software. As the concluding Chapter of this dissertation will discuss, it is unlikely that such a legal obligation will be introduced in SOLAS by August 2017.

¹¹¹ IMO sub-committee NCSR 3/28/Rev.1 'Report on monitoring of ECDIS issues submitted by the IHO' (25 December 2015), Page 1; <<https://docs.imo.org/Shared/Download.aspx?did=95376>> accessed on 18 May 2016.

¹¹² *ibid.*

¹¹³ IMO sub-committee NCSR 3/29 'Report to the Maritime Safety Committee' (22 March 2016), Section 28; <<https://docs.imo.org/Shared/Download.aspx?did=97375>> accessed on 12 June 2016.

¹¹⁴ Working Paper submitted by the International Hydrographic Bureau for consideration by the ENC Standards Maintenance Working Group (Tokyo, March 2016), Page 1; <https://www.iho.int/mtg_docs/com_wg/ENCWG/ENCWG1/ENCWG1-7.3A_OutcomeNCSR3.pdf> accessed on 20 May 2016.

Chapter 3 – *Conclusions from a Lex Ferenda perspective*

Having discussed the *lex lata* pertaining to ECDIS at length in Chapter 1 and Chapter 2, I believe it is best to conclude this dissertation by attempting to portray the *lex ferenda*.

To remind the reader, Chapter 1 showed that even for vessels relying on ECDIS as the primary means of navigation there is no unambiguous international legal obligation to update the ECDIS software so as to correctly display the up-to-date ENC's. The reason for this is that such a legal obligation would clash with SOLAS V/18.4. Translated into practical terms, this means that an ECDIS running an obsolete data rendering software which is displaying the up-to-date ENC's with errors, would technically be a legally compliant installation as per SOLAS Chapter V Regulation 18.4 and Regulation 27.

Considering that ECDIS is a safety critical navigational aid, it is essential that it always functions flawlessly. Encouraging the current practice of performing manual updates and corrections on the SENC is not ideal, as it defeats the whole purpose of having an electronic chart system. In the end, ECDIS should reduce the navigational workload compared to using paper charts, not increase it. As discussed in Chapter 2, it seems that opinions are somewhat split in the shipping industry as to whether these manual corrections are a legally acceptable mechanism for updating the navigational charts of the ECDIS or not. The position of this dissertation is that manual updating should not be used to circumvent the need to update the ECDIS software to the IHO standards required by the ENC's necessary for the voyage to be performed. Situations in which the ENC data is up-to-date but the software of the ECDIS is not capable of displaying it adequately should thus be considered below the SOLAS compliant level, as per SOLAS V/19.2.1.4 and SOLAS V/27. After all, it is inherent in the design of ECDIS that it should be capable of displaying the ENC's correctly and completely.

As examined at length in Chapter 1, when IMO Circular MSC.1/Circ.1503 was released in July 2015, one of its provisions was an explicit requirement that ECDIS software has to be updated to the latest IHO standards. However, since MSC.1/Circ.1503 is a non-mandatory instrument, the strong and mandatory language used in this Guidance created a lot of confusion and uncertainty regarding whether there exists a *legal* requirement to update ECDIS software or not.

3.1 Making MSC.1/Circ.1503 mandatory by reference into SOLAS – a quick fix?

The main reason why incorporating MSC.1/Circ.1503 into SOLAS V/27 by means of a footnote is not feasible is because such a modification would clash with SOLAS V/18.4. This is essentially the same obstacle faced by the co-sponsors of NAV 59/13, who proposed the inclusion of an explanatory footnote in SOLAS V/27 in order to explain what is meant by 'adequate and up to date' in relation to the use of ECDIS.

By the same token, adopting a new set of IMO Performance Standards for ECDIS to include an obligation to update the ECDIS application software would also face the legal obstacle posed by SOLAS V/18.4. The only way to bypass this inconsistency with SOLAS is to modify SOLAS V/18.4 itself. Thus, from a *lex ferenda* perspective it seems there is no 'quick-fix' for the ECDIS software updating legal uncertainty.

3.2 Regional action at the level of the European Union?

ECDIS is an equipment covered by the scope of the Marine Equipment Directive (MED),¹¹⁵ as per Annex A.1/4.30 of the said Directive. The MED applies to all ships whose safety certification is issued by or on behalf of Member States of the European Union. Norway and Iceland are also bound by the MED by virtue of the European Economic Area (EEA) Agreement. The MED does not prescribe extra legal requirements for the carriage and operation of ECDIS beyond the internationally agreed standards. For instance, the MED simply refers to the fact that ECDIS has to undergo type approval, and must comply with the relevant carriage and performance requirements. Notable instruments to which reference is made are SOLAS Chapter V/19 and the IMO Revised Performance Standards Resolution MSC.232(82).

Nonetheless, it is interesting to note that under Annex A.1/4.30, the MED also lists the non-mandatory IMO instrument ‘SN.1/Circ.266 – Maintenance of ECDIS software’ as one of the ECDIS standards with which compliance is required.¹¹⁶ As discussed in Chapter 1, this circular affirmed that in absence of the necessary software updates, ECDIS *may not* meet the chart carriage requirements as set out in SOLAS Regulation V/19.2.1.4. Accordingly, circular SN.1/Circ.266 was the first IMO instrument to suggest – albeit indirectly – that regular ECDIS software updates have to be treated as a mandatory requirement.¹¹⁷ In 2015 this circular was revoked and replaced by IMO MSC.1/Circ.1503, which contains an explicit requirement that ECDIS software should be kept up to date.¹¹⁸ However, this Circular is not listed as a requirement for ECDIS under the MED because the EU Commission¹¹⁹ has not yet passed an amendment to reflect the adoption of Circ.1503 by the IMO.

This is probably because the new Marine Equipment Directive 2014/90/EU has just entered into force on 18 September 2016, and the previous Annex A.1 indicating for which equipment the MED applies will soon be replaced by new implementing acts. However, until the entry into force of the first implementing act, the requirements and testing standards according to Annex A.1 (as per Directive 2015/559/EU) continue to apply to the MED.¹²⁰

Considering the leading role of the European Union in setting type approval procedures for marine equipment, the IHO-EU Network Working Group has advocated before the EU Commission for the introduction of an ECDIS updating requirement in the MED.¹²¹ The Commission is in the process of examining the feasibility of adopting a Directive amending the MED 2014/90/EU,

¹¹⁵ Marine Equipment Directive 2014/90/EU has entered into force on 18 September 2016. Until 18 September 2016, the Maritime Equipment Directive was Council Directive 96/98/EC of 20 December 1996 on marine equipment OJ L46/25 17/02/1997, last amended by Commission Directive (EU) 2015/559 of 9 April OJ L95/1 10/04/2015. The old Directive 96/98/EC has been repealed as of 18 September 2016, and Member States currently have to apply the provisions of the new MED Directive 2014/90/EU.

¹¹⁶ See Annex A.1 in Directive 2015/559 EU.

¹¹⁷ This was not an actual *de jure* requirement because the SN.1/Circ.266 was not a mandatory IMO instrument.

¹¹⁸ Circular MSC.1/Circ.1503 ‘ECDIS – Guidance for good practice’, para A.9.

¹¹⁹ More specifically the Commission’s Directorate-General for Mobility and Transport, which is responsible for the MED.

¹²⁰ Det Norske Veritas – Germanischer Lloyd website, ‘EU Marine Equipment Directive’ <<https://www.dnvgl.com/services/eu-marine-equipment-directive-med--2819>> accessed on 2 August 2016.

¹²¹ Working Paper for consideration by the IHO-EU Network Working Group (23 April 2015), para 12

<https://www.iho.int/mtg_docs/com_wg/IRCC/EC_IHO/IENWG3/IENWG%203%20file%208%20EU%20directive%20MARE-D%20IHB%20paper.pdf> accessed on 20 May 2016;

See also Working Paper for consideration by the Hydrographic Services and Standards Committee (Busan, November 2015), para 12 <https://www.iho.int/mtg_docs/com_wg/HSSC/HSSC7/HSSC7-07%20A_IMO_activities_affecting_HSSC_final.pdf> accessed on 20 May 2016.

through which it would impose an obligation to update ECDIS software for vessels flying the Flags of the EU Member States. Likewise, the EU Commission could also pass an implementing act listing IMO Circ.1503 as a standard with which compliance is required by the MED.

Note that this would not be the first time the European Union acted unilaterally in order to foster the world-wide adoption of more stringent standards, the best example being the EU's action on combating ship-source pollution.¹²² In a similar fashion, a potential future piece of EU legislation requiring ECDIS software-updating would clearly be at odds with the international legal standard in SOLAS V/18.4. Be that as it may, since the EU is an 'autonomous legal order'¹²³ all entities falling within the scope of the Maritime Equipment Directive would have to comply with its provisions. Failing to do so would amount to a breach of EU law and could be sanctioned accordingly.

From a *lex ferenda* perspective, such a unilateral legislative move from the European Union is only partially desirable. On the upside, the strong enforcement apparatus provided by EU law would compensate for the limited enforcement powers of the IMO.¹²⁴ It could thus be argued that the EU's unilateral action to fill-in the regulatory gap in SOLAS would be beneficial because it would lead to a much faster adoption of the obligation to update ECDIS software, compared to the international IMO framework. On the downside, when remembering the legal minefield created by the adoption of the EU Ship-source Pollution Directive, such a unilateral legislative action by the EU looks considerably less desirable.

3.3 Amendments to SOLAS Chapter V from a *Lex Ferenda* perspective

It has become evident that in order for an unambiguous requirement to update ECDIS software to be compatible with SOLAS, an amendment to SOLAS Chapter V is necessary. The same conclusion was reached at NCSR 1 in 2014, where it was agreed that 'the best way forward (...) would be to amend the relevant SOLAS regulation'. However, even though the NCSR sub-committee invited the interested Governments to submit proposals of draft SOLAS amendments, no such proposals have been submitted for the 96th session of the Maritime Safety Committee, which took place in May 2016. The following 3 proposals are thus my personal suggestions on the *lex ferenda* for ECDIS.

3.3.1 Unified interpretation of the meaning of 'up-to-date' in SOLAS

It is evident that an obligation to update the ECDIS software cannot be read in SOLAS V/27 as it stands today. Be that as it may, an unambiguous requirement in SOLAS to keep software 'up-to-date' would not only benefit ECDIS, but all current and future digital technologies used for navigation. The new generation of radar devices, AIS, VDR and the anticipated e-Navigation solutions would all benefit from an explicit requirement in SOLAS V to maintain software up-to-

¹²² Directive 2005/35/EC, as amended by Directive 2009/123/EC (on ship-source pollution and on the introduction of penalties for infringements). See also Case C-308/06 *Intertanko*, in which the CJEU assessed the compatibility of Directive 2005/35/EC with Public International Law – more specifically the United Nations Convention on the Law of the Sea (UNCLOS) and the MARPOL 73/78 Convention.

¹²³ In the landmark case *Costa v E.N.E.L.*, the CJEU said: 'By contrast with ordinary international treaties, the EEC Treaty has created its own legal system, which, on the entry into force of the Treaty, became an integral part of the legal systems of the Member States and which their courts are bound to apply.'

¹²⁴ See section 1.3.1.

date. Accordingly, from a *lex ferenda* perspective the best solution would be the introduction in SOLAS V of a generic software-updating requirement for all shipborne equipment that relies on software, rather than a requirement limited to ECDIS.

From a *lex ferenda* perspective this would certainly be a feasible amendment to SOLAS V, considering that the task of updating software has never been easier than in today's world of ubiquitous connectivity. However, with great power comes great responsibility – connecting all the bridge systems to the Internet could open a Pandora's box of cybersecurity issues. For instance, the ECDIS's Internet connection could serve as a gateway for cyber-attacks, which could potentially interrupt the display of chart information on the ECDIS, thereby endangering the vessel and its crew. A new 'cyber-security culture' thus also needs to be grafted into international legislation, requiring basic measures of 'cyber-hygiene' have to be implemented on-board.¹²⁵

3.3.2 Making ECDIS the primary means of navigation for ships subject to the mandatory carriage requirement

As introduced in SOLAS V by Resolution MSC.282(86), Regulation 19.2.10 requires that 'ships engaged in international voyages shall be fitted with an Electronic Chart Display and Information System', but this mandatory carriage requirement does not extend to require that ECDIS has to be used as the primary means of navigation. This is rather counter-intuitive, as it allows ship-owners to still choose to rely on paper charts (instead of the ECDIS) to fulfill the nautical chart carriage requirement of Regulation 19.2.1.4.

The STCW Convention also does not specify when or whether ECDIS has to be used. This is a problem because there have been situations in which ECDIS was the primary means of navigation as per Regulation 19.2.1.4, yet Port State Control Inspectors found that passage planning and route monitoring was done using paper charts, not taking into account that ECDIS was the primary means of navigation.¹²⁶ Reverse situations have also been reported, in which paper charts were the primary means of navigation yet ECDIS was used for the actual navigation.

From a *lex ferenda* perspective, an essential modification to SOLAS V Regulation 19.2.1.4 would be to mandate the use of ECDIS as the primary means of navigation for ships subject to the mandatory carriage requirement in Regulation 19.2.10. This would make the regulations regarding ECDIS implementation much more clear and straightforward, but admittedly such an inflexible requirement would basically ban the use of paper charts as the primary means of navigation.¹²⁷

Finally, the STCW Code would benefit from the addition of an explicit requirement that only the primary source of navigation – be it paper charts or ECDIS – has to be used for all navigation tasks (chart work, passage planning and position fixing, etc.).

¹²⁵ BIMCO, 'The Guidelines on Cyber Security on-board Ships' Version 1.0 (Copenhagen, January 2016)

<<https://www.bimco.org/News/2016/01/~media/AEEEE215CBE3421F8F7493A6A1B0E521.ashx>> accessed on 6 January 2016

¹²⁶ Maritime Authority of the Cayman Islands, Shipping Notice 03/2016 Rev 1 'ECDIS as the primary means of navigation' (July 2016), section 2.

¹²⁷ Note that when relying on ECDIS as the primary means of navigation, the vessel needs to have at least one redundant ECDIS system (two independent ECDIS computers, databases, and screens). If they meet this requirement, then are they not required to carry paper charts at all.

3.3.3 Exception for situations in which there are no new navigational charts¹²⁸ available for the journey to be performed

Any future modification to SOLAS V would ideally have to require that when ECDIS is used to meet the chart carriage requirements, its data rendering software must only be updated to the version necessary to display the up-to-date ENC's correctly and with no errors. Thus, the desirable *lex ferenda* outcome is that if there are no new ENC's available for the journey to be performed and the ECDIS which is not up-to-date according to the latest version of the IHO standards is nonetheless capable of displaying the ENC's correctly and without any errors, this installation should comply with SOLAS V/27. Not including such an exception would create, in certain circumstances, the discriminatory situation in which ship-owners who rely on ECDIS to comply with the chart carriage requirement of SOLAS automatically have a more onerous burden compared to those who rely on paper charts. This type of situation has been examined at length in section 1.1.

3.4 Looking into the future

Enfin, it is essential to re-state that contrary to what the IHO claims, the previous versions of the S-52 and S-64 will remain legally compliant even after 31 August 2017. Since under the *lex lata* there is no mandatory obligation to update to the latest versions, the uncertainty regarding ECDIS software updating will endure and will probably live beyond the recently extended deadline of August 2017. The IHO and IMO will monitor the implementation of the upgrade of existing ECDIS systems, and will consider a further extension beyond August 2017 if necessary. It is thus a real possibility that the previous editions of S-52 and S-64 will continue to be accepted well-beyond 2017.

¹²⁸ Paper charts or Electronic Navigational Charts.

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