

Revision of the IMO's Performance Standards for ECDIS. Three Versions of Performance Standards in Use

A. Weintrit

Gdynia Maritime University, Gdynia, Poland

ABSTRACT: Traditional marine navigation methods are replaced by new solutions that use computers. Electronic Chart Display and Information Systems (ECDIS) are mandatory almost on every vessel [24],[25]. ECDIS not complying with regulations is an existing problem and a hazard for seafarers and the marine environment. But unfortunately, there is a deficit or even lack of procedures for checking whether ECDIS meets related performance standards. Regulatory bodies of the maritime industry are now contemplating how to tackle this blunder [1]. SOLAS regulations V/18 and V/19 [24], requires that in order to achieve chart carriage requirements (in terms of SOLAS Convention), the ECDIS equipment must conform to the relevant IMO performance standards. ECDIS units on board of the ships are required to comply with one of three performance standards (either IMO resolution A.817(19) [18], as amended [19],[20], or resolution MSC.232(82)) [21], or resolution MSC.530(106) [23], depending on the date of their installation. In this article, the author tries to explain the differences in these three documents. Along with technological progress, the equipment becomes more and more advanced and technologically sophisticated. This applies to both hardware, software and databases. ECDIS software developers should use the right tools, including incorporate automated self-tests into their products and shipping companies should employ maintenance strategies to improve ECDIS compliance [1], taking into account that time is running quickly.

1 BACKGROUND

ECDIS is a computerized navigation information system that complies with International Maritime Organization (IMO) regulations. It is a complex, modern, software-based, safety-relevant marine navigation system with multiple options for data display, analysis and integration [25]. The ongoing safe and effective use of ECDIS involves many stakeholders including seafarers, equipment manufacturers, chart producers, hardware and software maintenance providers, shipowners and operators, maritime administration, hydrographic offices, classification societies, and marine education and training providers. It is important that all these stakeholders have a clear

and common understanding of their roles, duties and responsibilities in relation to ECDIS [25].

In December 2022 the International Maritime Organization adopted the IMO's Circular MSC.1/Circ.1503/Rev.2 [4], also known as ECDIS – Guidance for Good Practice, to assist seafarers in understanding technological development along with the consequences for the digitization process in marine navigation. It is new version of a combination of several prior ECDIS IMO's circulars. Each of those documents dealt with a certain aspect of ECDIS use, and MSC.1/Circ.1503/Rev.2 provides a comprehensive guide on this field by merging them. The document is meant to help educate navigators, captains, pilots, deck

officers, and other relevant personnel in the proper use of their ECDIS.

At the same session of the Maritime Safety Committee has been adopted revised version of the Performance Standards for ECDIS - IMO Resolution MSC.530(106) [23].

2 INTRODUCTION. ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEM (ECDIS) REQUIREMENTS

2.1 ECDIS Standards

The appropriate standards and specifications regarding ENC and ECDIS are approved by international agencies and organizations such as IMO, IHO, and IEC developed since the late eighties of the last century. The first international standards related to ECDIS were adopted in 1995 by IMO [18]. With technological progress, the equipment became more and more advanced and technologically sophisticated, and thus subsequent versions of standards and specifications were developed, more and more detailed and specialist. Almost every year, more or less significant legislative changes were introduced.

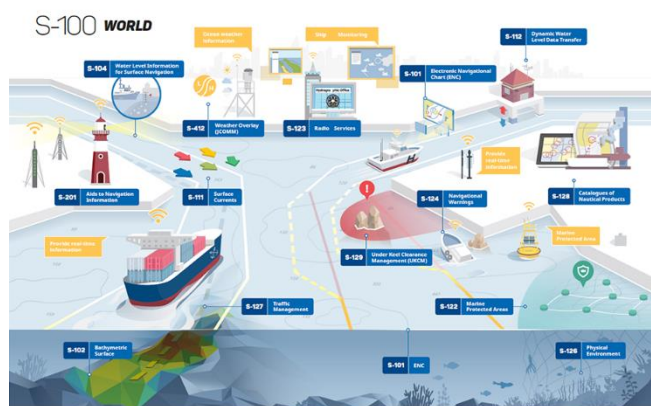


Figure 1. International Hydrographic Organization standards - IHO S-100 World [2],[3]

The IMO Performance standards for electronic charts were adopted in 1995, by resolution A.817(19) [18], which were amended in 1996 by resolution MSC.64(67) [19] to reflect back-up arrangements in case of ECDIS failure. Additional amendments were made in 1998 by resolution MSC 86(70) [20] to permit operation of ECDIS in RCDS (Raster Chart Display System) mode.

In 2006 there were adopted Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS) by resolution MSC.232(82) [21].

Where an ECDIS is being used to meet the chart carriage requirements of SOLAS [24], it must [2]:

- be type-approved;
- use up to date electronic navigational charts (ENC);
- be maintained so as to be compatible with the latest applicable IHO standards; and
- have adequate, independent back-up arrangements in place.

In December 2022 having considered the recommendation made by the IMO's Sub-Committee

on Navigation, Communications and Search and Rescue (NCSR), at its ninth session [16],[17], Next the IMO's MSC (Maritime Safety Committee) adopted the revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS) [23].

It is recommended that the Governments through their Marine Administrations have been obliged to ensure that ECDIS equipment (see Table 1):

1. if installed on or after 1 January 2029, conforms to performance standards not inferior to those specified in the annex to the present resolution [23];
2. if installed on or after 1 January 2026 but before 1 January 2029, conforms either to performance standards not inferior to those specified in the annex to resolution MSC.530(106) [23] or to performance standards not inferior to those specified in the annex to resolution MSC.232(82) [21];
3. if installed on or after 1 January 2009 but before 1 January 2026, conforms to performance standards not inferior to those specified in the annex to resolution MSC.232(82) [21]; and
4. if installed on or after 1 January 1996 but before 1 January 2009, conforms to performance standards not inferior to those specified in the annex to resolution A.817(19) [18], as amended by resolutions MSC.64(67) [19] and MSC.86(70) [20].

Table 1. ECDIS units requirements [23]

When installed?	What version of performance standards should ECDIS equipment be adapted to?
if installed on or after 1 January 2029,	conforms to performance standards not inferior to those specified in the annex to resolution MSC.530(106)
if installed on or after 1 January 2026 but before 1 January 2029	conforms either to performance standards not inferior to those specified in the annex to the present resolution or to performance standards not inferior to those specified in the annex to resolution MSC.232(82)
if installed on or after 1 January 2009 but before 1 January 2026	conforms to performance standards not inferior to those specified in the annex to resolution MSC.232(82)
if installed on or after 1 January 1996 but before 1 January 2009	conforms to performance standards not inferior to those specified in the annex to resolution A.817(19), as amended by resolutions MSC.64(67) and MSC.86(70)

2.2 ECDIS requirements in SOLAS Convention

The revision of SOLAS Convention, Chapter V, adopted in 2000, which has been entered into force on 1 July 2002, has firmly established the electronic navigational chart as part of the international maritime safety system. Its possible recognition as a paper chart equivalent confirmed the considerable safety benefits provided by the official Electronic Chart Display and Information Systems (ECDIS) [24].

In 2009 the IMO decided to make ECDIS mandatory for all IMO ships of 300 gross tonnage and over (passenger ships of 500 gross tonnage and over) with some transition periods. The new carriage requirement applies to an ECDIS with appropriate backup requirements that can be met either by a type-

approved backup ECDIS or by official and up-to-date paper standard navigational charts. ECDIS may be used as the main means of navigation and as an alternative to paper nautical charts in accordance with chapter V of the SOLAS Convention, regulation 19. IMO adopted performance standards for electronic charts in late 1990s. In 2000, IMO adopted revised SOLAS Regulation V/19 – Carriage Requirements for Shipborne Navigational Systems and Equipment, so that an ECDIS could be recognized as meeting the requirements of the regulations for chart carriage. Regulation V/19.2.1.4 of the SOLAS Convention requires ships to be equipped with all charts required for the intended voyage [24]: “All ships, irrespective of size, shall have nautical charts and nautical publications to plan and display the ship’s route for the intended voyage and to plot and monitor positions throughout the voyage. An Electronic Chart Display and Information System (ECDIS) is also accepted as meeting the chart carriage requirements of this subparagraph. Ships to which paragraph 2.10 applies shall comply with the carriage requirements for ECDIS detailed therein.”

In addition according to SOLAS Chapter V, Regulation 19/2.1.5 [24]: “All ships, irrespective of size, shall have back-up arrangements to meet the functional requirements of subparagraph .4, if this function is partly or fully fulfilled by electronic means”. An accompanying footnote reads “An appropriate folio of paper nautical charts may be used as a back-up arrangement for ECDIS. Other back-up arrangements for ECDIS are acceptable (see appendix 6 to Resolution A.817(19), as amended).”

When new equipment is installed, deck officers must receive adequate training before being operationally deployed to meet the requirements of the STCW and ISM Code. The flag State of the ship should also be consulted if continuing education requirements exist. In general, personnel must have completed IMO Model 1.27 – “Operational Use of Electronic Chart Display and Information Systems” and have completed specific training organized by the manufacturer [25].

3 REVISION OF ECDIS PERFORMANCE STANDARDS FOR ECDIS

3.1 *Performance Standards for ECDIS discussed at Plenary during 9th session of NCSR Sub-Committee*

During the ninth session of the IMO’s NCSR Sub-Committee which was held in June 2022 under chairmanship Mr Nigel Clifford (New Zealand) in Agenda item 16 entitled “Revision of ECDIS Guidance for good practice and amendments to ECDIS performance standards” [11], the NCSR Sub-Committee considered the proposed amendments to resolution MSC.232(82) [21] on revised performance standards for Electronic Chart Display and Information Systems (ECDIS) to include references to IHO product specifications S-98, S-100 and S-101 [2], [3].

The NCSR Sub-Committee had for its consideration documents [16],[17]:

- NCSR 9/16/1 (IHO et al.) [12] proposing amendments to resolution MSC.232(82) [21] to

allow for the introduction of the next technical generation of Electronic Navigational Charts (S-101 ENC) and explaining the resulting implications for existing and new ECDIS installations;

- NCSR 9/16/4 (Canada) [13], commenting on document NCSR 9/16/1 [12], and proposing additional amendments to resolution MSC.232(82) for improving S-100 application [3] by requiring a connection between AIS and ECDIS; and
- NCSR 9/16/5 (China) [14], commenting on document NCSR 9/16/1 [12], in particular on the proposed inclusion of the electronic provision and display of nautical publication data and standardized digital exchange of ships’ route plans in the draft revision of resolution MSC.232(82) [21].

Regarding documents NCSR 9/16/1 [12] and NCSR 9/16/5 [14], the following views were expressed:

- the work to enable the use of product specifications S-98, S-100 and S-101 [2],[3] was important; however, a transition period for legacy systems should be provided and carefully considered; and
- proposed modifications related to ships’ route plan exchange should not be discussed until the scope of the associated output was agreed by MSC.

With regard to document NCSR 9/16/4 [13], the following views were expressed:

- connecting the AIS signals into ECDIS might assist the navigator with situational awareness; however, it could equally cause more reliance on ECDIS as a collision avoidance tool, when it should never be used as a sole tool to judge the risk of collision;
- no SOLAS requirements were provided for AIS to be connected to ECDIS, thus the display of AIS information on ECDIS should be optional and voluntary; and
- the proposal for ECDIS to be connected to AIS would represent an expansion of the current output and thus, it should first be approved by the Committee.

After consideration, the Sub-Committee referred documents NCSR 9/16/1 [12], NCSR 9/16/4 [13] and NCSR 9/16/5 [14] to the Working Group on Navigation for detailed consideration and advice, paying due regard to the scope of the output.

3.2 *Amendments to the IMO Performance Standards for ECDIS considered by NCSR Working Group*

The NCSR Working Group considered the proposed amendments to resolution MSC.232(82) on revised performance standards for Electronic Chart Display and Information Systems (ECDIS) set out in document NCSR 9/16/1 [12], taking into account the comments in documents NCSR 9/16/4 [13] and NCSR 9/16/5 [14].

Recalling that this part of the output approved by MSC was to be completed within one session to include references to IHO product specifications S-98, S-100 and S-101 [2],[3] into the current performance standards, the NCSR Working Group noted the information provided by the observer delegation of IHO on the urgency to amend the current ECDIS performance standards in order to allow for the introduction of the next technical generation of Electronic Navigational Charts (S-101 ENC) [2]. The Group also noted IHO’s explanation that the development of industry standards takes time but as

the current IMO standards only refer to S-57 ENC standards, despite technological readiness in manufacturers and other stakeholders, industry standard bodies, IEC, for example, had been unable to produce its standard based on IHO's S-100 Universal Hydrographic Data Model [3], the use of which was approved by IMO in 2011.

Having noted the information provided by IHO, the NCSR Working Group was advised that the cosponsors of document NCSR 9/16/1 (IHO, CIRM and INTERTANKO) [12] withdrew the part of the proposed amendments concerning the digital exchange of ships' route plans. This was in line with MSC instruction and the decision for the withdrawal was endorsed by the Group.

Noting the concerns expressed over the validity of the existing S-57 based ECDIS, the Group agreed to allow the transitional period of three years between 1 January 2026 to 1 January 2029, during which the new installation of ECDIS compliant with either resolution MSC.232(82) [21] standards or the newly introduced S-101 based ECDIS performance standards would become possible.

Referring to document NCSR 9/16/5 (China) [14], a question was raised regarding the proposed inclusion of the electronic provision and display of nautical publication data in the proposed new standards. The Group noted the clarification made noting the new inclusion of IHO Publication S-98 – Data Product Interoperability in S-100 Navigation Systems [2],[3] within the reference documents of the draft new standards.

The Working Group did not agree to the proposal made in document NCSR 9/16/4 (Canada) [13], observing that this was outside the scope of the amendment.

Having deleted the part of the proposed amendments concerning the digital exchange of ships' route plans from the proposal and having made necessary modifications to the application dates provisions for the transitional period, the Group finalized the draft MSC resolution on Performance Standards for Electronic Chart Display and Information Systems (ECDIS), set out in annex 7, to which the Sub-Committee is invited to approve and forward it to the Committee for adoption [16],[17].

Having finalized the new revision of the Revised performance standards (resolution MSC.232(82)) [21] which had already revised the original standard (resolution A.817(19) [18], as amended and revised twice by resolutions MSC.64(67) [19] and MSC.86(70) [20]), the Group endorsed the proposed Secretariat's edit not to use "Revised" as part of the title of the newly revised standards. The Group noted that the fact that these performance standards had been revised was easily distinguishable from the preambular paragraph of the resolution which clearly states "revised" (with a lower case "r") from the previous standards, once revised. Scope of the output on "Amendments to the revised ECDIS performance standards (resolution MSC.232(82)) [21] to facilitate a standardized digital exchange of ships' route plans"

The Working Group considered the scope of the output approved by MSC on "Amendments to the

revised ECDIS performance standards (resolution MSC.232(82)) [21] to facilitate a standardized digital exchange of ships' route plans".

Noting the instruction of MSC not to discuss the contents of the output until the scope had been agreed by the Committee, and also noting the timeline approved was only one session to complete the item, the Group agreed in general that the scope should be limited to a specific task that was only to facilitate a standardized digital exchange of ships' route plans, as its description of the output suggests.

In consideration, the Group noted that by allowing the addition of such a new function to ECDIS, this could possibly create the wrong expectations that the master might in future no longer feel ownership of responsibilities if the route was created by shore-side staff and they only have to follow what is being provided or instructed from elsewhere. The decision and the responsibility for a voyage plan would continue to rest with the master and this point would need to be made clear and reminded, preferably in the form of an IMO instrument such as a circular or guidance, if not in the performance standards. The Group agreed that this point would need to be duly taken into account in the deliberations, provided that such work was completed within an agreed timeline.

The NCSR Working Group also considered the possible expansion of the output also to facilitate the connection of AIS to ECDIS proposed in document NCSR 9/16/4 (Canada) [13].

In deliberations, concerns were expressed that while it might provide a useful add-on tool to deck officers, this could create further over-reliance on ECDIS-displayed AIS signals, which should never be used solely to judge the risk of collisions. Noting that the ECDIS performance standards should be user driven, rather than technology driven, the Group did not agree to include this proposal into the scope, but agreed that in order to carry on the work for such amendment, a separate new output would be required.

With the finalization of the revision of performance standards, as set out in annex 7 [16],[17], and with the expectation that MSC 106 would be in the position to adopt the revision, replacing the existing standards set out in resolution MSC.232(82) [21] for new ECDIS installations, the Group agreed that the new work to facilitate exchange route plans should be based on these new revised performance standards just agreed.

Accordingly, the Group recommended that the scope of the output "Amendments to the revised ECDIS performance standards (resolution MSC.232(82)) [21] to facilitate a standardized digital exchange of ships' route plans" should only be limited to amendments necessary to facilitate a standardized digital exchange of ships' route plans and that the work should be based on the new revised standards to be adopted by MSC 106, thus requiring the output to be renamed accordingly [15].

3.3 *Amendments to IMO Performance Standards for ECDIS considered at the 9th session of NCSR Sub-Committee*

The NCSR Sub-Committee approved the report of Working Group [17] in general, and in particular:

- approved the draft MSC resolution on Performance Standards for Electronic Chart Display and Information Systems (ECDIS) and forward it to the Committee for adoption (annex 7 [16],[17]);
- agreed with the Group's recommendation that the scope of the output "Amendments to the revised ECDIS performance standards (resolution MSC.232(82)) [21] to facilitate a standardized digital exchange of ships' route plans" should only be limited to amendments necessary to facilitate a standardized digital exchange of ships' route plans and that the work should be based on the new revised standards to be adopted by MSC, thus requiring the output to be renamed accordingly);
- noted that the Group did not agree on the unified interpretation, as proposed in document NCSR 9/24 (paragraph 8.2) [15];

3.4 Amendments to IMO Performance Standards for ECDIS considered at the 106th session of MSC

The IMO Maritime Safety Committee at its 106 session in November 2022 considered the draft MSC resolution on Performance Standards for Electronic Chart Display and Information Systems (ECDIS) [5] presenting, inter alia, a phased introduction of new IHO product specifications (i.e. S-98, S-100 and S-101) [2],[3] for ECDIS, together with the following documents:

- MSC 106/13/3 (IACS) [6], proposing consideration of consequential amendments to SOLAS regulation V/19.2.1 and the records of equipment regarding the use of electronic nautical publications (ENP) through ECDIS, which was incorporated as an ECDIS function in the draft MSC resolution;
- MSC 106/13/4 (IACS) [7], proposing modifications to the draft MSC resolution in order to clarify the application statement, in particular, the use of the expression "installed on or after [date]"; and
- MSC 106/13/5 (China) [8] commenting on the draft MSC resolution and proposing consideration of a number of actions to:
 - evaluate the feasibility of the proposed implementation dates according to the development of S-100 [3] based product specifications and IEC standards;
 - develop a mechanism for further revisions to ECDIS – Guidance for good practice (MSC.1/Circ.1503/Rev.2) [4] to address onboard ECDIS updates; and
 - review and consider human element issues, including training requirements and possible amendments to the STCW Code or MSC.1/Circ.1503/Rev.2 [4].

During the consideration of document MSC 106/13/3 [6], the majority of the delegations that took the floor indicated that it would be premature to consider amendments to SOLAS regarding the use of ENP through ECDIS at this stage. Views were also expressed that a formal proposal for a new output would be necessary to give appropriate consideration to the matter.

With regard to document MSC 106/13/4 [7], the proposed modifications to the cover page of the draft MSC resolution were supported in general, also in line with the decisions taken under agenda item 3 (see paragraphs [...] to [...]).

In connection with document MSC 106/13/5 [8], the delegation of China advised that, following consultations with IHO after the submission of the document, China had agreed on the implementation dates set out in the draft MSC resolution noting that IHO would continue to monitor the implementation and provide regular updates to the NCSR Sub-Committee.

Subsequently, the observer from IHO advised that the implementation dates proposed in the draft MSC resolution had been carefully considered with relevant stakeholders and were part of an implementation roadmap agreed by IHO members.

The majority of the delegations that took the floor supported the draft MSC resolution and the proposed implementation dates to give effect to the new IHO product specifications. view was expressed, however, that human element aspects had not been appropriately considered and that an adequate transition period should be further assessed.

Following consideration, the Committee agreed to the modifications proposed in document MSC 106/13/4 (IACS) [7] and adopted resolution MSC.530(106) [23] on Performance Standards for Electronic Chart Display and Information Systems (ECDIS), as set out in annex [9],[10]. In doing so, the Committee invited IHO to keep IMO informed on the process development of the IHO S-100 framework standard [3].

The IMO Maritime Safety Committee at its 106 session in November 2022 approved also MSC.1/Circ.1503/Rev.2 on ECDIS – Guidance for good practice.

4 REVISED PERFORMANCE STANDARDS FOR ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEMS (ECDIS)

4.1 Scope of ECDIS

The primary function of ECDIS is to contribute to safe navigation. ECDIS with adequate backup arrangements may be accepted as complying with the up-to-date charts and nautical publications required by regulations V/19 and V/27 of the 1974 SOLAS Convention [24]. For the purpose of this document [23], the definition of electronic navigational data service (ENDS) encompasses the nautical charts and nautical publications as defined in SOLAS chapter V [24] and IHO standards in force [2].

ECDIS should be capable of displaying all nautical information necessary for safe and efficient navigation, originated and distributed by or on the authority of a government authorized hydrographic office or other relevant government institution, as required by SOLAS regulations V/19 and V/27 [24]. ECDIS should facilitate simple and reliable updating of the ENDS (Electronic Navigational Data Service). ECDIS should reduce the navigational workload compared to using the paper chart and paper nautical publications. It should enable the mariner to execute in a convenient and timely manner all route planning, route monitoring and positioning. It should be capable of continuously indicating, monitoring and recording the ship's position.

The ECDIS display may also be used for the display of radar, radar tracked target information, AIS and other appropriate data layers to assist in route monitoring.

Recommendation that "ECDIS should have at least the same reliability and availability of presentation as the paper chart published by government authorized hydrographic offices" has been withdrawn. Term "alarms" have been substituted by "alerts" and new recommendation that "ECDIS should meet the requirements of the Performance standards for bridge alert management (resolution MSC.302(87)) [22]" has been added.

4.2 Definitions

For the purpose of revised performance standards [23] definitions of most important terms related to ECDIS were revised and verified (see Table 2).

4.3 Module A – Database

The text of the performance standards [23] has been verified and modified in many places. For example, the following changes have been made to the module A, titled database (see Table 3), not all of them with a cosmetic nature only.

Table 2. Definitions of most important terms related to ECDIS

IMO Performance Standards for ECDIS	
IMO Resolution MSC.232(82), 2006 [21]	IMO resolution MSC.530(106), 2022 [23]
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 SOLAS regulations V/19 and V/27, by displaying selected information from a system electronic navigational chart (SENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and if required display additional navigation-related information.	Electronic Chart Display and Information System (ECDIS) means a navigation information system which with adequate backup arrangements can be accepted as complying with the up-to-date nautical chart and nautical publications required by SOLAS regulations V/19 and V/27, by displaying selected information from a system database with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and if required display additional navigation-related information.
Electronic Navigational Chart (ENC) means the database, standardized as to content, structure and format, issued for use with ECDIS by or on the authority of a Government, authorized Hydrographic Office or other relevant government institution, and conform to IHO standards. The ENC contains all the chart information necessary for safe navigation and may contain supplementary information in addition to that contained in the paper chart (e.g. sailing directions) which may be considered necessary for safe navigation.	Electronic navigational chart (ENC) means the database, standardized as to content, structure and format, issued for use with ECDIS by or on the authority of a Government, authorized hydrographic office or other relevant government institution, and conforming to IHO standards. The ENC contains all the nautical chart information necessary for safe navigation.
System Electronic Navigational Chart (SENC) means a database, in the manufacturer's internal ECDIS format, resulting from the lossless transformation of the ENC contents and its updates. It is this database that is accessed by ECDIS for the display generation and other navigational functions, and is equivalent to up-to-date paper chart. The SENC may also contain information added by the mariner and information from other sources.	Electronic navigational data service (ENDS) means a special-purpose database compiled from nautical chart and nautical publication data, standardized as to content, structure and format, issued for use with ECDIS by or on the authority of a Government, authorized hydrographic office or other relevant government institution, and conforming to IHO standards; and, which is designed to meet the requirement of marine navigation and the nautical charts and nautical publications carriage requirements in SOLAS regulations V/19 and V/27. The navigational base layer of ENDS is the electronic navigational chart (ENC). System database means a database, in the manufacturer's internal ECDIS format, resulting from the lossless transformation of the ENDS contents and its updates. It is this database that is accessed by ECDIS for the display generation and other navigational functions, and is equivalent to up-to-date ENDS.

Table 3. Module A – Database [23]

IMO Performance Standards for ECDIS	
IMO Resolution MSC.232(82), 2006 [21]	IMO Resolution MSC.530(106), 2022 [23]
4. PROVISION AND UPDATING OF CHART INFORMATION	4. PROVISION AND UPDATING OF ENDS
4.1 The chart information to be used in ECDIS should be the latest edition, as corrected by official updates, of that issued by or on the authority of a Government, government-authorized Hydrographic Office or other relevant government institution, and conform to IHO standards	4.1 The ENDS information to be used in ECDIS should be issued by or on the authority of a government, government-authorized hydrographic office or other relevant government institution, and conform to IHO standards as listed in appendix.
4.2 The contents of the SENC should be adequate and	4.2 The contents of the system database should be adequate and

up-to-date for the intended voyage to comply with regulation V/27 of the 1974 SOLAS Convention as amended

up to date for the intended voyage to comply with SOLAS regulations V/19 and V/27.

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

4.3 It should not be possible to alter the contents of the ENDS or system database information transformed from the ENDS. The display of the content of ENDS should be compliant with IHO standards including rules set for interoperability.

4.4 Updates should be stored separately from the ENC.

has been withdrawn

4.5 ECDIS should be capable of accepting official updates to the ENC data provided in conformity with IHO standards. These updates should be automatically applied to the SENC. By whatever means updates are received, the implementation procedure should not interfere with the display in use.

4.4 ECDIS should be capable of accepting official updates to the ENDS provided in conformity with IHO standards. These updates should be automatically applied to the system database. By whatever means updates are received, the implementation procedure should not interfere with the display in use.

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

4.5 ECDIS should also be capable of accepting updates to the ENDS data entered manually with simple means for verification prior to the final acceptance of the data. They should be distinguishable on the display from ENDS information and its official updates and not affect display legibility.

4.7 ECDIS should keep and display on demand a record of updates including time of application to the SENC. This record should include updates for each ENC until it is superseded by a new edition.

4.6 ECDIS should keep and display on demand a record of updates including time of application to the system database. This record should include updates for each ENDS until it is superseded by a new edition.

4.8 ECDIS should allow the mariner to display updates in order to review their contents and to ascertain that they have been included in the SENC.

4.7 ECDIS should allow the mariner to display updates in order to review their contents and to ascertain that they have been included in the system database.

4.9 ECDIS should be capable of accepting both non-encrypted ENCs and ENCs encrypted in accordance with the IHO Data Protection Scheme

4.8 ECDIS should be capable of accepting ENDS in accordance with the IHO Data Protection Scheme

Table 4. ECDIS Alarms [23]

IMO Performance Standards for ECDIS

IMO Resolution MSC.232(82), 2006 [21]

IMO Resolution MSC.530(106), 2022 [23]

IMO Resolution MSC.232(82), 2006 [21]	IMO Resolution MSC.530(106), 2022 [23]
Alarm Crossing safety contour	Alarm Pass closer than set distance from the safety contour
Alarm or Indication Area with special conditions	Warning or Caution, or Indication Pass closer than set distance from an area with special conditions
Alarm Deviation from route	Alarm Deviation from route
Alarm Positioning system failure	Warning or Caution, or Indication Pass closer than set distance from a danger in route monitoring mode
Alarm Approach to critical point	Warning Positioning system failure
Alarm Different geodetic datum	Warning Approach to critical point
Alarm or Indication Malfunction of ECDIS	Warning or Indication Different geodetic datum
Indication Default safety contour	Indication Malfunction of ECDIS
Indication Information overscale	Indication Default safety contour
Indication Larger scale ENC available	Indication Information overscale
	Indication Larger scale ENC available
	Indication Information not displayed due to scale minimum
Indication Different reference system	Indication Different reference system
Indication No ENC available	Indication No ENC available
Indication Customized display	Indication Customized display
Indication Route planning across safety contour	Indication Route planning closer than set distance from the safety contour
Indication Route planning across specified area	Indication Route planning closer than set distance specified area
Indication Crossing a danger in route	Indication Monitored route pass closer than set distance from the safety contour
monitoring mode	Indication Monitored route pass closer than set distance from a specified area or danger
Indication System test failure	Indication System test failure

4.4 Alarms

In this performance standards [23] the definitions of Indicators and Alerts provided in resolution A.1021(26) Code on Alerts and Indicators, 2009 and resolution MSC.302(87) Performance standards for Bridge alert management [22] apply (see table 4).

Definition of alert has been added: Alert: Audible and/or visual announcement of a condition requiring attention. Priorities of alert are alarm, warning and caution.

Definition of alarm has been withdrawn: "Alarm: An alarm or alarm system which announces by audible means, or audible and visual means, a condition requiring attention".

Definition of Indication remains the same like before: "Indication: Visual indication giving information about the condition of a system or equipment".

5 CONCLUSIONS

The document presented in this article IMO Resolution MSC.530(106) [21], developed by the International Maritime Organization, seems much more to increase the safety and credibility of the operational use of ECDIS for today than its previous version.

Unfortunately, to this question: So what are the IMO performance standards currently used in ECDIS? there is no simple answer today. ECDIS units on board are required to comply with one of three performance standards (either IMO resolution A. 817(19) [20], as amended [21],[22]; or resolution MSC. 232(82)) [23], or resolution MSC.530(106) [24], depending on the date of their installation.

In this article, only the most important changes introduced to the text of the Performance Standards for ECDIS have been discussed in detail. Some were treated only briefly. Undoubtedly, the navigator must get acquainted with all changes and modifications. Fortunately, the legislator left some time to read the details and implement them into practice. Nevertheless, the difficulty is the fact that three versions of standards are currently in use.

All opportunities should now be used to promote the existence of the new version of Performance Standards for ECDIS and encourage stockholders involved in maritime activities to implement the content of the revised standards.

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