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ECDIS | July 2015

Regulation • Equipment • Training
Chart Delivery • Practical Considerations

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Introduction

This year sees the start of the rollout of ECDIS to ships built prior to 2012. The first ships affected are tankers above 3,000gt. Potentially there are more than 8,000 vessels that fall into this category although some will already have ECDIS installed and others will be scrapped within this year or the two year period allowed for end of life vessels. Even so the market potential is more than double that of any year since the rollout began.

The tanker retrofit is just a precursor to an even bigger market over the final three years of the rollout programme when dry cargo vessels built before 2012 become subject to the rules. Up to now, most users of ECDIS have been the pioneers of electronic navigation but as the roll out programme gathers speed and the retrofit of cargo vessels begins then gradually all but a very few navigators will have to learn to live and work with the new technology.

It is probably fair to say that the navigators themselves will have an open mind as to the pros and cons of ECDIS and it will be the owners and operators that will be complaining most seeing the capital expenditure on equipment, ENCs and related training expenses as yet another drain on limited funds.

There should be a little sympathy extended to them because ECDIS is probably the smallest expense they will face and the imminent need to fit ballast treatment systems and weighing up the benefits of fitting scrubbers as against burning expensive distillates to meet impending changes in SOx levels will be uppermost in their minds.

But they must be careful not to overlook the demands of meeting ECDIS carriage requirements. Here there are plenty of factors for operators to consider as the rules do require the equipment to be maintained, electronic charts to be installed, licensed and kept up to date and crew trained to use the equipment. Failure to do any one of these will leave operators open to PSC actions and detentions.

System makers and service providers are doing what they can to help ease the introduction. This guide will help operators identify what they need and who can assist.

Malcolm Latarche
Lead Editor

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Chapter 1 *Regulation*

Retrofit roll out gets underway

EXACTLY WHEN THE IDEA OF ELECTRONIC CHART SYSTEMS was conceived is open to debate but by the early 1990s several companies were in the process of developing systems for displaying digitised versions of papers charts. It could be said that the development was one of many made possible by rapidly improving computer technology that had earlier allowed the introduction of automatic radar plotting aids (ARPA) on to the navigation bridge.

Initial systems were developed by individual manufacturers with little collaboration and to diverging standards as there was no performance standard to comply with. Despite there being no requirement to install the early systems, several ship operators were willing to act as pioneering guinea pigs in the field.

As systems became more complex and sophisticated with the ability to incorporate value added interactive features, the distinction between them needed to be made clear, especially as the IMO was beginning to formulate performance standards. Systems that could comply with the standards would be referred to as an Electronic Chart Display Information System (ECDIS) while those that did not would carry the label Electronic Chart System (ECS). It is appropriate to say at this point that SOLAS

requires ships to carry valid official charts and in the early days of electronic chart systems no official electronic charts existed. Official charts — both paper and Electronic Navigation Charts (ENC) — are produced by, or under licence from, national Hydrographic Offices or other relevant government institutions.

Most national institutions are members of the International Hydrographic Organization (IHO) which has developed a set of standards covering collection of chart data and production of charts. Charts for use on SOLAS vessels must have been produced by a national hydrographic office using these standards.

With regard to ECDIS the most important of these standards are S-52 presentation library which contains all the symbols colours and lines styles required to recreate the ENC on the ECDIS screen and S-57 which includes a description of the data format, product specification for the production of ENC data, and an updating profile. Another IHO standard, S-63 covering security of data, became a requirement in 2009.

Each ECDIS maker has developed their own means of displaying ENCs which must adhere to the rules contained in IHO S-52. An ECDIS will convert an ENC into a SENC (system electronic navigational chart) and store the information which can then be added to for the purpose of updating charts by use of official Notice to Mariners or with third party information sources.

In 1995, the IMO adopted the first Performance Standards for ECDIS which are contained in Resolution A.817(19). These standards have been amended and added to since. In 1996 for example, resolution MSC.64(67) was adopted to reflect back-up arrangements in case of ECDIS failure and additional amendments were made in 1998 by resolution MSC 86(70) to permit operation of ECDIS in RCDS (raster chart) mode if official ENCs were unavailable.

In December of 2006, the IMO released Resolution MSC.232(82) which laid out completely new standards and specifications to apply with effect from 1 January 2009.

This involved many ECDIS manufacturers having to adapt their equipment to meet the new standards and to renew their type approval. Vessels with older ECDIS systems are permitted to continue to use the system on board but if changing it will be required to install a system complying with the new standards.

Regulation

The revised 2009 standards incorporate a number of decisions from within and outside of the IMO including:-

- ***IEC Standard 61174 (2008/2009) – Operational and performance requirements, methods of testing and required results for ECDIS. (edition 4.0 effective August 2015).***
- ***IMO Resolution MSC.191(79) 2006 – Performance standards for the presentation of navigation-related information on shipborne navigational displays.***
- ***IEC Standard 62288 (2008 revised edition 2.0 effective July 2014) – Presentation of navigation-relatedinformation on shipborne navigational displays – General requirements, methods of testing and required test results.***
- ***IHO S-52, Specifications for Chart Content and Display Aspects of ECDIS, edition 6.1.0 (Oct 2014)***
- ***IHO Presentation Library, S-52 Annex A edition 4.0.1 (Oct 2014)***
- ***IHO S-64 Test Data Sets in ECDIS, edition 3.0 (Dec 2014)***
- ***S-63 – IHO Data Protection Scheme edition 1.2 (Jan 2015)***
- ***IHO S-100 Universal Hydrographic Data Model, edition 2.0.0 (June 2015)***

The MSC.191 and IEC62288 standards harmonise symbology and other display-related elements across all navigational displays, and were new to ECDIS.

Previously ECDIS did not need to be tested against S-63, which defines the encryption and licensing of ENCs. Following its inclusion there are comprehensive tests that all ECDIS must pass to ensure that they provide appropriate error-checking with informative messaging. It also allows for improvements to ENC delivery on large media (DVD).

Resolution MSC.232(82) is a reasonably large document of 27 pages in its original form. Most of the information contained in it is directed more to manufacturers than users but it is important for users to understand the minimum requirements for a system so as to be aware what a PSC inspector might be looking for during a routine inspection.

In September 2014, IHO produced a new draft version (4.0) of its presentation library that covers the symbology used in ENCs and which ECDIS equipment must be able to display. In time this new library will become part of the ECDIS performance standards and it will be for makers

to make use of them in new products and update existing operational systems. Many makers add functionality that goes beyond the performance standard and if the user cannot differentiate between these and the basic standards he cannot know if a problem with one makes the system invalid or not.

At MSC 86 in June 2009, the IMO finally approved amendments to SOLAS V (19) making ECDIS mandatory on most ships over 500gt in accordance with a rolling timetable that began in July 2012. As can be seen from the table below, all new and pre-July 2012 passenger buildings over 500gt and all other new ship types over 3,000gt are now subject to the mandatory carriage requirements.

July 2015 sees the rollout begin to apply to other existing ship types and by 2019 the rollout will be complete.

MANDATORY ECDIS IMPLEMENTATION DATES — SOLAS AMENDMENT MSC 282 (86):	
~~1 July 2012~~	~~New passenger ships over 500gt and new tankers over 3,000gt~~
~~1 July 2013~~	~~New cargo ships over 10,000gt~~
~~1 July 2014~~	~~New cargo ships over 3,000gt and existing passenger ships over 500gt~~
1 July 2015	Existing tankers over 3,000gt *
1 July 2016	Existing cargo ships over 50,000gt *
1 July 2017	Exisiting cargo ships of 20,000gt and under 50,000gt *
1 July 2018	Exisiting cargo ships of 10,000gt and under 20,000gt *
	** Existing refers to vessels constructed before 1 July 2012*

The dates mentioned for existing vessels are actually the earliest possible date because the full text of the regulation says that the deadline is the 'first annual, periodic or renewal survey after the date mentioned'. In theory that would mean that a ship that completes a survey just days before one of the trigger dates will be allowed a further year before an ECDIS has to be fitted.

There is also an exemption for ships that will be permanently taken out of service within two years of a trigger date. Policing that may be a challenge for some flag states and also for some port states because unless another reason for an extended inspection exists, the lack of an ECDIS may not be revealed.

Until ECDIS is mandatory on a vessel, navigation and passage

planning must be done using paper charts. When a ship becomes subject to the requirement to carry ECDIS there are options available to the ship operator although it should be noted that different flag states may interpret the regulations in different ways. For ships using ECDIS as their primary means of navigation and wishing to go 'paperless' an additional and independent ECDIS must be provided as a back-up. The back-up ECDIS should be connected to an independent power supply and connected to systems providing continuous position-fixing capability. Ships making use of this dual ECDIS option must ensure that chart updating is maintained on both devices. When the ECDIS is being operated in Raster Chart Display System (RCDS) mode using RNC data due to lack of suitable coverage of ENCs then an appropriate folio of up-to-date paper charts must be maintained for areas where only raster chart coverage is available.

For ships using ECDIS as an aid to navigation then only a single ECDIS is required but the ship must carry and maintain an appropriate folio of up-to-date paper charts.

In July 2014 an amendment to the VDR performance standards contained in MSC333(90) came into effect that has an implication for ECDIS users and manufacturers. The new regulation states "Where a vessel is fitted with an ECDIS installation, the VDR should record the electronic signals of the ECDIS display in use at the time, as the primary means of navigation. The recording method should be such that, on playback, it is possible to present a faithful replica of the entire ECDIS display that was on view at the time of recording, albeit within the limitations of any bandwidth compression techniques that are essential to the working of the VDR and in addition the source of the chart data and the version used".

All new VDRs must now include the ability to capture ECDIS screen shots every 15 seconds, record the actual chart in use every 10 minutes and record all changes of chart. In order to meet this requirement it is clear that ECDIS systems must have the ability to send its output to the VDR. The new regulation only applies to new VDRs so it has no effect on existing set-ups providing the VDR is not replaced. If it is then an update to the ECDIS may also be required. Most ECDIS systems are designed for networking so this will not be an issue for new ECDIS systems.

Most operators and seafarers understand the requirement for up-to-date paper charts as meaning the most recent version, updated according

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to information contained in any Notice to Mariners issued since the chart was released. Electronic charts must also be similarly updated but this is not done by way of tracings or manual amendments but electronically. More details on this aspect are contained in chapters 4 and 5 together with information on the licensing of ENCs which introduces a complication not found with paper charts.

With the movement towards e-navigation gathering pace, ECDIS has been recognised as being a core element of the concept. As the main source of electronic information concerning the passage plan and with the potential for hazard avoidance (water depths, currents etc.), the ECDIS of future ships may need to integrate with shore-based systems and possibly even other vessels if some of the proposed aspects of e-navigation come to reality. If this scenario comes about there will be an obvious need for new regulation and possible upgrade of equipment on existing ships. That is currently still in the future but may influence equipment choice and supplier.

STEEP LEARNING CURVE

Electronic charts and by implication ECDIS, were recognised in STCW 95 (the IMO Code that covers training and qualification requirements of seafarers) as being equivalent to paper charts.

A literal interpretation of what was written in that document concerning familiarity with all forms of chart would be that all navigation officers should have been examined for competence in electronic chart use from the time the code came into effect.

However, this requirement was widely ignored and it is doubtful if any state has actually followed the regulation as it was written. Fortunately this situation has been rectified and the Manila amendments to the STCW Code have formalised the need for navigational officers to undergo ECDIS training even if electronic chart navigation is just being used as an aid and not as a primary means to navigation.

The Manila amendments entered into force in January 2012 and carry with them a requirement for ECDIS operators to undergo specific training if an ECDIS is installed on board. There are though some concessions given to navigators with existing certificates and a transition period extending to January 2017 when the new Code will take full effect.

As with the requirement for back up charts, there are differences in

interpretation which is made more complex because not all navigators on every ship will have certificates issued by the ship's flag state.

Of particular importance to the regulatory aspects of ECDIS training, STCW.7/Circ.18 provides guidance on ECDIS training. It should be noted that a Certificate of Competency (CoC) issued under STCW 78 (as amended) can be valid until 1 January 2017. This is due to the fact that any CoC with expiry dates beyond 1 Jan 2017 must comply with the Manila Amendments 2010 to STCW 78 effective as of 1 July 2013.

The 2010 Manila Amendments to the STCW Convention and Code have introduced several additional specific competencies in the use of ECDIS for officers in charge of a navigational watch both at management and operational levels (Refer STCW Code Tables A-II/1 and A-II/2) serving on ECDIS-fitted ships.

STCW.7/Circ.18 stipulates that after 1 January 2017, all masters and navigating officers serving on ships fitted with ECDIS certificated under chapter II of the STCW Convention shall have undertaken appropriate generic ECDIS training (which may be based upon IMO model course 1.27), meeting the competence requirements of the 2010 Manila Amendments to the STCW Convention and Code. The circular also highlights that masters and officers certificated 6.3 and 6.5 of the International Safety Management (ISM) Code require companies to ensure seafarers are provided with adequate familiarisation. A ship safety management system should include familiarisation with the ECDIS equipment fitted, including its back-up arrangements, sensors and related peripherals. To assist Member Governments, Parties to the STCW Convention, companies and seafarers, a record of such familiarization should be provided. One of the issues mentioned in STCW is that of over reliance on ECDIS and this is definitely seen as an inherent problem by many experienced navigators. A connected concern is that where ECDIS relies on GPS for determining vessel position and thus initiating alarms if a vessel strays off course, any GPS failure could lead to a hazardous situation developing very quickly. An absence of alarms from the ECDIS may lead navigators to believe all is well when in fact the opposite is the case.

More information on the training required and where it can be obtained can be found in a later chapter in this guide.

Chapter 2 *Equipment*

Leading makers and their hardware

WITH THE ROLLOUT PROGRAMME FOR ECDIS NOW AT THE MID-POINT STAGE, the market as regards to suppliers appears to have reached equilibrium with few new entrants into the list. That is not to say there are no new products as the makers are continually refining and upgrading their offerings and adding to ranges.

There may be a common performance standard for ECDIS but there are very large differences between individual makers' products and in the way they are intended to be used on board. There will almost certainly be big differences in the level of support and service offered but this will only be learnt from experience.

Using ECDIS will eventually become second nature to navigators but for the time being the range of options is not seen as a good thing in all quarters. As an indication, the foreword to the UK's MAIB report into the grounding of the chemical tanker *Ovit* in the Dover Straits in 2013 highlighted the problem saying "This is the third grounding investigated by the MAIB where watchkeepers' failure to use an electronic chart display and information system (ECDIS) properly has been identified as one of the causal factors. As this report is published, there are over 30 manufacturers of ECDIS equipment, each with their own designs of user interface, and

little evidence that a common approach is developing". The report had other comments about ECDIS use and training but while incidents of this type are regrettable, they were not unforeseen. Almost all modern vessels leave the shipyard with a fully integrated navigation or bridge system in which ECDIS is a vital element. However, now the retrofit part of the rollout programme is in full swing several different types of ECDIS will be required to meet the different standards of bridge facilities. Undoubtedly an ECDIS is most effective when combined with other navigation systems but this will not be possible on every, or even most, retrofit ships.

Here the commonest and cheapest solution will be a simple stand-alone system that allows compliance but little more than that. It may well be that on some ships the ECDIS will be declared as an aid to navigation and sit unused in the corner of the bridge while navigation on board is practised as it always has with paper charts and little else.

There are more advanced stand-alone console types that can be fed with data from other systems often making use of the fact that the VDR already draws much of the data together and provides a good source to tap in to. In an integrated navigation system with multiple screens it will be possible for even a single ECDIS to be linked to several of them allowing for a high degree of flexibility in workstations.

If an operator decides to settle for a 'paperless' bridge and this is allowed by the flag state, then a dual ECDIS system is required under SOLAS. This would naturally suggest a second machine but some manufacturers do provide a dual ECDIS solution in a single console. The back-up ECDIS is permitted to have a marginally smaller minimum display size and this may favour the makers of PC type systems, although it has to be said that most systems on the market do have displays that exceed the minimum size required by a considerable margin.

A MATTER OF CHOICE

The number of type-approved systems on the market has mushroomed since the IMO decided to make ECDIS carriage mandatory. The handful of pioneers from ten years ago has now been joined by at least 30 more manufacturers. Some of the newcomers are actually selling badge-engineered products from other makers rather than developing and producing the systems themselves, and in some new integrated navigation systems a

choice of ECDIS may be offered to the shipowner.

Aside from a very few basic models designed to allow compliance and little else, most ECDIS have unique value added features meaning users may find some difficulty in migrating between systems. For this reason some ship operators have adopted a policy of using just one manufacturer's products across their fleet. Some have even replaced an existing ECDIS on a ship with one of a different make to ensure uniformity.

Buyers of ECDIS should realise that although the equipment is mandatory and despite the cost in some cases running into tens of thousands of dollars, it is in reality little more than a marinised PC and it is the software and some of the electronics at the heart of the system that make it function. While it is possible that the hardware that goes into an ECDIS may last the life of a vessel, the regulatory requirements and technological advances over that time may mean that regular updates to the operating system are required and possibly it may be more cost effective to replace rather than upgrade. Some early systems and many new models are supplied with hard disk drives but these seem to be losing out in popularity to more robust solid state memory.

Few manufacturers offer a wide range of systems although some have recognised the different needs of customers and can offer a system to suit most pockets. In many cases the difference between a basic machine and the most advanced will not be obvious from the outside since the difference is in the software loaded onto the machine or the features activated. These machines make upgrading to a higher level easier and cheaper than might otherwise be the case.

In a small number of cases, the same device might be sold as a radar, a chart radar or an ECDIS with different aspects of the same pre-loaded software being activated. Some ECDIS come with a full catalogue of ENCs pre-loaded and only require a licence key to be entered for the chart to become available.

For operators still overwhelmed or unsure of what to commit to, there are alternatives to outright purchase. A growing number of makers and some independent service companies are offering a leasing service. Leasing would appear to be an ideal way of equipping a fleet without a high capital outlay and also permits a 'try before you buy' approach that will identify the best system to suit an individual operator. Another ben-

efit is that leased equipment can be exchanged for upgraded models as required and can also be swapped in case of a breakdown under the terms of the lease agreement.

SYSTEM MAKERS

The following directory is of manufacturers providing type-approved systems suitable for complying with SOLAS regulations. They may also produce other equipment or offer services that could be of interest to operators. The list is extensive but not necessarily fully inclusive.

Some systems may also permit use of the UKHO's Admiralty Information Overlay service which combines all UKHO Temporary and Preliminary Notices to Mariners (T&P NMs) for all ADMIRALTY SNCs and ENC Preliminary Notices to Mariners (EP NMs) resulting from the UKHOs' unique ENC verification process. It is available free of charge to AVCS customers.

Adveto
Country – Sweden
Website – www.adveto.com
System – ECDIS-4000
Ability to display AIO – No

A modular system that comes in three versions; Base, Standard and Extended, all of which comply with SOLAS requirements but with some offering additional value added features. The modular aspect allows for flexible installation and interface with other navigation systems.

Adveto has developed an Alternative Night Presentation Mode in cooperation with navigators of Norwegian fast ferries which is said to better suit their specialist operation and to eliminate the risk of blinding the bridge crew during night navigation. The feature may not be permitted by some flag states. The Multi Routes feature of the top two models stores different routes that can be chosen depending on weather and traffic situations. This is promoted as being an excellent tool for Fast Ferry archipelago operations. All three versions use a solid state drive which is considered more robust and reliable than conventional hard drives.

Equipment

Beijing Highlander
Country – China
Website – www.highlander.com.cn
System – HLD-ECDIS-1000
Ability to display AIO – No

Highlander says its console mounted ECDIS uses the latest digital technology and familiar windows graphic user interface for presentation and operations, allowing quick training and familiarisation of equipment. The ECDIS provides the complete navigation information, routes, weather prediction and automatic updates among the many user friendly features. The product has China Classification Society Type Approval.

Among the several features of the ECDIS Highlander highlights its compatibility with C-MAP worldwide database, instant update on board of ARCS, ENC Charts using the HLD-ECDIS 1000 integrated and optimised update service via email. The ECDIS also feature multiple route management and can display several routes, create routes by selecting any waypoints from any display route and link or split routes.

Chartworld
Country – Germany
Website – www.ecdis-as-a-service.com
System – eGlobe G2
Ability to display AIO – Yes

eGlobe G2 is a type-approved ECDIS and is offered as part of the management service eSeries available with full touch screen operation.

eSeries is a completely new distribution approach providing the ECDIS hardware, life time warranty, updates and training on a monthly fee basis. The package solves the financial burden of mandatory ECDIS and includes professional consultancy on how to go paperless free of charge. eGlobe G2 features a high quality panel display, inbuilt RAID drives and redundant power supplies, combined with a docking station that allows effortless system installation and exchange. The system comes pre-filled and pre-configured for ChartWorld ACES (Advanced ChartWorld ENC

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Service) which is a SENC data service powered by the Admiralty world.

Consilium
Country – Sweden
Website – www.consilium.se
System – ECDIS, S-ECDIS
Ability to display AIO – Yes

Consilium produces two versions of ECDIS; one designed for integrated navigation systems and the second (S-ECDIS) intended as a back-up or basic compliance model. The basic model comes as a Panel PC with 24" monitor while the advanced version is supplied as a separate PC with a choice of monitor sizes. The ECDIS version can be run on Consilium Voyage Data Recorders (S-VDR & VDR) to save space and resources. The S-ECDIS is supplies as a "one box" solution with all required equipment included. Several advance features are available for the high end version including the Consilium ECDIS weather module which displays different weather layers including wind force and direction, pressure, swell, waves, typhoon history and forecasts and temperature. Weather forecasts may cover several days depending on the source of the data.

A Port module allows comprehensive details on over 8,000 ports and terminals including a complete description of the port and the relevant facilities, plans and mooring diagrams (over 4,000 in total), contact details of port service providers and agents, maritime atlas, port photographs and worldwide distance table. A Tide and Current module gives predictions for thousands of main tide stations.

Danelec Marine
Country – Denmark
Website – www.danelec-marine.com
System – DM800
Ability to display AIO – No

Danelec's ECDIS can be supplied in a modular form for installation into an

integrated navigation system or as a stand-alone console with a choice of three different monitor sizes. There are specific tools available for overall route planning and chart purchase including pay as you sail. If a company uses AVCS S-57, e-navigator can be used. This is available on a separate planning station (PC). If a company uses S-ENC from Jeppesen, Jeppesen Nautical Station (JNS) is available. The Danelec Marine ECDIS range has a number of additional services included such as weather forecast.
The company markets its ECDIS as being suitable for retrofit and also says it is easy for crew to maintain by making use of hot-swap replacement of faulty components. The device's memory is stored on a solid-state CF card that only needs to be removed and placed in a replacement hardware unit.

Furuno
Country – Japan (has global sales and representation offices)
Website – www.furuno.com
System – FEA-2107/2807, FMD-3100/3200/3300
Ability to display AIO – Yes

Furuno is a major supplier of navigation systems and equipment and produces the voyager integrated bridge which includes versions of its own ECDIS. The company also sells individual components. The FEA- 2107 and the FEA-2807 can utilize ENC (S57 Edition 3), ARCS RASTER CHARTS and C-Map CM93 Edition 3, C-Map CM-ENC to deliver global chart coverage. They are the older models in the company's portfolio and replaced an earlier version in which the software could not be upgraded. Furuno's latest ECDIS is a multifunction display, the FMD-3200 (with 19" LCD) and FMD-3300 (with 23.1" LCD) are claimed to deliver great enhancement in terms of user interface as well as functionality and easy to install as retrofits.

The FMD-3100 is a newer model designed for retrofit and is available with a 24" widescreen monitor. The FMD models employ intelligently arranged Graphic User Inter- face elements that give the operator direct access to necessary operational procedure. They also feature a new chart drawing engine that delivers instantaneous chart redraw with the seamless zooming and panning. The system will also bring about streamlined chart management scheme providing easy chart management

independent of the chart providers. They are compatible with Jeppesen Dynamic Licensing and support the Admiralty Information Overlay (AIO).

GEM Elettronica
Country – Italy
Website – www.gemrad.com
System – ECD-600, ECD700/710
Ability to display AIO – No

The ECD-600 is a modular unit with basic configuration including monitor, keyboard, computer unit with basic interfaces while the ECD-700 is a full option desk top ECDIS including table-top unit, with basic and optional interfaces to other navigation systems. The ECD-700 can be table or console mounted. The ECD-710 is the basic version of the ECD-700. One of the main additional features is the anti-collision system. All the targets detected by ARPA and AIS are automatically checked by the ECDIS to avoid possible collisions with the ownship. This is done dynamically, by continuouslypredicting the future scenario based on the current cinematic data.

Acoustic and visual alarms are immediately activated in case of collision risk. All the ARPA and AIS target information is available on user's request. A Man Overboard emergency function is provided, enabled by simply pushing a button: immediately a special symbol is drawn on the map in the same spot of the ownship current position. All data about stream direction and speed can be written on a special window to allow the system to calculate and display the movement of the man overboard. The time necessary to go back to rescue the man is also calculated.

HaiHua
Country – China
Website – www.hhee.com.cn
System – CH-01
Ability to display AIO – No

TRANSAS

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Equipment

According to the company's website, the CH-01 ECDIS aims to meet the voyage requirement for large and middle-sized vessels. It is in full compliance with the relevant standards and requirements of IEC, IMO and IHO and has already gained type approval by China Classification Society CH-1 type ECDIS supports automatic overlay image with AIS and ARPA information and can be connected with data interface of various equipment. It is claimed to be the first Chinese ECDIS to gain LR and EC type approval.

The system has an integrated BeiDou communication module with option to use the BeiDou positioning and communication function.

Headway
Country – China
Website – www.headwaytech.com
System – HMT-E1000
Ability to display AIO – No

Headway says its ECDIS is developed according to IEC, IMO and IHO requirements and rules. The system is able to integrate with most communication and navigation equipment. Headway says its ECDIS can provide collision-avoidance assistance and route management of vessels, and is simple to operate, user friendly and with low power consumption. Multiple Display Modes allow the display to be configured to suit ambient lighting conditions with dusk, night and daytime options.

Hyundai-Marine
Country – South Korea
Website – www.hd-emarine.com
System – e-navigator
Ability to display AIO – No

This system was completely developed in-house by Hyundai subsidiary company e-Marine which has a large involvement in ECDIS in Asia being a regional distributor for major ENC suppliers and service providers.

The e-Navigator can be supplied in a number of formats including

modular for inclusion into an integrated bridge system, as a stand-alone console, as a dual console and as a compact desktop system aimed primarily at tugs and small craft. The console versions come with a choice of 19" or 23" screens. The e-navigator can be integrated with all other navigation systems and has some interesting features of its own. For example passage plans can be made, checked and verified and then saved for future use. They can also be exported to other vessels in a fleet which would permit fleet operators to ensure uniformity in routes across a number of vessels.

Imtech Marine
Country – Netherlands
Website – www.imtech.com
System – Seaguide
Ability to display AIO – No

Imtech Marine is unique among manufacturers because it provides customers with a choice from many of the leading ECDIS suppliers as well as its own system. The company offers advice about which system would be right for the customer and this can then be accompanied with the required system specific or generic training which Imtech Marine can also provide or arrange. SeaGuide is based on the Hagenuk ECDIS2000 produced by HDW of Germany and now part of the Imtech Group. The Graphical User Interface of SeaGuide has an improved system architecture and ergonomic menu structure, which is simple and intuitive to operate. The basic System consists of an embedded Mini PC processing unit with display and input devices and a data collection unit for the navigation sensor data, the SeaGuide Data Matrix. SeaGuide includes Route Monitoring, Route Planning and Check Route functionalities as well as the real-time display of the ship's position.

The system has high flexibility in connection of ships' sensors, making it very easy to install in different type of bridge systems. The sensor interface is designed for easy configuration and installation for new-building and retrofit projects, using an intelligent system configuration tool. As a mini PC or integrated system SeaGuide features solid state drive and supports different types of TFTdisplays from 19" standard to 27" widescreen

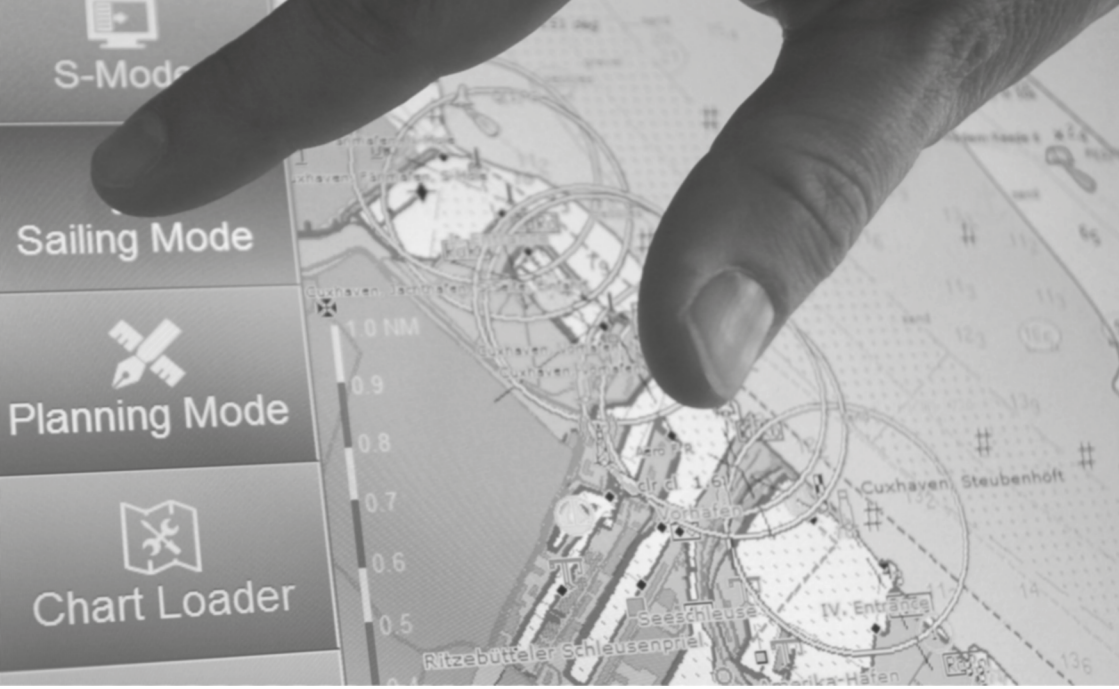
monitors. Imtech also produces a naval version as WECDIS 4500.

JRC
Country – Japan
Website – www.jrceurope.com
System – JAN-9201, JAN-7201
Ability to display AIO – Yes

Introduced in 2014 to replace older models the two new models of ECDIS come in a display range from 19 to 26-inch but the system can also be integrated as part of a total bridge solution, with the option to increase the screen size up to 46-inch. The new powerful Blizzard™ processor features advanced signal processing and graphic drawings with all display sizes. The full feature systems can be supplied as consoles or desk top versions or integrated into a bridge. As consoles they can be configured in a variety of ways including ECDIS, radar and conning. When installed as a dual ECDIS, both systems can be updated simultaneously from one work station.

The new JAN series ECDIS has the capability to evolve into a full Multi Function Display by adding the optional chart radar or conning software licenses (and possibly hardware), while keeping the standard user interface throughout all the products, with same default logic and design elements. Other new features include flexible route planning with multi view options in various scales in which the same or different charts can be displayed in a mixture of ways including providing a 'look-ahead' capability. With the wide screen view function, an additional screen in the display area, showing a segment of the chart, allows viewing at a glance. Other features include combining of routes and the creation of an alternative route during the voyage. In case of an AIS or ARPA target, with radar overlay on the ECDIS, there is instant information of that specific target simply by "mouse over" on the target.

Kelvin Hughes
Country – United Kingdom
Website – www.kelvinhughes.com
System – MantaDigital
Ability to display AIO – No



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Equipment

Not surprisingly for a major bridge system producer, the MantaDigital has been designed for true multi-functionality, providing a platform for Radar, Chart Radar, ECDIS and Conning Display options. MantaDigital is driven by Kelvin Hughes' "commoncore" processor system which is now in use throughout the Radar, ECDIS and VDR product ranges.

MantaDigital is available in a variety of mounting configurations to meet the needs of different vessel types and operational scenarios. It can be supplied in options ranging from a single 22" desktop retrofit system through to a fully integrated navigation system. Display options include 22" and 26" high-definition screens for pedestal, desktop and mounting into consoles. Kelvin Hughes has its own chart updating service called ChartCo and offers a turnkey service called ECDISPLUS which includes hardware supply and installation, initial electronic and paper chart data supply, licence management, ChartCo updates and an IMO approved training package.

Kongsberg Maritime
Country – Norway
Website – www.km.kongsberg.com
System – K-Bridge
Ability to display AIO – Yes

The K-Bridge Electronic Chart Display and Information System - ECDIS system, is a fully SOLAS compliant and easy to operate ECDIS for new builds and retrofit installations. The system comes as a drop in kit with a 19" or 23" TFT display or as a console with a 23" TFT display. The system is designed to be integrated with the full range of other navigational equipment from the Kongsberg range. The ECDIS system uses official vector charts and accepts CM-93 vector charts from C-Map, and is compatible with ARCS from The United Kingdom Hydrographic Office. An ECDIS planning station that can be used away from the integrated bridge units has full ECDIS system functionality including route planning, route monitoring and chart management, and can be used as a back-up ECDIS system. The planning station can be fitted with the same displays as the main unit or a smaller 17" display. The system allows for user defined

safety areas and will generate an alarm when crossing out of an area.

L3 - SAM Electronics
Country – Germany
Website – www.sam-electronics.de
System – ECDIS PilotBasic, ECDIS PilotPlatinum
Ability to display AIO – Yes

The SAM Electronics ECDIS PILOT Platinum is a full feature ECDIS exceeding the mandatory requirements. In its standard form it features advanced route planning and updating and a Man Overboard button. An advanced version with additional functionality is available via a simple software licence. A fast trouble-free procedure adapts the ECDIS to specific needs, including integrated conning page or output for conning display. As well as all standard features it has on-screen Navtex, tidal and current information and a remote maintenance function. Both versions can be used as standalone systems or as part of a SAM integrated bridge.

The ECDIS PILOT Basic is a new product especially designed for the retrofit market. This compact solution based on a panel PC is easy to install (even by ship's personnel) and suitable for vessels of any size. It complies with all relevant performance and test standards.

Marine Technologies
Country – US
Website – www.marine-technologies.com
System – Bridge Mate
Ability to display AIO – No

Incorporating user-friendly route planning functions, the Bridge Mate ECDIS provides precise vessel position data, optimising navigation, safety and fuel consumption. Designed for the rugged offshore environment, the compact Bridge Mate ECDIS system promotes intuitive operation with state-of-the-art touchscreen marine monitors. The ECDIS is said to be easy to install and service with a modular design that can be delivered as a

stand-alone version or as part of the MT Bridge Mate Integrated Bridge System. The system is available with three display sizes, 19", 23" or 26"monitors with touchscreen displays available in 19, 23.1 or custom sizes.

Martek Marine
Country – United Kingdom
Website – www.martek-marine.com
System – iECDIS
Ability to display AIO – No

IECDIS was launched in January 2014 making it one of the newest systems available. It is believed to be one of the first network connected systems and has an optional integrated GSM modem allowing downloading and installation of charts and updates using a mobile network signal. The iECDIS is pre-loaded with Jeppesen charts for global ENC coverage with multiple licensing options to suit budget and operational requirements.

The iECDIS is available as a console mounted or desk top system with a 24" widescreen backlit LED monitor. The main unit is said to feature rugged military specification hardware, 32GB Solid Sate Drive and fanless operation offering ultimate stability, durability and lifetime. It also features a multi-power input with automatic switch over eliminating the need for an additional UPS.

Martek is offering the device on a lease basis in addition to an outright purchase allowing for upgrades to the system to accommodate changes in technology and to ease the financial pressure on shipowners in challenging market conditions.

MECys
Country – South Korea
Website – www.mecys.com
System – MeCys ECDIS
Ability to display AIO – No

A fully featured console mounted ECDIS but little information is available on the manufacturer's website. The system does offer 3D mapping and tidal information.

FURUNO

ECDIS

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FMD-3200 [19" LCD]

FMD-3300 [23.1" LCD]

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- Generic ECDIS training in accordance with IMO ECDIS Model Course 1.27. Presently, the generic ECDIS training is only available at INSTC Denmark.
- FURUNO type specific ECDIS training. The FURUNO type specific ECDIS training is available at INSTC Denmark, INSTC Singapore and through the NavSkills network of training centers:

  FURUNO Deutschland (Germany), Thesi Consulting (Italy), GMC Maritime Training Center (Greece), Ocean Training Center (Turkey), Odessa Maritime Training Center (Ukraine), A.S. Moloobhoy & Sons (India), FURUNO Shanghai (China), COMPASS Training Center (Philippines), VERITAS Maritime Training Center (Philippines) and PIVOT Maritime Intl. (Australia)

Please contact INSTC Denmark at: **instc-denmark@furuno.com** for further details

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www.furuno.com

Equipment

OSI Maritime Systems
Country – Canada
Website – www.osimaritime.com
System – ECPINS 5000
Ability to display AIO – No

In 1979, OSI Maritime Systems introduced its first generation electronic chart system. OSI's ECDIS solutions include ECPINS-W (Electronic Chart Precise Integrated Navigation System for Warships) and ECPINS-W Sub (Warship Submarine) both are IMO Approved and the only WECDIS systems independently certified against NATO WECDIS STANAG 4564.

For the commercial market, OSI produces ECPINS® 5000. An IMO approved ECDIS, ECPINS 5000 is a computerised, shipboard navigational aid that displays electronic charts, the own ship's position in real time along with sensor data. It is an ECDIS equipped with rich features, including radar image overlay that facilitates precise navigation, audio and visual alarms to alert users on potential groundings, collisions, cross track distance range being exceeded, and loss of sensor data; advanced Voyage and Route Planning; and AIS, ARPA and Radar Image Overlay Capabilities.

PC Maritime
Country – UK
Website – www.pcmaritime.co.uk
System – Navmaster 800, Navmaster 1000
Ability to display AIO – Yes

Navmaster ECDIS is suited for installation on newbuilds and simple to retrofit into existing bridge layouts. Two hardware options are available: a separate processor with two display sizes and a combined panel PC unit. Navmaster 800 comprises a 24" widescreen monitor or a 19" monitor and a compact rackmount processor with solid state hard drive and Navmaster 1000 comprises a panel PC combining monitor and processor with solid state hard drive into one unit. Either configuration can be fitted into integrated bridge consoles at newbuild stage. The Navmaster 800 monitors can

be console-fitted and the compact processor neatly stored in a cabinet. Navmaster ECDIS 1000 can be fully flush mounted into a console.

A useful feature for ships not obliged to carry a VDR is the record and playback mode that automatically captures all own and other vessel data without crew action, stores the data compressed and encrypted in archives and enables voyages to be reconstructed from the playback function. It provides vital evidence in the event of incident or damage and has assisted customers in resolving insurance claims. For the data to be replayed on another PC, an office-based Navmaster installation is required. Optional extras include a radar image overlay unit, the ability for single ECDIS to be upgraded to dual via network cable and a pay as you sail feature for ENCs.

Raytheon Anschütz
Country – Germany
Website – www.raytheon-anschuetz.com
System – Synapsis ECDIS and ECDIS 24
Ability to display AIO – No

Synapsis ECDIS provides intelligent functions which exceed the basic IMO requirements such as automatic route planning, online updating of charts, AIS operation, Navtex integration and weather data as well as Track Control up to Category C. A full featured Synapsis Multifunctional Workstation is also available and able to display Radar, Chart Radar, ECDIS, Conning and AIS data in any desired combination at one dedicated position. Being based on standard hardware, the workstations allow for highly scalable system solutions. The new ECDIS 24 has been designed especially for the needs of ECDIS retrofit. Based on the well-known Raytheon Anschütz ECDIS software, the new ECDIS 24 comes as a turn-key solution with an off-the-shelf 24 inch TFT Panel-PC display to simplify and accelerate installation.

ECDIS 24 includes all serial interfaces as required by ECDIS performance standards IEC61174 and does not need a separate UPS. Complementary to its ECDIS hardware, Raytheon Anschütz offers approved manufacturer-specific online training for ECDIS in cooperation with Safebridge and land-based training courses in training centres around the world.

Equipment

Samsung
Country – South Korea
Website – www.shipcs.com
System – XailorStar
Ability to display AIO – No

This system has been developed as part of the Samsung XailorStar integrated bridge system. It is a full function ECDIS that is claimed to have a user friendly interface. Systems can be supplied with 19" or 23.1" monitors.

Special features include the ability for early prevention of incidents at sea by forecasting collision with other ship in advance through analysis of sailing data and conducting effective automatic navigation by choosing optimal sailing conditions depending on the status of cargo on board.

Navico (SIMRAD© brand)
Country – Norway
Website – www.navico.com/commercial
System – MARIS ECDIS900 Mk5, MARIS ECDIS900 Mk15, ECDIS E5024
Ability to display AIO – Yes

Navico offers one of the most comprehensive ECDIS portfolios in the market following the acquisition of Maritime Information Systems AS (MARIS). Marketed under the SIMRAD brand, the portfolio of type approved systems expands from the feature rich MARIS ECDIS900 Mk5 and Mk15 systems, to the entry level simple to use and simple to install ECDIS E5024 system.

The MARIS ECDIS900 system was upgraded in 2015 with new hardware and software, and comes in different specifications. The Mk5 is a split system, while the Mk15 is a console mounted flat panel display. The systems are available in a combination of 19", 24", and 26" size displays. Both systems have an intuitive interface based on Microsoft Windows, and are available with an extensive range of optional features and interfacing options. Amongst those features are radar overlay (both with SIMRAD and other brands of radars), Navtex and BNWAS integration, docking & prediction, simplified conning, IHS Fairplay ports data, tides & weather

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data, integrated chart management, PAYS, and voyage planning and optimisation (for speed, time, fuel consumption, weather/tides). Type specific training is available in a wide range of course delivery options, including CBT, Online and at over 120 training centres worldwide.

The ECDIS E5024 type approved system introduced in 2015 has an entirely new user interface to help simplify ECDIS usage. The new UI has a clear and consistent layout, along with clear visual indicators for operating modes. It is simple to install reducing cost and is available in 24" widescreen display with the option of radar overlay with SIMRAD radars via a simple Ethernet cable connection. It operates with Navtor chart support for SENC, S-63, and S-57 charts from UKHO (AVCS), PRIMAR, IC-ENC and NOAA ENC. Type-specific training is available in Online Web Based Training courses and class room based training at several locations worldwide.

Sodena
Country – France
Website – www.sodena.eu
System – GECDIS
Ability to display AIO – No

Sodena is part of the ixBlue Group that markets to commercial and military ships. Its commercial system – GECDIS - is a PC-based system and claimed to be easy to implement, to customise and to maintain. Sodena offers several hardware configurations to meet operator needs with TFT Screens from 15" (ECS- non back up system) to minimum ECDIS 19" up to 23" and larger if approved. A back-up system can be added to existing system, if a full ECDIS System is required. Under certain conditions SODENA's old ECS systems can be upgraded to the ECDIS standard when a full ECDIS system is needed. GECDIS can integrate Tidal world Database and weather forecast information for better route planning.

Sperry Marine
Country – US
Website – www.sperrymarine.com
System – Visionmaster FT, ECDIS-E
Ability to display AIO – Yes

The VisionMaster FT ECDIS provides a complete IMO-compliant type approved system and also meets the requirements for navigating without paper charts when installed with a backup ECDIS. Although primarily likely to be included as part of a full VisionMaster Bridge system, the ECDIS can be installed as a console-based stand-alone unit.

The system's Universal Chart Manager is designed to work with a broad range of authorised vector and raster charts. Charts may be uploaded directly through a DVD reader or via the optional Performance Based Navigation VisionMaster FT GateWay.

The VisionMaster FT ECDIS features disappearing menu bars and menus when not in use, to optimise full-screen viewing of the chart display. The split-screen function (one of five display modes) permits two independent charts to be displayed simultaneously, or for displaying the same navigational picture at different chart scales. Multiple voyage plans can be created quickly and edited easily at any time during the voyage without interrupting the navigation process.

The ECDIS-E combines an optimised feature set with easy to install hardware. Based on the VisionMaster FT platform, the new ECDIS-E has been designed with particular focus on retrofit installations where a cost effective solution is desirable.

Telko
Country – Norway
Website – www.telko.no
System – TECDIS
Ability to display AIO – No

The system is modular and can be installed as a desk top type or console mounted. When a dual TECDIS installation is present on board and ENC

charts are available, the vessel can use TECDIS as its primary chart source and can sail without paper charts. The vessel can then enjoy the C-Map Real-Time Update service and can easily keep the electronic chart collection up to date according to "Notice to Mariners" by downloading updates over the internet or by email.

Other features of the system include; Detailed weather overlay with configurable weather window display and route planning integration, Automatic generation of route drafts between any positions or world-wide ports, Tailored conning / docking displays, Automated storage of all navigation data with options for later playback, Radar overlay using Furuno radars.

Each navigator using the system can configure individual settings for chart display. Elements in the chart display can be displayed or hidden according to the navigator's preferences. Telko's arrangements with Furuno extend to the latter handling all sales and marketing for the TECDIS system.

Tokyo Keiki
Country – Japan
Website – www.tokyo-keiki.co.jp
System – EC8000, EC8500
Ability to display AIO – Yes

This system is available as a stand-alone unit or a modular system for integration into bridge systems. Both come with a choice of monitor sizes. It also has the possibility to be connected to a network allowing monitoring and creation of routes on up to three connected PCs and a back-up ECDIS for paperless navigation..

Tokyo-Keiki has issued a notice to customers concerning a software upgrade needed to make use of the S-63 charts and future updating of charts. The company has its own type-specific training programme available in Japan and several other locations in Asia and Europe.

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Equipment

Totem Plus
Country – Israel
Website – www.totemplus.com
System – Totem ECDIS
Ability to display AIO – Yes

The Totem comes as a modular or console mounted ECDIS with a number of unique and value added features. It is the only ECDIS with Decision Support tools for Collision Avoidance (Much More than ARPA). The TOTEM COLREGS ADVISER module automatically analyses the data of all targets and advises the OOW on the required action – change of course or change of speed. If required, a "Course to steer" advice based on analysis of data from all the ships in the vicinity will be given to the OOW automatically. Similar advice will be given for recommended speed changes.

AIS messages can be sent directly from the ECDIS, and received messages can be displayed on the ECDIS. AIS configuration can be performed directly from the ECDIS monitor. The system constantly monitors the difference between the GPS position and the Dead Reckoning position, where the DR position is calculated from different sensors (Gyro and Speed Log). If the distance between the two positions is greater than a value pre-set by the user, an alarm will activate.

A "Shift Change" procedure is also a unique feature of Totem, a built in safety feature to avoid ECDIS - related accidents resulting from navigators not fully aware on the status of their ECDIS. When implemented, each OOW takes 5 minutes to answer 11 simple questions on the status of the ECDIS before commencing watch – verifying that all functions are known and working.

Transas
Country – Sweden
Website – www.transas.com
System – Navi-Sailor 4000, Navi-Sailor 4000 ECDIS Multifunction Display
Ability to display AIO – Yes

Transas is one of the earliest pioneers of ECDIS and was the first maker to have a system type approved. It has a full range of modular and console mounted units for meeting all requirements from basic ECDIS to Multifunction Display (MFD) with several value added options. In order to meet all budget requirements its Navi-Sailor 4000 comes in four variants. Standard and Standard+ are the entry-level system and meet all IMO and SOLAS ECDIS regulations.

The Standard features a 24" Marine Panel Computer, Transas ES6 Trackball and basic ECDIS functions. The Standard+ variant has added chart formats, route planning, tide and current data, AIS, ARPA and target management and Navtex interface.

Navi-Sailor 4000 ECDIS MFD is available as Premium and Premium+. Every Transas MFD workstation can be equipped with a standard set of software such as ECDIS, Radar, Conning, Chart Assistant utility and SPOS weather module giving the mariner the ability to switch between applications at the touch of a button. All applications run simultaneously as part of the Multifunction Display. The Premium variants have additional features including additional information overlay, trial manoeuvring, special purpose objects, dual chart panel and target simulator and E-log book and Navi-Conning on the Premium+.

Transas ECDIS Complete solutions include type-approved ECDIS, Transas Admiralty Data Service TADS (official charts and data), Navi-Planner voyage planning software, PAYS, Wave fuel efficiency monitoring system, weather service, ECDIS Training solutions, service and maintenance programs and more.

Chapter 3 *Living with ECDIS*

The challenges for shipowners

A SIGNIFICANT LANDMARK WAS REACHED on 1 July 2015, with all existing tankers over 3,000gt being required to fit ECDIS no later than their next survey. According to the latest UKHO data, 54% of the 8,750+ tankers in the global fleet required to comply with these regulations are now using ENCs. This shows progress, with the global 'ECDIS readiness' figure having risen from 42% in September 2014. However, the remaining 46% — or 4,000 ships — of the global tanker fleet are not yet using an ENC service and therefore not yet ready to comply with the mandatory carriage of ECDIS. Even allowing for exemptions and the grace period until their first survey after 1 July 2015, this is a considerable undertaking and is likely to place pressure on all elements of the ECDIS supply chain, including OEMs, shipyards, crew, training providers, crewing companies, class societies and Flag States.

Tanker owners and operators that have not yet planned for the adoption of ECDIS should address this immediately to ensure a safe and timely transition. From an operational, commercial and reputational perspective, the consequences of failing to comply with the SOLAS regulations can be severe.

Now, halfway through the rolling timetable of ECDIS compliance

dates, the focus for many shipping companies is shifting from implementing ECDIS to living with ECDIS and every part of the ECDIS supply chain needs to consider how best they can support owners and operators that have already installed ECDIS to ensure that it is properly managed.

ECDIS MANAGEMENT

So what happens after a ship owner has adopted and is living with ECDIS? Well, a considerable responsibility is upon the owner because it is imperative that the necessary processes are in place along with close relationships with their partners, including their ECDIS manufacturer and chart data supplier.

ECDIS management encompasses a wide range of considerations including bridge policies and procedures, the latest legal requirements, ECDIS hardware and software maintenance, ECDIS regulations and IHO standards. Whilst some relate to ensuring the safest and most efficient practices are in place, others relate directly to compliance as part of a ship's SOLAS requirements.

THE UKHO ARE HERE TO HELP

The ship owner is not alone. In order to help them get the best from their ECDIS, the UKHO has an extensive range of resources — many of which are free — to assist with the transition to digital navigation and the challenge of living with ECDIS. This ranges from over 160 'how to' videos for 17 different ECDIS on the UKHO's YouTube channel to the UKHO's renowned ECDIS Seminar series and ADMIRALTY publications.

As world-leaders with a reputation built on trust, reliability and accuracy, in 2011 a global ECDIS seminar programme entitled 'Are you Ready for ECDIS?' was launched to help shipowners, operators, managers and other industry professionals to understand the steps involved in adopting digital navigation in a safe, effective and timely manner. Since then, the UKHO has provided free expert guidance on the ECDIS transition to thousands of delegates in over 60 locations around the world.

In the year ahead, the UKHO will continue to support the industry through the current 'Living with ECDIS' global seminar programme. As well as the free 'ECDIS Buyers Guide' and 'Guide to ECDIS audits and inspections' provided at the seminars, there are ECDIS-specific

publications available, which include the ADMIRALTY Guide to the Practical Use of ENCs (NP231), the ADMIRALTY Guide to ECDIS Implementation, Policy and Procedures (NP232) and the ADMIRALTY Guide to ENC Symbols Used in ECDIS (NP5012).

ECDIS TECHNICAL STANDARDS

At the UKHO the safety and integrity of the data we provide is of paramount importance, and we want the mariner to see all the information provided whether it's on an ADMIRALTY paper chart or as an ENC. However, without the latest Presentation Library (version 4.0) this won't be the case with an ENC. For that reason, one of the most important initiatives currently underway — in my view as the Chairman of the IHO's ENC Working Group — is the revision to the technical standards for ECDIS. As well as ensuring greater consistency in the display of ENC data across all ECDIS, the new standards deliver other benefits for the mariner.

The responsibility for the portrayal of an ENC on an ECDIS screen is controlled by the ECDIS standard 'S-52', authored by International Hydrographic Organization (IHO). ECDIS manufacturers refer to the IHO ECDIS Standards when developing their software, specifically the latest Presentation Library 4.0 within S-52. This contains instructions for the 'drawing engine' within the ECDIS on how to display symbols, colours and line styles on the screen.

The latest Presentation Library 4.0 addresses the number one complaint leveled at ECDIS; constant audible alarms. By providing clear guidance to ECDIS manufacturers on ENC objects that will raise an alarm, the IHO has tackled the major issue of alarm fatigue on the bridge.

The ENC Working Group listened to mariner feedback. Information such as fairway and anchorage area names now appears on screen, with landmarks, lights and buoys viewable via a 'hover-over' function. Both initiatives reduce the time-consuming need to find information buried in a pick report.

The new ECDIS testing standard publication date is expected to be August 15th 2015. From this date the new edition of S-52 will be the reference for the type approval of new ECDIS. Existing ECDIS will have to be upgraded to the latest Presentation Library within twelve months.

Looking ahead, the ECDIS regulations will be extended to all existing

cargo ships over 50,000gt from 1 July 2016 and those who are still in the procurement phase should be asking their ECDIS manufacturer 'is my ECDIS compatible with the latest S-52 standard'?

It is worth noting that the IMO state in Circ.266/rev1 'ECDIS that is not updated for the latest version of IHO Standards may not meet the chart carriage requirements as set out in SOLAS'.

ADMIRALTY NAUTICAL PRODUCTS & SERVICES

The ADMIRALTY Vector Chart Service (AVCS) is the most comprehensive, official, digital maritime chart service in the world; with over 14,000 ENCs from hydrographic offices around the world, packaged and quality assured by the UKHO into a single value-added service. AVCS also comes with the ADMIRALTY Information Overlay (AIO) at no extra cost, combining all Temporary and Preliminary Notices to Mariners for all ADMIRALTY Standard Nautical Charts, and ENC Preliminary Notice to Mariners.

This guide contains a list of ECDIS manufacturers who are able to provide AIO.

The UKHO has also developed a wider range of digital tools to support the mariner, including ADMIRALTY Digital Publications (ADP) and electronic Nautical Publications (e-NPs). These digital versions of some of our most important nautical publications are accepted as SOLAS compliant by the Flag States of almost 80% of the global fleet over 2000gt.

Furthermore, we are continuing to adopt digital technology to support the mariner, whether through the addition of QR Codes to our paper charts or with our H-Note app for smart phones, which makes it faster and easier for mariners to send us navigationally significant information.

The next 12 months will be a pivotal period for modern maritime navigation, as more shipping companies adopt digital navigation and understand what is required when it comes to living with ECDIS. By providing the products, services and support that mariners need we can help them to make informed decisions in order to keep their ship, crew and cargo compliant with regulations and — most importantly — safe at sea.

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Chapter 4 *Training*

Understanding ECDIS is essential

WORKING WITH CHARTS IS AT THE HEART OF NAVIGATING and while there may be plenty of similarities in working with paper or electronic charts it is a fact that the electronic option offers both many benefits and not a few pitfalls as well. In at least three cases, UK MAIB investigators have identified a watchkeepers' failure to use an ECDIS properly as one of the causal factors. Doubtless there have also been other cases in other jurisdictions where the same conclusion has been drawn.

Under the new STCW Code, crew operating ECDIS will need to be competent in its use, certified to have undergone training (unless the flag state has given a temporary waiver) and be able to demonstrate their ability to Port state Control, other authorities, ISM auditors and in some cases also to charterers. However, it will be January 2017 before all of the requirements come into force.

ECDIS training is mandated by the IMO but it is left to Flag States and owners to decide whether or not type-specific training is necessary and, if so, how it should be delivered. As experience of ECDIS systems improves, evidence indicates that many owners are concluding that type-specific training is essential, though some are resorting to computer-based training once the watchkeeper is on board. In at least one accident investigated

by MAIB however, despite dedicated training ashore on the system they were to use, the operators' knowledge of the ECDIS and ability to navigate their vessel safely using the system were said to be 'wholly inadequate'.

Most would argue that under ISM it is an owner's obligation to ensure that all users of ECDIS on a ship are trained and competent with the actual system on board. However, many authorities and others both inside and outside the shipping industry have an outdated view of how crewing of ships is done these days and do not realise that this obligation can present quite an obstacle.

Some owners — particularly those considered 'premier league' — do indeed have a crewing policy that ensures senior officers, navigators and most crew are directly employed on long-term contracts. However, further down the table things gradually change with agency staff and short term contracts becoming the norm. Under such circumstances it is first for the crewing agencies and in some cases for the seafarers themselves to arrange appropriate training.

Without knowing what ships they may be serving on and what equipment is installed, it becomes almost impossible to undergo type specific training except by sheer chance. More to the point agency staff are more likely to change vessels on a regular basis and will quite likely be faced with new equipment on each new contract.

As well as understanding new working techniques related to interactive ENCs, navigators training on ECDIS will also need to learn a whole new set of symbols in addition to those used on paper charts. ECDIS contains different 'palettes' of colours which may be used in different ambient lighting conditions such as day, dusk and night. The colours used in ECDIS display are standardised and all ECDIS should be colour calibrated prior to actual use. Obviously that is not something that occurs with paper charts.

The UKHO has three publications that would be of use to ECDIS trainees. *NP231 the Admiralty Guide to the Practical Use of ENCs* — an illustrated hardback publication with screenshots, top tips and hints on getting the most from ENCs, *NP5012 The Admiralty Guide to ENC Symbols used in ECDIS* — which identifies the differences between traditional paper symbols and the new digital versions and *NP5011 Symbols and Abbreviations Used on Admiralty Charts* – which covers the notations and symbols on traditional paper charts from the UKHO and foreign hydrographic offices.

Training

The official requirement for training is usually for a navigator to have completed generic ECDIS training based upon the IMO's model 1.27 ECDIS course but as ECDIS manufacturers add more and more value added features, it is becoming clear that type specific training is needed and this is being insisted upon in some cases.

Most within the industry training courses based upon the 1.27 model should be of at least 40 hours duration. However, individual flag states may make their own decisions on this point when issuing competence certificates. The usual 40-hour generic training courses take place in nautical colleges and training establishments around the globe. Some of these will be equipped with a wide choice of ECDIS models but many will be far more limited.

As an example of the former, INTERSCHALT operates MET, a fully equipped training centre in Schenefeld, Germany, which offers a five-day ECDIS courses making use of simulators. The course based around the IMO model course are manufacturer independent, but can include type-specific two days-training courses on many leading systems such as those from TRANSAS, JRC, Raytheon Anschütz, Jeppesen, Sperry Marine and Furuno.

The extent of training that ECDIS makers offer will vary. At the lowest level it may be no more than a few hours of familiarisation but others make much greater efforts. Transas for example has established a world-wide network of training establishments and courses under its GET-net programme. As well as offering 5-day courses based around the IMO 1.27 model, the company also has 2-day 'hands on' courses where the extra features of its products can be covered in more detail. Some training takes place in Transas' own facilities but most is undertaken by approved training centres.

Other makers, particularly those that make a full range of navigating and bridge equipment, frequently have dedicated training centres where generic and type specific training courses are run and where their ECDIS can be integrated with other equipment they produce. Leading manufacturers have also had to commit to specialist 'Training the trainers' programmes in order that independent training providers can become sufficiently conversant with the unique features to pass that knowledge on to others. One big attraction of manufacturer provided training, especially if the generic 1.27 course is included, is that it can be provided as part of a

package that covers cost of equipment, installation, servicing and training. Usually this will result in a lower overall cost compared to purchasing each element separately. Seafarers are no strangers to continuous training over the course of their careers but the acknowledged shortage of seafarers generally makes any absence expensive. Losing a man for what could be two weeks taking into account travelling, is therefore something that some owners will seek to avoid. Similarly, for an agency seafarer obliged to arrange and pay for their own training, the loss is double when the cost of the course is added to the time removed from his wage earning capacity.

Fortunately, modern methods of communication have been able to make this less of a problem, and have the added advantage of incorporating type specific and generic training into one programme. Computer-based online courses are now being offered by a growing number of training providers in conjunction with ECDIS manufacturers. Companies leading this new field include the likes of Safebridge, a German company that partners with another MSG providing shore-based ECDIS training, Seagull from Norway and KVH subsidiary, Videotel based in the UK. A number of manufacturers also have their own online training services.

The costs for online training can vary but as an example, the Safebridge website currently (April 2015) shows a figure of €188 for type specific ECDIS training on 12 different makers' systems but this can reduce by between 10% and 20% if an owner is willing to bulk buy courses for between 100 and 500 navigators. Bulk purchased courses can be allocated to individuals as required. There are variations in the way the training is structured but typically an online CBT course is delivered to navigators while serving on vessels at sea or prior to joining a vessel.

The training is usually based closely upon the model 1.27 course and is delivered by making use of PC-based simulation software that allows exercises to be done on a virtual machine of the type chosen. At the end of the course the student will be required to undergo an exam before being given a certificate confirming the course has been completed. Security measures are taken by the course providers to ensure that the person taking the exam is indeed the candidate.

That may be done by using webcams and means of identification or by the candidate taking the exam at a location where his identity can be independently verified. It could be possible to take the exam on board a

vessel with the master attesting to the candidate's identity providing a ship's communications were able to cope with the data transferred.

Typically these courses have a three week window for the candidate to complete the exercises and take the exam. If the candidate fails the exam they will be advised of the reason and given advice on further learning. The exam can be retaken with different questions during the validity of the course window. Exactly what type of training is recognised by flag states can vary so it is important for anyone seeking to arrange training for staff or for themselves to ascertain the exact requirements.

Unlike the IMO 1.27 generic course, there is no standard for type specific training. Some training programmes have been approved by class societies or other appropriate organisations as meeting standards established by them but some courses may not even have the recognition of the system maker.

One factor that should figure in every course and which should be the subject of regular training exercises and drills is how to cope in the event of an ECDIS failure. In terms of passage planning there can be a reversion to paper charts but if the failure is during navigation under ECDIS control and even perhaps the loss of the GPS feed, then reliance on traditional position fixing skills and abilities will be needed. Constant monitoring of the accuracy of the ECDIS should also be encouraged and required under the safety management system.

TRAINING SERVICES	
ECDIS Ltd	www.ecdis.org
ECDIS Training Consortium (ETC)	www.etc-training.com
MSG Marineserve	www.interschalt.com
PC Maritime	www.pcmaritime.com
Safebridge	www.safebridge.net
Seagull	www.seagull.no
Singtel Communications	www.singtelofficeatsea.com
Transas	www.transas.com
Videotel	www.videotel.com

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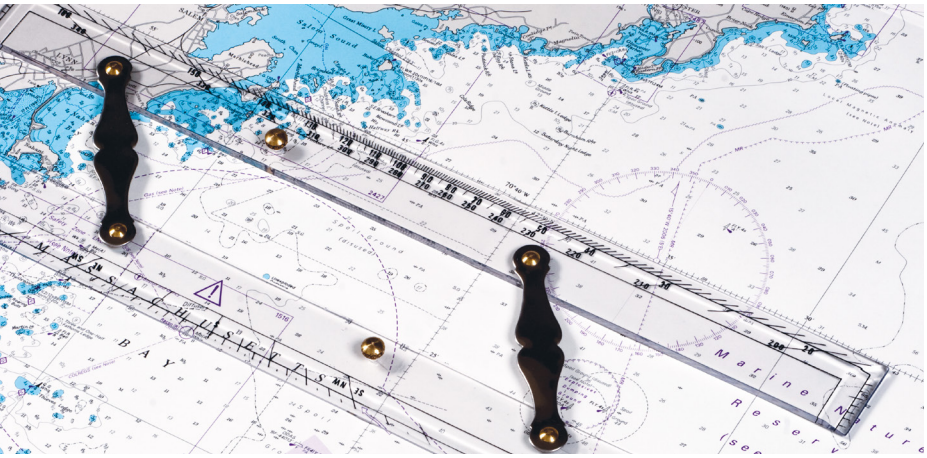
Chapter 5 *Chart Production*

Making charts interactive



UNLIKE A PAPER CHART which is nothing more than a graphic representation of a defined area with depth contours and hazards marked, either when the chart was produced or added by navigators using information from Notices to Mariners, electronic navigation charts (ENCs) are designed to have an interactive element.

Electronic charts come in two basic types, raster and vector. Both types are drawn or compiled using data from actual surveys and information from authorities concerning aids to navigation, restricted zones, navigational hazards (wrecks or submarine cables for example).

A Raster chart is a scan of a paper chart and as such has the same clear and easy to use style mariners have been accustomed to. What makes navigation with raster charts appealing is that the updating is automated and GPS position can be overlaid to give real time situational awareness. A vector chart on the other hand is a database that permits a computer generated representation of the chart making use of detailed data that can be further interrogated.

Objects on a vector chart can be selected or 'clicked on' to reveal further details and the datathat is contained within the chart can be accessed by the ECDIS to activate certain features. For example, the depths and con-

tours on a raster chart are mere inanimate pixels but while the vector chart will show the same figures and lines, if an alarm feature relying on depth is activated, the ECDIS can inform the user of any conflict or danger.

Zooming is a highly useful feature of modern computing capability and the ECDIS is no different. However, when zooming a raster chart every detail will grow larger and more pixelated making it difficult to interpret. By contrast, zooming on a vector chart will simply move the display to a different scale without any pixilation occurring. If zooming out on a vector chart to the smallest scale, some objects and features may become over-written and it may be necessary for the operator to turn off some layers of detailing.

Raster charts are not considered as complying with SOLAS requirement for ECDIS but there use may be permitted for navigation in areas where no official ENC exists.

National hydrographic offices are the only official source for chart data for SOLAS and electronic charts produced by official hydrographic offices for use with ECDIS must be vector charts that conform to standards laid down by the International Hydrographic Organization.

The key standard that applies to current ENCs is S-57 which covers the data and S-63 which is an S-57 chart with additional security encryption to deter illegal amendments and pirating of ENCs. ECDIS makers have been obliged to incorporate means of dealing with the encryption in their products.

Raster charts are not considered as complying with SOLAS requirement for ECDIS but there use may be permitted for navigation in areas where no official ENC exists. A raster chart may also qualify as a back-up for an ECDIS.

Although an S-57 ENC is the requirement for SOLAS, manufacturers of ECDIS have devised their own graphics and hardware configurations and the data that is contained within an ENC will need to be converted into

a System Electronic Navigation Chart (SENC). Some major distributors of ENCs have developed their own system standards which a number of ECDIS makers have incorporated into their systems. Some- times ECDIS makers refer to products that can operate with several of these distributors as 'multi-fuel' ECDIS.

There are a number of ECDIS makers that distribute the official AVCS dataset in their own internal SENC format, ChartWorld, Navtor and Transas. Jeppesen also operate a SENC data service in conjunction with Primar. These services can in some instances reduce the ENC installation time as the dataset has come in a converted state. The number of OEMS offering this service is low because of the need for a large install base to make the service profitable as each SENC is proprietary. Not all Hydrographic Offices allow their data to be converted to SENC on shore.

S-57 is the current standard for ENC production but the ECDIS makers and the IHO are already looking to the future and a new standard S-100 is in the process of development. S-100 came into force on 1 January 2010 and is the document that explains how the IHO will use and extend the geospatial standards for hydrographic, maritime and related issues. S-100 extends the scope of the existing S-57 Hydrographic Transfer standard.

Unlike S-57, S-100 is inherently more flexible and makes provision for such things as the use of imagery and gridded data types, enhanced metadata and multiple encoding formats. It also provides a more flexible and dynamic maintenance regime via a dedicated on-line registry. S-100 provides the data framework for the development of the next generation of ENC products, as well as other related digital products required by the hydrographic, maritime and GIS communities.

Work has just been completed at the IHO on the latest version of the presentation library and it is also working on the new ENC standard S-101, derived using S-100. The International Association of Lighthouse Authorities are using S-100 as the basis for the e-Navigation concepts being developed. A new presentation library will mean that new systems will need to incorporate it and older systems may need upgrading. Buyers of ECDIS systems should satisfy themselves that they are purchasing a system that conforms to the latest requirements.

ENC LICENSING & LIMITATIONS

Paper charts once produced remain valid until a new chart is produced by the relevant hydrographic office. During this time if they are part of a ship's folio of charts they must be maintained up to date with information that is published from time to time in Notices to Mariners. As long as this is done the chart may be several years old before it needs to be replaced. The situation with ENCs is quite different and to many peoples' minds unnecessarily complicated and expensive.

The cost issue has been quite controversial in the run up to making ECDIS mandatory and there is no doubt that installing an ECDIS will add to the costs for ship operators, especially those that opt for maintaining paper charts either as the primary or back up method of navigating – in some cases being obliged to do so by the flag state. With paper charts and ENCs being approximately equal in price the result will be a doubling of initial costs.

Work is currently underway at the IHO to produce a new version of the presentation library used for ENCs.

Over the last few years there have been attempts to play down this aspect of ECDIS citing the potential fuel savings that ECDIS can give – although this would only really apply to full feature ECDIS which has a higher capital cost than a basic system – and time saved through not updating paper charts. The last point would of course only apply to a ship installing dual ECDIS but also ignores the fact that the salary for the officer came previously tasked with updating the paper charts is not likely to be reduced.

The greatest criticism that has been levelled at the method of supply of electronic charts is that true ownership does not really pass to the ship operator because the payment is not for the chart itself but a licence to use it for a fixed period. The licence period for ENCs is three, six, nine or 12 months. Additional Chart data may be added to the licence at any point

during the licence period and there is no requirement for all data to expire at a common date.

This allows the users to hold only the data which is appropriate for their operations at any given time. Some countries do not allow data to be licensed for a shorter period than 12 months. Where shorter licences are available they generally carry a pro-rata price although the rebate is in some cases less. One thing that can be said in favour of the licensing system is that for ships operating in the spot charter market, a voyage outside of its normal trading region need not cost as much in charts as would otherwise be the case.

Obtaining a licence to use a chart can be done in a variety of ways. On systems where the ECDIS is populated with ENCs bought as and when needed, the licence will be included in the price charged for the ENC which might be supplied by way of digital media, USB or download. On those ECDIS that are delivered with a complete folio of ENCs pre-installed, the shipowner may subscribe to a service that either requires him to request a licence for a particular chart in advance or one where the licence is activated the moment the ships sails into the area covered by the ENC.

Once the licence for a chart expires the chart will continue to display but it will no longer be possible to load and apply updates to it. If the chart is still needed for navigation because the ship must pass through the area covered by it to complete a voyage this may leave the vessel open to action by PSC inspectors. If this does happen it should be quite simple for the shipowner to purchase a new licence and update the chart within a very short space of time.

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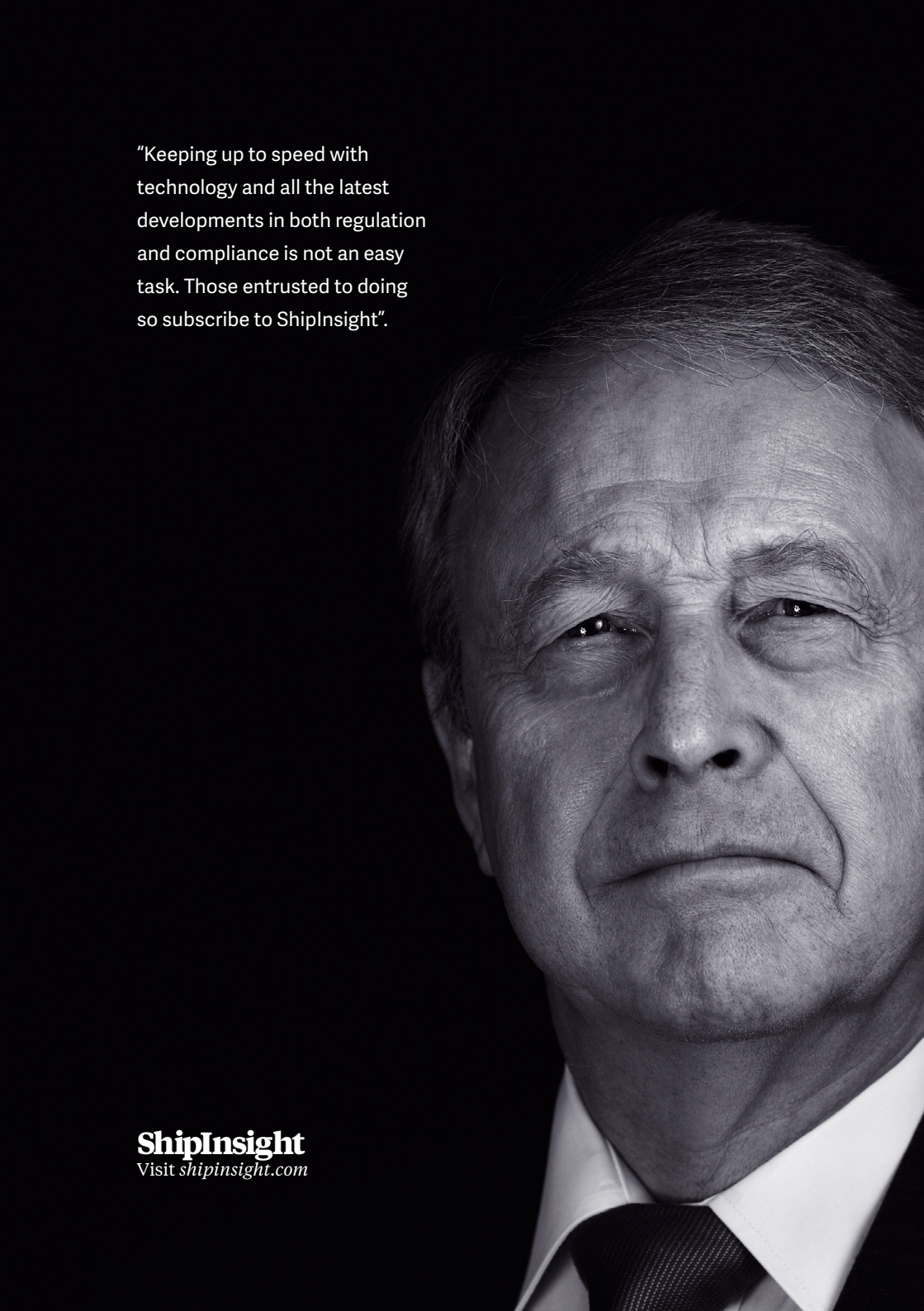

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Chapter 6 *Chart Delivery & Services*

Bringing the information onboard

AN EARLY CRITICISM OF ECDIS and one which is rapidly losing validity is the argument that ENCs are not available for all the areas currently covered by paper charts. Presently the coverage is approaching very nearly 100% but there are some gaps still for minor ports and more remote areas of the world. Certainly the coverage of main trade routes is at 100%.

It is for each national hydrographic office to produce ENCs of its territory but not that of its neighbours even though in some cases this may mean that the display on the ECDIS may be missing features in parts. The problems that could arise because of this and which could impact on the safety of ECDIS were recognised by the IHO which responded by establishing the Worldwide Electronic Navigational Chart Database.

WEND covers the standards to which charts must be produced and principles of co-operation between hydrographic offices and establishes the concept of a network of Regional Electronic Chart Coordinating Centres (RENCs) that allows members of the IHO to cooperate to resolve overlaps and gaps in coverage. Each RENC takes over the responsibility in its area for the collation of ENCs and up dates for the region and through the exchange of the regional datasets and their updates between all RENCs each RENC can offer an identical global dataset for ECDIS.

It was not intended for the RENCs to become distributors of ENCs to vessels. That role was left for commercial organisations to apply to become value added retailers (VARs) and to develop their own distribution channels in much the same way as Inmarsat services are delivered by service providers. The WEND concept has not been fully adopted by all ENC producing nations and some still insist on distributing their ENCs individually either through chart data suppliers or directly.

There are currently two RENCs in existence, Primar and IC-ENC. Primar headquartered in Norway includes the national hydrographic

Presently the coverage is approaching very nearly 100% but there are some gaps still for minor ports and remote areas.

offices in Brazil, Croatia, Denmark, Estonia, Finland, France, Greece, Iran, Latvia, Mozambique, Norway, Poland, Russia and Sweden.

IC-ENC has offices in the UK and Australia and its membership comprises Argentina, Australia, Bahrain, Belgium, Brazil, Chile, Colombia, Cuba, Denmark, Ecuador, Germany, Greece, Iceland, Mexico, Mozambique, Netherlands, New Zealand, Pakistan, Peru, Portugal, Romania, Russia, South Africa, Spain, Turkey, United Kingdom, Uruguay and Venezuela.

When an ECDIS is supplied by the manufacturer some will be delivered with a complete world folio of ENCs, some will come preloaded with ENCs agreed between buyer and seller and some will be devoid of ENCs altogether. It remains the owner's responsibility to ensure that ENCs for the voyages a ship is undertaking are both licenced for use and up to date.

If the ECDIS has no or insufficient ENCs installed, the owner must obtain them from an authorised distributor appointed by a RENC or national hydrographic office as appropriate. Being only data, an ENC can be delivered by any method of direct transfer (CD, DVD, USB etc) the ECDIS supports or via broadcast download using the ship's communication system. Martek Marine's iECDIS also has an additional option of updating

using the GSM networks by way of an integrated modem.

There are distributors all over the globe just as there always have been for paper charts but the very different method of using ENCs has led to a small number of specialist distributors appearing. All distributors can deliver ENCs in S57or S63 format for the ECDIS to convert into SENC but some of the major companies will have a proprietary SENC format that certain ECDIS makers have integrated into their systems.

Some advanced ECDIS have additional features such as weather, tidal and even information on latest pirate activity.

Where an ECDIS maker has preloaded the system with a full or partial folio, the licences still need to be obtained from a distributor. Even when the only charts available were paper charts, SOLAS required ships to have up to date official charts on board for their intended voyage.

That requirement has not altered with the advent of ECDIS but it does now apply to both paper and electronic charts. Ships that can go paperless because they have a dual ECDIS on board and the sanction of the flag state to dispense with paper charts need only have the appropriate licensed and updated ENCs on board. For vessels with just a single ECDIS or where the flag state does not permit paperless navigation, both paper and ENCs need to be maintained up to date.

Paper charts are updated manually by way of tracings supplied by chart agents and using information contained in Notice to Mariners (NTM) which are distributed by various flag states and which can be obtained by subscription or by collection from customs and port authority offices. Most port agents maintain a collection of NTMs which they make available to ships consigned to them. With the advent of satellite communications it has become possible to distribute NTMs using broadcast services and e-mail.

ENC updating is a far easier task only involving running the update

data which can be provided by CD/DVD, e-mail or broadband. Some ECDIS and some chart providers' software can recognise which ENCs need updating and perform the update automatically whereas others require intervention from the ECDIS user. It is important when updates are done by ECDIS users to log which updates have been applied.

If a user forgets to update an ENC, it will still display but obviously without the update. This could prove dangerous and could result in a PSC detention. In this respect ENCs are no different from paper charts.

As explained in Chapter 2, some advanced ECDIS have additional features such as weather, tidal and even information on latest pirate activity that can be overlaid on the ENC display. These services also rely on broadcast information and often use the same software that manages chart updates to ensure the latest information from these services is being displayed. If and when S-100 ENCs become standard the number and type of additional overlays is likely to increase and there is the possibility that some could even update in real time. The Admiralty Information Overlay, a free service to Admiralty Vector Chart Service customers is claimed as the only service available to include worldwide Admiralty Temporary and Preliminary Notices to Mariners and new ENC Preliminary Notices to Mariners, which identify navigationally significant differences between ENCs and Admiralty paper charts.

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NAVTOR	www.navtor.com
Singtel Communications	www.singtelofficeatsea.com
Transas	www.transas.com

Chapter 7 *Practical Considerations*

The pros and cons of introducing ECDIS

JULY 2015 BEGINS THE MAJOR RETROFIT of the pre 2012 built fleet of cargo ships. Starting with around 8,000 tankers, the rollout will continue over the next four years (after allowing for the leeway given depending on survey dates) to all the other vessel types affected by the regulation.

Thereafter, the market will be limited to newbuildings and replacement systems due to failure or a need to upgrade. Consequently many ECDIS makers will be looking at this single opportunity to profit from a mandatory need to install equipment. For owners, as explained in the previous pages, there are many more aspects to ECDIS than the simple matter of cost. The first thing to consider in planning the migration to ECDIS is when individual ships in a fleet will be affected. The next is deciding whether to opt for installing a singled ECDIS and continuing with paper charts as well or going paperless and opting for a dual ECDIS installation.

Before deciding any further it may be necessary to check with the flag state if there are any flag state requirements that apply, particularly if a paperless option was being considered.

One factor that has not so far been considered in depth is how an ECDIS might affect an operator's ISM Code procedures and other QA systems it operates. ISM Code section 6.3 and 6.5 cover familiarisation

and training and could be interpreted to cover the type specific aspects of ECDIS in the way that they have been used by PSC officers to record non-compliance issues with other types of equipment.

Depending upon a company's ISM procedures and documents, some actions may be necessary and it may even be that some changes to documents will also be called for (some manuals may include lists of essential equipment, or identify training/certification needs etc.). Involving affected officers and crew at this stage can help to identify issues that may arise and may also turn up navigators who have had experience of ECDIS on other vessels and who can give particular insight into the process.

A MATTER OF CHOICE

With so many systems now available there is almost certain to be a suitable ECDIS for every individual ship even if choosing an appropriate ECDIS will require several factors to be taken into account.

Cost will be high on the list as always and for vessels approaching end of life and where ECDIS will not be the primary means of navigation then a basic model may suit best — it may even be that if a scrapping date has been decided the best choice will be to apply to the flag state for an exemption.

In a situation where a whole fleet is being equipped, the best answer may be to opt for a single type to be fitted fleet wide. This would reduce issues relating to training requirements, simplify servicing and possibly be a negotiating factor in obtain a best price package. Costs for ECDIS vary depending upon type, if ECDIS is to be used as the primary means of navigation and whether a paperless dual ECDIS sailing option is preferred to save on the cost of paper charts.

At one time installing an ECDIS would have involved a capital outlay for the hardware but this is no longer the case. Two makers — Maris and Martek Marine will supply systems on lease and third parties are also joining the fray. Among these is communications provider Singtel with its Secure-ECDIS all-inclusive package that combines electronic chart navigation services with a suite of Singtel satcom services.

The service includes remote diagnostics and trouble-shooting, which significantly improves response time and reduces operating costs for shipowners. Partnering with Transas, this solution features a lease-to-own

model that bundles monthly recurring charges with other satcom services ensuring no initial capital outlay and repayment over two years.

The likely area where a ship is planned to operate may have an influence on the choice of ECDIS. If it is extremely limited range, such as for ferries, coastal cargo and feeder vessels choosing a supplier from the same region may be a wise choice as regards maintenance and servicing. For vessels operating over a wide range, the best choice would likely be one of the major suppliers with an extensive network of agents and service facilities.

The background of the ECDIS manufacturer should not be overlooked especially where the ECDIS is being fitted to a new vessel or one that will be in service for a long time in the future. ECDIS is an evolving technology and has already undergone some changes in the ENC standards it uses. Selecting a manufacturer that can offer upgrade facilities could be a wise choice. It is probably fair to say that an ECDIS is unlikely to survive the full lifespan of a new vessel and that at least one replacement will be needed.

If the ECDIS is to be used as part of an energy efficiency strategy, then one that has advanced features able to make use of weather routeing, tidal and oceanography information is a good choice over a basic model.

ENSURING FAMILIARITY

Depending upon the crewing strategy of the company, some thought given at an early stage to training will pay dividends when the equipment is eventually installed. Having made the choice of which models of ECDIS are favoured, an operator can begin to investigate the type specific training available. If planning to implement cascade training on board, arrangements should be made for chosen trainers to attend relevant courses on specific ECDIS models. In cases where crewing agents are used to employ navigators, details of the type of equipment likely to be installed can be passed on with a request that only officers with appropriate type specific training be considered for employment. Details of training establishments used by the crewing agency and /or the seafarers themselves for both generic and type specific training should be checked to confirm if they are approved by the flag state.

INSTALLATION OPTIONS

Installing a basic ECDIS does not require much more than some basic connections to a power supply and other equipment such as the GPS and VDR. Such work could normally be carried out during a typical port stay assuming no difficulties are encountered. Installing a dual ECDIS or a system that integrates with all other navigation systems on board is a different prospect and requires careful planning.

It may be best to do this type of installation during a scheduled dry-docking or when an extended port stay can be arranged. Some preliminary work may be possible before the actual installation. Obviously the delivery of the ECDIS has to be closely coordinated with the supplier and because of likely demand at certain points in the rollout programme, some equipment shortages might occur.

OPERATIONAL OPTIONS

Even before its installation, the operator should have decided how to make use of the ECDIS under operational circumstances. With a basic ECDIS the options are limited to the core elements of passage planning and route monitoring but more advanced models offer many benefits. Making the most of an ECDIS' features may require subscription to tidal and weather forecasting services in addition to the chart updating services that are essential in keeping ENCs current and valid.

ECDIS permits data from many sources to be incorporated into passage planning. One example of how this can be exploited is for a ship practicing slow steaming. As well as helping to define a safe route, the capabilities of an ECDIS that can make use of weather and tidal data can also allow for appropriate speeds to be calculated to meet a given ETA. This sort of feature may aid masters and navigators to overcome their natural inclination to build in some reserve of time by progressing faster than necessary at the outset of a voyage.

Safety is an area where ECDIS has much to contribute by reason of the alarms that are built in and which sound if the ship deviates from a pre-planned route or encounters depths and obstacles that have been identified as being safety issues. However, recent experience has shown that the inability of some navigators to fully understand the use of ECDIS even when they have received type specific training is an issue that has to

be addressed. It is recommended to closely monitor how ECDIS is being used during safety audits and regular drills on board.

Following the UK MAIB investigation of the grounding of the chemical tanker *Ovit* due to an ECDIS related navigational error, Transport Malta, the vessel's flag state was recommended to propose to the Paris MOU Committee that a Concentrated Inspection Campaign be conducted on ECDIS-fitted ships to establish the standards of system knowledge among navigators using a list of pre- defined questions. The International Chamber of Shipping and the Oil Companies International Marine Forum (OCIMF) were recommended to develop and promulgate, in conjunction with ECDIS experts, a set of focused questions for use by surveyors and auditors when conducting audits and inspections on ECDIS fitted ships.

The MAIB's recommendation to the owners of the *Ovit*, for steps to be taken to monitor the effectiveness of the ECDIS familiarisation provided to its deck officers, is a recommendation that could equally be well heeded by all owners and managers of vessels fitted with ECDIS.

Operational matters such as passage planning are frequently included into ISM and as with the training and familiarisation mentioned earlier, some procedures may need to be re-written to take account of the ECDIS. One of these will be the issue of keeping ENCs updated and with valid licences. Choosing a suitable chart supply and updating service is another task that has to be done at this point. Where a fleet has ships that follow similar routes on a regular basis, it is possible for an approved ECDIS passage plan to be distributed to all vessels in the fleet. One ECDIS already has COLREG advice built in and this coupled with the AIS and radar overlays could be another factor in reducing incidents at sea. Charts are not the only thing that needs to be kept up to date as the firmware of the systems themselves are sometimes changed to remove faults that have come to light or to accommodate new technologies. Ensuring this is done should be something that is written in to a company's safety management system and in practice will require some detective work. The IHO maintains a list of the latest firmware of most systems. Particular attention to chart updating should be paid by buyers of second hand vessels in case the seller's crew has not been diligent in this regard. More importantly perhaps when acquiring a second hand vessel will be the matter of licencing as licences for charts are not necessarily transferable.

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