Whitepaper: EDCIS

Abstract: This whitepaper will present what ECDIS is, a brief history for context, where it came from and why it is important to all commercial mariners.

What is ECDIS?

ECDIS is an acronym for "Electronic Chart Display and Information System". Electronic Chart Display and Information System (ECDIS) means a navigation information system which, with adequate back up arrangements, can be accepted as complying with the up-to-date chart required by regulation V/19 & V/27 of the 1974 SOLAS Convention of the International Maritime Organization (IMO). Simply stated, it establishes the standard presentation of accurate navigational information regardless of the software, computer processing or display hardware used to present it. For example, if a symbol is used to represent a navigational item, the same symbol, with the same color, at the same light conditions will always look the same independent of the manufacturer of the software or hardware used to present it. This normalizes training, allowing any properly certified mariner of any country on any vessel to correctly interpret any EDCIS display uniformly. It removes the chance for misinterpretation and possibly dangerous mistakes from occurring. For display hardware, this basically relates to the correct color at a known brightness being displayed whether it be daylight, dusk or nighttime operations. The intention is to suppliment or replace paper charts with ECDIS systems.

Brief History of Maritime Navigation

The first means of navigating of a boat other than following a shoreline was celestial navigation, using the positions of the stars, moon and sun, to sail a course. This was useful in a relatively small area such as the Mediterranean or Aegean Seas or the China Sea, but not reliable enough to allow open ocean sailing This was approximate at best and depended on the skill of the ships master. The first use of drawn nautical charts dates back to the 6th century BC by Greek and other sailors. The next major technological breakthrough occurred with the invention of the compass in China around 1100AD, and then in Europe in the late 1200's.

With increased exploration and now a navigational aide in the compass, maps and nautical charts improved dramatically, but it was still very difficult if not impossible to determine longitude. The compass and the astrolabe, a precursor to the sextant, and more accurate astronomical data and an awareness of winds and currents were all that was available to the early explorers such as Columbus and Magellan. Speed and distance were rough guesses at best. Mariners would share data among themselves

and through information clearinghouses that would continuously update and expand the knowledge base. Time was the key measurement needed to accurately determine longitude. The first attempts were simple devices such as the hourglass (still in use by the Royal Navy as late as 1839). The sextant was invented in 1757 and became the main instrument for navigation. It allowed for a reasonable estimate of longitude using the regular lunar cycle, but it wasn't until 1761 that accurate time pieces small enough and robust enough to travel onboard a ship allowed for more precise navigation, although they were not widely adopted for another 100 years.

Many smaller but significant contributions were made along the way, such as lighthouses and buoys, but with the development of radio came the invention in 1940 of the LORAN (long range navigation) system, the first real electronic navigation. Then in the 1960's, the possibilities of really precise navigation came in with the space race and satellites, first with super-accurate clocks and known orbital satellite positions, and then in the 90's with the introduction of the GPS we know today, opening the door for electronic navigational charts (ENC's). Still, change comes slowly to this ancient discipline. Paper charts, in use for almost 3,000 years, are still legal, and in some places, mandatory today even with proven electronics available.

Where did ECDIS Come From?

The solidification on an international scale for the concern for **S**afety **o**f **L**ife **a**t **S**ea (SOLAS) occurred immediately following the sinking of the Titanic. In late 1914, a treaty was passed outlining minimum requirements for ocean going commercial vessels for such things as lifeboats, safety procedures, design, etc. This was updated in 1929 and again after WWII in 1948. With the founding of the United Nations in 1948, a new organization was chartered to provide a global regulatory framework within which all member nations would operate. It took over 10 years to organize, but in 1959 the International Maritime Organization (IMO) came into force. It's first major result was the 1960 SOLAS Convention, and with its adoption five years later, clearly advanced the mandate for all commercial shipping to adhere to the minimum safety standards and charging them with keeping up to date with modern technologies. It was updated in 1974, and then in 1985, the first effort to incorporate electronics as an important safety and navigational system was introduced. The original concept was called e-Navigation, and became formalized as the general term ECS (electronic chart system). As work progressed, the specific standards developed by IMO, differentiated from other forms of ECS, became known as ECDIS. It may be noted that other electronic aids such as AIS, ARPA and GMDSS also came into being at this time. (See Appendix A for Reference Information)

Safety of Life at Sea (SOLAS) requires (from the current charter):

> 2.1 All ships irrespective of size shall have:

2.1.4 Nautical charts and nautical publications to plan and display the ship's route for the intended voyage and to plot and monitor positions throughout the voyage; an Electronic Chart Display and Information System (ECDIS) may be accepted as meeting the chart carriage requirements of this subparagraph.

2.1.5 Back-up arrangements to meet the functional requirements of subparagraph 2.1.4, if this function is partly or fully fulfilled by electronic means. *(This means that a single ECDIS can be used for navigation but it requires a backup by paper charts or a secondary ECDIS.)*

In front of the IMO now is complete harmonization of the standards among all participating flag countries, and implementation (See Table 1) to bring the global fleet up to current standards. They are always on the watch for new emerging technologies to incorporate that can improve the safety of those at sea, and also the environment and the security of the ships and cargo. Interestingly, the United States, an active and willing participant from the beginning, while actively promoting and adopting the SOLAS Convention in International waters as well as for ships transiting US waters, does not impose the SOLAS Convention on US Flag vessels operating in US waters. It is due to this fact that US manufacturers of ECS's, computing and display equipment, have not been compelled to develop Approved equipment, so that primary supply of ECDIS Approved equipment is of non-US manufacture.

Why is ECDIS Important in the US?

The IMO has mandated ECDIS compliance for all commercial vessels of a certain size within a reasonable time period of implementation. The US does not enforce this. So why should anyone in the US and its commercial maritime industry be concerned with ECDIS?

There are several levels from which you can evaluate this question and come up with a response. The first is simple altruism, doing the safest thing is the best thing, especially when human life, expensive cargo and fragile ecosystems are at stake. Remember, the IMO did this for SOLAS reasons.

The second is for practical reasons, the standing carriage requirement for navigation of commercial vessels of all sizes in all US waters is the paper chart. There is no requirement relative to how current that chart is, only that it was purchased from a certified source and that it was current when produced. Electronic charts, on the other hand, can be updated and redistributed directly to the bridge of operating vessels automatically, allowing for the latest buoy and depth data, vertical clearances, underwater obstructions, construction, and a whole host of other variable

data, to be as current, *and as safe for operating a vessel,* as possible. Why assume added risk just because that's the way it's always been done?

A third level is financial. This is always in there somewhere. The financial impact of ECDIS can be both positive and negative. Commercial vessels are owned and operated by businesses, who need to justify expenses and mitigate risks for the greatest return on their investments. The fallacy in the resistance to regulation of electronic navigation is that it will cost a lot more money. The fact is that there is only a very small difference now between the cost of marine grade compliant equipment and marine grade non-compliant equipment, and that difference will disappear when universal adoption occurs. If owners were to start now with an eye to the future by replacing older units as they come out of service with Approved products designed to meet future requirements, then the normal replacement costs bear the compliance costs almost completely, and very little needs to be done down the road when inspections start. Why spent money now on a non-compliant unit only to throw it away before it's useful life in a few years and pay again for a unit that meets the standards? Also, insurance underwriters are also concerned about risk of loss and look for every loophole to reduce their payout, so the best way an owner can protect himself should a claim need to be made, is to meet all existing and future standards with his equipment. Being denied a claim because the underwriter knows that all foreign vessels meet a standards that can be easily achieved by US flag vessels, yet was not met, could be the most expensive decision they make. Having modern electronics that meet the global industry standards is a very defensible position. Like the old ad, "pay me now or pay me later". Incrementally upgrading, on the other hand, is the most cost effective way to manage risk and improve safety.

A fourth response to the question is that ECDIS provides systems and technology equivalent to what we use in our daily lives and readily acceptable to younger navigators coming on the bridges today. We live in an electronic world, why shouldn't you have the equivalent technology at work that you have in your home, your car or your pocket? Think about the use of paper maps in cars today, and that isn't even regulated. Even though in-car GPS mapping systems may cost a little more than free maps (if they are still free), today operators of motor vehicles opt for electronic navigation because it is a safer and better solution, period. How many professional truck drivers today do you think still use paper maps? Even commercial aircraft now employ what is called "EFB' or Electronic Flight Bag, eliminating all those heavy paper charts, saving pilots time and airlines fuel, not to mention more up to the minute data for improved efficiency and safety.

A fifth is patriotic. Vessels flying the US Flag are protected by the Merchant Marine Act, passed by Congress in 1920 and commonly referred to as the Jones Act. This was enacted to guarantee that in times of national emergency including war, there would always be a merchant marine fleet available to the government for the national

defense and development and execution of domestic and foreign commerce. It states that all ships transporting goods between two US ports must be owned and operated by US citizens and built and serviced in US facilities. This protects all US citizens so that water-borne commerce can continue to exist regardless of conditions external to the US. If the owners of these vessels and the servicers of these vessels feel some economic protection from this service obligation, then that should also extend to the manufacturers of the products used to operate and navigate these vessels. The idea here is that the US maritime industry is to remain completely independent of foreign interests. The only way that can be done is if all critical systems for operating a vessel can also be supported independently by US-based manufacturers owned by US citizens and employing US workers. Even though the US has yet to adopt standards for navigational electronics and other modern technologies that can improve safety and mitigate loss of life, cargo and ecological damage from preventable accidents, these standards are being formulated and will be enacted, it is just a matter of time.

It is also true that the time and expense of creating standards out of thin air, versus the adoption of existing standards used universally around the world, make it clear that the IMO standards will become the basis of US regulations. Unless US manufacturers can step up to serve the US flagged vessels, we will not be prepared, not be independent, not be secure in operating these vessels. Whether now or a few years from now, ECS in general terms, or specifically ECDIS, will be used for navigation of most if not all commercial vessels in the US as they are in the rest of the world. In the same way, electronic navigation is the best way to operate a commercial maritime vessel, period. Professional mariners deserve the best and safest means to operate their vessels, and as a US manufacturer of professional maritime displays, we are here to provide that.

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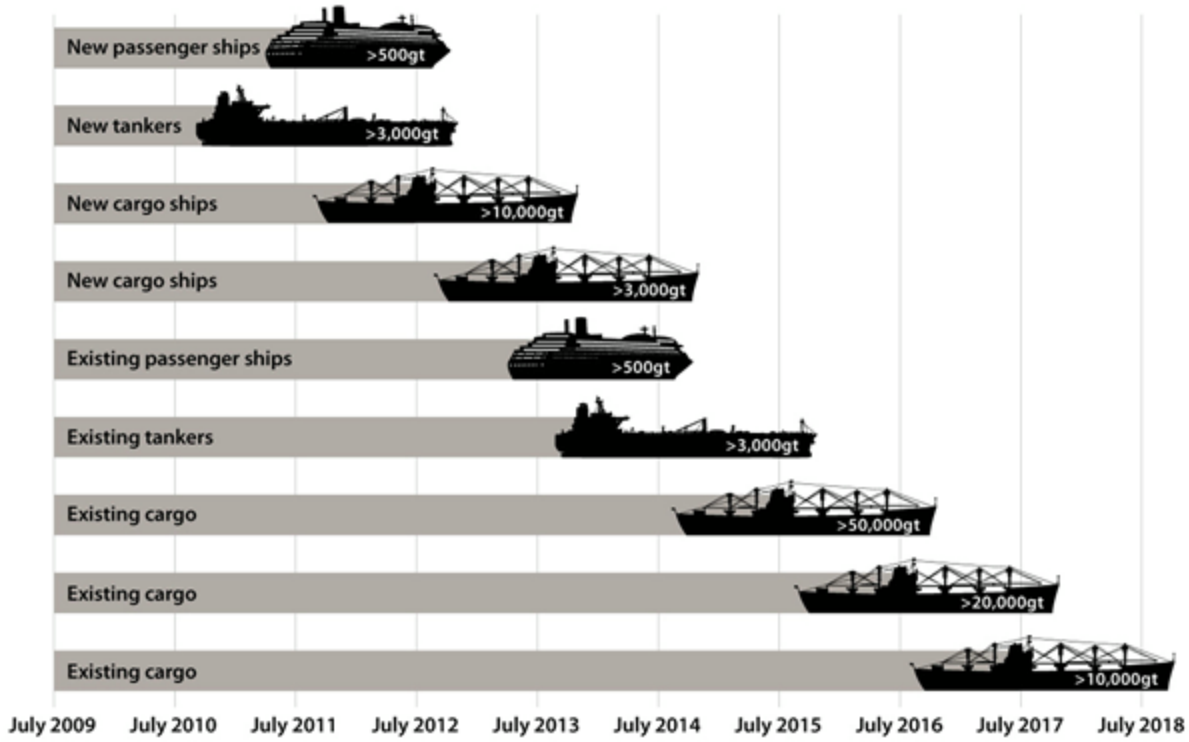
Table 1



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Appendix A

What are the applicable ECDIS standards and specifications?

New performance standards and specifications apply to ECDIS from January 2009 which introduced significant changes to existing ECDIS. All ECDIS manufacturers re-Type Approved their systems and ECDIS installed after 1st January 2009 must be approved against the new standard of IMO Resolution MSC. 232(82) ADOPTION OF THE REVISED PERFORMANCE STANDARDS FOR ECDIS; IMO Resolution MSC.282(86) defines implantation dates.

SOLAS COMMISSION DIRECTIVE 98/85/EC of 11 November 1998 amending Council Directive 96/98/EC on marine equipment calls out: IMO Resolution A.694 (17), IMO Resolution A.813 (19), IMO Resolution A.817 (19), IMO Resolution MSC64(67) Annex 5, EN 61174, EN 61162-1, and EN 60945 (note - A.817(19) references IHO S-52)

NOTE - The US navy has their own specification OPNAVINST 9420.2, 15 Feb 2001, referred to as ECDIS-N, which is nearly identical to the standard ECDIS specification.

The current test standards are:

- IEC 60945 (4th Edition, 2002)
  Maritime navigation and radio-communication equipment and systems – General requirements - Methods of Testing and Required Test Results
- IEC 61174 (2nd Edition, 2001)
  Maritime navigation and radio-communication equipment and systems – Electronic chart display and information system (ECDIS) – Operational and performance requirement, methods of testing and required test results
- IEC 61162 (Edition 2, 2007)
  - Maritime navigation and radio-communication equipment and systems – Digital interfaces
- IEC 60936 (Edition 1)
  Maritime navigation and radio-communication equipment and systems – Radar
  - Part 1 (Edition 1.1, 2002) Shipborne radar - Performance requirements –methods of testing and required results
  - Part 2 (Edition 1, 1998) Shipborne radar for high-speed craft – methods of testing and required results
  - Part 3 (Edition 1, 2002) Radar with chart facilities –performance requirements and methods of testing

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Normative references:

- IHO Special Publication No. 52
  (S-52) - Specification for chart content & display aspects of ECDIS" (Ed.6 March 2010)
- IHO ECDIS presentation library USER'S MANUAL
  Edition 3.4 January 2008 (S-52, Annex A of Appendix 2)
- IMO MSC 64(67) Annex 4 Performance standards for radar equipment
- IMO Resolution A.694(17) General requirements for shipborne Radio Equipment
- IMO Resolution A.820
  Performance standards for navigational radar equipment for high speed craft
- IMO Resolution MSC.232(82) 2009 – Revised ECDIS performance standard
- IMO Resolution MSC.191(79) 2006 – Performance standards for the presentation
  of navigation-related information on Shipborne navigational displays
- IMO Resolution A.817(19)
  Performance standards for electronic chart display and information systems (ECDIS)
- IEC Standard 62288 (2008) – Presentation of navigation-related information on
  Shipborne navigational displays – General requirements, methods of testing and required test results