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Delegations will find attached document SWD(2021) 156 final.

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COMMISSION STAFF WORKING DOCUMENT

Union submission to the 104th session of the International Maritime Organization's Maritime Safety Committee proposing a new output to amend the Revised ECDIS Performance Standards to facilitate a standardised digital exchange of vessels' route plans

Union submission to the 104th session of the International Maritime Organization's Maritime Safety Committee proposing a new output to amend the revised ECDIS Performance Standards to facilitate a standardised digital exchange of vessels' route plans

PURPOSE

This Staff Working Document contains a draft Union submission to the International Maritime Organization's (IMO) 104th session of the Maritime Safety Committee (MSC 104). The IMO has indicatively scheduled MSC 104 from 4 to 8 October 2021.

The draft submission proposes a new output for the Maritime Safety Committee's work programme to amend the Revised ECDIS Performance Standards. The output's aim would be to facilitate a standardised digital exchange of vessels' route plans.

Several e-navigation projects have studied exchange of route plans. Its positive effects, namely increased safety, reduced administrative burden and more efficient operations, combined with reduced environmental impact, have been validated.

An international standard format for route plan exchange has been developed and it is considered an appropriate next phase to also adapt the regulatory aspects to facilitate standardised exchange of route plans.

A delay to implement e-navigation may have a negative effect on safety and security. The submission therefore proposes to swiftly set up a digital exchange of route plan at forthcoming meetings of the Sub-Committee on Navigation, Communications and Search and Rescue (NCSR).

EU COMPETENCE

ECDIS equipment may only be placed on ships under an EU Member State's flag if it complies with the design, construction and performance requirements, and testing standards for marine equipment in entry MED/4.30 of Commission Implementing Regulation 2020/1170.[1]

This Implementing Regulation is based on the empowerment of the Commission to indicate, by means of implementing acts, the design, construction and performance requirements and testing standards for marine equipment falling within the scope of application of Directive 2014/90/EU on marine equipment[2]. Any change to resolution MSC.232(82), explicitly listed in entry MED/4.30 of the Implementing Regulation, will thus affect the content of Union rules contained in Directive 2014/90/EU on marine equipment, or alter their scope.

In light of all of the above, the present draft Union submission falls under EU exclusive competence.[3] This Staff Working Document is presented to establish an EU position on the matter and to transmit the document to the IMO prior to the required deadline of 2 July 2021.[4]

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[1] OJ L 264, 12.8.2020, p. 1–269

[2] OJ L 257, 28.8.2014, p. 146–185

[3] An EU position under Article 218(9) TFEU is to be established in due time should the IMO Maritime Safety Committee eventually be called upon to adopt an act having legal effects as regards the subject matter of the said draft Union submission. The concept of '*acts having legal effects*' includes acts that have legal effects by virtue of the rules of international law governing the body in question. It also includes instruments that do not have a binding effect under international law, but that are '*capable of decisively influencing the content of the legislation adopted by the EU legislature*' (Case C-399/12 Germany v Council (OIV), ECLI:EU:C:2014:2258, paragraphs 61-64).

[4] The submission of proposals or information papers to the IMO, on issues falling under external exclusive EU competence, are acts of external representation. Such submissions are to be made by an EU actor who can represent the Union externally under the Treaty, which for non-CFSP (Common Foreign and Security Policy) issues is the Commission or the EU Delegation in accordance with Article 17(1) TEU and Article 221 TFEU. IMO internal rules make such an arrangement absolutely possible as regards existing agenda and work programme items. This way of proceeding is in line with the General

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WORK PROGRAMME

Proposal for a new output to amend the Revised ECDIS Performance Standards (resolution MSC.232(82)) to facilitate a standardised digital exchange of vessels' route plans

Submitted by the European Commission on behalf of the European Union

SUMMARY

Executive summary:	This document proposes establishment of a new output for the Committee's work programme to amend *The Revised ECDIS Performance Standards* (resolution MSC.232(82)) to facilitate a standardised digital exchange of vessels' route plans. Several e-navigation projects have studied exchange of route plans. Its positive effects, namely increased safety, reduced administrative burden and more efficient operations, combined with reduced environmental impact, have been validated. An international standard format for route plan exchange has been developed and it is considered an appropriate next phase to also adapt the regulatory aspects to facilitate standardised exchange of route plans. As an alternative, the Committee may decide to include the work under the existing post-biennial output 164 "Revision of ECDIS Guidance for good practice (MSC.1/Circ.1503/Rev.1) and amendments to ECDIS performance standards (resolution MSC.232(82))", which would then have to be included in the biennial agenda of the Sub-Committee for 2022-2023 and in the provisional agenda for NCSR 9, as proposed by NCSR 8.
Strategic direction, if applicable:	2, and 6
Output:	post-biennial output 164
Action to be taken:	12.1 and 12.2
Related documents:	MSC.1/Circ.1593, MSC.1/Circ.1595, MSC.1/Circ.1610, MSC 102/24, NAV 59/INF. 8, NCSR 1/INF. 18, NCSR 7/22/5, NCSR 8/13, NCSR 8/13/1, HGDM 2/5, HGDM 2/10, MSC-

Arrangements for EU statements in multilateral organisations endorsed by COREPER on 24 October 2011.

1 Introduction

1.1 This document is submitted in accordance with MSC-MEPC.1/Circ.5/Rev.2 on Organization and method of work of the Maritime Safety Committee and the Marine Environment Protection Committee and their subsidiary bodies, taking into account resolution A.1111(30) on the Application of the Strategic Plan of the Organization.

1.2 This document proposes establishment of a new output for the Committee's work programme to amend *The Revised ECDIS Performance Standards* (resolution MSC.232(82)) to facilitate a standardised digital exchange of vessels' route plans. (MSC.1/Circ.1595, Annex, Table 6 and MSC.1/Circ.1610, Annex, Pages 1 and 4 refer). An initial draft amendment proposal is presented in annex 1 in order to facilitate an understanding of the scope and intended amendments.

1.3 As an alternative, the Committee may decide to include the work under the existing post-biennial output 164 "Revision of ECDIS Guidance for good practice (MSC.1/Circ.1503/Rev.1) and amendments to ECDIS performance standards (resolution MSC.232(82))", which would then have to be included in the biennial agenda of the Sub-Committee for 2022-2023 and in the provisional agenda for NCSR 9, as proposed by NCSR 8. If the Committee decides on this option, it may also consider if the output should also make reference to strategic direction 2 – Integrate new and advancing technologies in the regulatory framework.

1.4 The proposal relies on international standards, e.g. within IHO (International Hydrographic Organization) and IEC (International Electrotechnical Commission) domains, for technical details regarding how the exchange of route plans should be implemented.

1.5 The proposed digital exchange of route plans is envisaged to be used ship-shore and shore-ship in the voyage planning and execution phase. The proposal does not include ship-ship exchange of route plans.

1.6 The proposed amendment to *Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS)* would only apply to new installations.

2 Background

2.1 Maritime Transport is a global business that to a great extent relies on an international framework of regulations and technical standards. It's only through global cooperation, commitment, standards and joint coordinated action that global shipping can be taken into a more organized form of integrated transport system with the help of digitalization and information sharing. In that process, maritime transport can also be made more energy efficient, cost effective and at the same time avoid accidents including the negative impact on the marine environment and save lives.

2.2 As part of the outcomes from the EU-funded MONALISA (2010-2013) and MONALISA 2.0 (2013-2015) projects an industry standard for a route plan exchange format was developed. The route plan exchange format (RTZ) was standardised by IEC and included in the IEC 61174 ed.4 standard (*Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results*). This provided a standardised data format that could be used for exchange of route plans (route information, route geometry and route schedule)

between different systems onboard as well as for exchange of information between different manufacturers´ in ship-shore and shore-ship communication e.g. between ship and VTS, route optimisation service providers etc. The RTZ format has since been updated by CIRM (Comité International Radio-Maritime) and made available in an IEC Publicly Available Specification (PAS), IEC PAS 61174-1:2021.

2.3 The outcomes of these projects have been reported to NCSR 1 in document NCSR 1/INF.18 on "Development of an e-navigation strategy implementation plan; Results and recommendations from the MONALISA and MONALISA 2.0 projects", submitted by Italy and Sweden.

2.4 The route exchange format is currently being updated by IEC to become S-100 compliant. The IHO S-100 Standard is a Univeral Hydrographic Data Model that is intended for the development of digital products and services for hydrographic, maritime and GIS communities[5]. The new standard, IEC 63173-1 *Maritime navigation and radiocommunication equipment and systems - Data Interface - Part 1: S-421 Route Plan Based on S-100*, is expected to be approved and published in the end of 2021 as have been reported to NCSR 8 in document NCSR 8/13 on "Progress on standards development by IEC", submitted by IEC. The S-421 format will secure compliance and interoperability with the expected future S-100 products.

2.5 The EU-funded STM Validation Project (2015-2019) took the standard data format (RTZ) as a starting point but to reach the full potential of a standardised exchange of route plans it was necessary to specify not only what format (i.e. RTZ/S-421) the data should have but also how the exchange should be done. This is crucial in order to achieve interoperability in machine-to-machine communication which allows users to connect seamlessly even on their first encounter which is necessary in the shipping domain since shipping is often a series of first-occasion encounters, e.g. a ship visiting new terminals and ports. Accordingly a generic information service/Application Programming Interface (API), based on IALA's Service Guideline G1128[6] for maritime services, was developed and provided an interface for how to exchange route plans. The interface was implemented in the project testbed with approximately 400 ships and a dozen shore centers.

2.6 After refinement and validation of the interface in the project, IEC initiated the work on a new standard IEC 63173-2, Secure communication between ship and shore (SECOM) that describes how the exchange of, e.g. route plans should be done. The standard, expected to be released towards the end of 2022, will enable wider technical interoperability where the same service interface can be used for exchanging information regardless of operational use. This can thus support the *E-navigation Strategy Implementation Plan – Update 1* (MSC.1/Circ.1595) of the IMO and the delivery of Maritime Services in the context of e-Navigation, as means of providing electronic information in a harmonised way. SECOM is also recommended in IALA G1157[7], Web service based S-100 data exchange, for the technical realization of Maritime Services. SECOM is referenced as an explicit implementation of a S-100 Web Service API and as a means to harmonize and make distribution services interoperable.

2.7 As described in the above sections, the object has been on creating the technical ability for digital exchange of route plans and validate the effects. It is considered an appropriate next phase to also adapt the regulatory aspects to allow and facilitate standardised exchange of route plans. Standardised in this context is to be understood as electronic exchange, machine-to-machine, including cyber security measures to prevent unauthorised access.

[5] https://iho.int/en/s-100-universal-hydrographic-data-model
[6] https://www.iala-aism.org/product/g1128-specification-e-navigation-technical-services/
[7] https://www.iala-aism.org/product/g1157-web-service-based-s-100-data-exchange/

2.8 It is regognized that the IHO has proposed to NCSR 7, *Report on monitoring of ECDIS issues by IHO* (NCSR 7/22/5), and NCSR 8, *Report on monitoring of ECDIS issues by IHO* (NCSR 8/13/1), to amend *The Revised ECDIS Performance Standards* (resolution MSC.232(82)) as a consequence of the introduction of the next generation of S-101 Electronic navigational charts (ENC) and S-100 as such. As an outcome of NCSR 8 IHO was invited to prepare draft amendments for both MSC.232(82) and MSC.1/Circ.1503/Rev.1 and submit a draft proposal to NCSR 9. The proposal to facilitate route plan exchange should be coordinated with the ongoing IHO initiative.

2.9 Furthermore, it is also recognized that MSC 102 decided to agree with the recommendations of the Sub-Committee regarding consolidation and renaming of outputs, as well as the expansion and renaming of output No.164 – to include work on draft amendments for to MSC.232(82). (MSC 102/24, paragraph 21.14).

3 IMO's objectives

3.1 This proposal relates to digital exchange of route plans which contributes to Strategic direction 2 ("Integrate new and advancing technologies in the regulatory framework") and is clearly within the scope of IMO's objectives.

3.2 Furthermore, this proposal is also understood to be consistent with IMO's Strategic Direction 6 (SD 6: Ensure regulatory effectiveness), which aims to "ensure that a universally adopted, effective, international regulatory framework is in place and implemented consistently, embracing and integrating new and advancing technologies, without causing unnecessary burdens."

4 Need

4.1 Various statistics and well-known accidents, available in the IMO GISIS database, Marine Casualties and Incidents, gives that navigational related accidents occur at regular basis.

4.2 According to a Formal Safety Assessment (FSA)[8] exchange of route plans can reduce the risk for navigational accidents. The FSA is in accordance with the format provided by the *Revised Guidelines for Formal Safety Assessment (FSA) for use in the IMO rule-making process* (MSC-MEPC.2/Circ.12/Rev.1) and performed by an independent consultant team in order to provide un-biased and fully transparent results and recommendations.

4.3 The FSA concluded exchange of route plans are principally considered to have a preventive influence on accidents caused by human factor related failures but are not expected to reduce navigational accidents caused by technical failures or external factors. The preventive effects of exchange of route plans are anticipated to reduce navigational accidents in open, coastal waters, archipelagos, and port approaches whilst accidents in ports and inland waterways are less affected.

4.4 Further need and supporting evidence are presented in section 6, Analysis of implications and section 7, Benefits.

5 Analysis of the issue

[8] https://s3-eu-west-1.amazonaws.com/stm-stmvalidation/uploads/20160502131247/ML2-D2-FSA-Formal-Safety-Assessment.pdf

5.1 The existence of supporting international technical standards and the foreseen limited necessary changes to include digital exchange of route plans in the resolution MSC.232(82) *The Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS)*, henceforth referred to as "ECDIS Performance Standards", supports its practicability and feasibility.

5.2 Given the validated benefits with exchange of route plans and the various potential areas of use as part of the Maritime Services (MSC.1/Circ.1595, Annex, Table 6 and MSC.1/Circ.1610, Annex, Pages 1 and 4 refer) supports the proportionality of amending the ECDIS Performance Standards.

6 Analysis of implications

6.1 The proposal for a new output to amend the ECDIS Performance Standards aims to regulate the technical ability for digital exchange of route plans while the actual usage of the functionality is voluntary. It is the actual usage of the functionality rather than the technical ability that drives running costs, e.g. communication costs and user fees, while enhancing current performance standards would result in minimal additional costs to the maritime industry.

6.2 The ECDIS Performance Standards amendment proposal would only apply to new installations. As a result, both benefits and implications arising from the proposal will be sequenced over a number of years. However, a voluntary industry driven retrofit could speed up the adoption process. Further, voluntary retrofit would also benefit from the stability provided by the ECDIS Performance Standards referencing IEC standards as a stability assurance that the investment of shore actors and shipowners will not be lost.

6.3 IEC standards are often supported by maritime system providers even if they are not mandatory to implement. As an example IEC 61174 ed.4 standard (*Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results*) does not mandate route exchange capability. However *if* routes are to be exchanged between different proprietary devices on a bridge of a ship, e.g. radar and autopilot, the route exchange format (RTZ) is required.

6.4 For manufacturers that already plan to support IEC standards, referenced by the ECDIS Performance Standards, the envisaged proposed amendment would not add any additional need for development. However, if some ECDIS manufacturers would not implement IEC standards on a voluntary basis, the amendment proposal would imply development work to support the new functionality. This development effort is decided by the status and architecture of current systems and therefore it is difficult to provide any generic figures but the development effort is expected to be low based on testbed experiences within the STM Validation Project. Eventually these limited costs for the ECDIS manufacturers development work would be transferred to the end-customers, i.e. shipowners, but distributed per installed ECDIS they would be minimal.

6.5 Results of studies and testbed validations

The effects of standardised digital exchange of route plans have been studied in several e-navigation projects. Costs have been calculated by Cost Benefit Analysis (CBA) and validated in testbeds for e-Navigation, where standardised digital exchange of route plans has been the main enabler for achieving the described benefits amongst the included actors e.g. for ship and port to share mental model for better planning conditions and Just In Time Arrivals (JIT). Thus the outcome of projects and studies are of relevance for the proposed amendment of the ECDIS performance standards.

6.6 The CBA of the effects of implementing route plan exchange related maritime services in the Northern parts of the EU[9], performed by researchers at Linköping University, Sweden, concentrated on analyzing the possible gains for society as a whole. Although the studied area focused on Northern Europe the result was extrapolated to encompass all European waters. The study was divided into three main areas; route optimization supported by better information sharing, adjusted arrival times (Just-In-Time Arrivals) resulting from better ship-shore communication and savings in ports from having a system support for real-time sharing of each actors readiness to perform services to enable higher resource utilization and shorter turn-around times.

6.7 The results from this CBA give that the break-even reduction in distance for making route optimization profitable is as little as 0.2% when the effect on lower emissions is included. The CBA study expected this threshold to be exceeded by making route optimization services more effective by standardizing how the information should be exchanged between ships and route optimization providers.

6.8 For the adjusted arrival times, ships lying at anchor outside ports waiting for service in the port were included. Ships awaiting orders, waiting for bunkering etc. were excluded from the calculations. The selected main alternative for bunker savings assumed a ship could make a 25% reduction of speed on the last 4 or 12 hours before original ETA.

6.9 The port section of the CBA indicated potential benefits but better knowledge remained to be developed regarding the potential in larger and smaller ports and thus the effect of the lower figure was set to 0 i.e. no positive effects were included in the CBA.

6.10 In addition, effects of increased safety are also included in the CBA. The value of increased safety is based on the output of the Formal Safety Assessment (FSA)[10]

6.11 The cost calculations included investments for ships, investment for training, communication costs, governance costs, port costs and costs for shore based service and control centers. Not to underestimate costs all assumptions made were conservative. In conclusion, the results of the CBA give that the net benefits are positive.

6.12 In the STM Validation Project[11] an additional CBA was carried out. This CBA followed the methodology included in the Guide to Cost Benefit Analysis of Investments Projects[12] elaborated in December 2014 by the European Commission's Directorate-General for Regional and Urban Policy (DG REGIO). The guide includes the following steps: description of the context, definition of objectives, identification of the project, technical feasibility and environmental sustainability, financial analysis, economic analysis and risk assessment.

6.13 The STM Validation Project CBA was performed in order to evaluate the net benefits that maritime services related to route plan exchange could produce, if implemented, in terms of economic welfare. The purpose was to determine net positive

[9] https://s3-eu-west-1.amazonaws.com/stm-stmvalidation/uploads/20160420144655/ML2-D2-CBA-Cost-Benefit-Analysis.pdf
[10] https://s3-eu-west-1.amazonaws.com/stm-stmvalidation/uploads/20160502131247/ML2-D2-FSA-Formal-Safety-Assessment.pdf
[11] https://s3-eu-west-1.amazonaws.com/stm-stmvalidation/uploads/20190715120828/STM_ID_5.3.6_STM-VALIDATION-COST-BENEFIT-ANALYSIS.pdf
[12] https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf

effects from a European Union perspective as the project was co-funded by the Trans-European Transport Network through its Connecting Europe Facility Programme (CEF).

6.14 The data comes from the approximately 400 ships that took part in the testbed and their related port calls on the eight ports included in the STM Validation Project. The testbed data, even from a conservative point of view, offer positive results for society in terms of reduction of GHG emissions as well as the reduction of accidents at sea which has an important impact on the reduction of environmental costs due to accidents.

6.15 The main results obtained in the CBA are the reduction of operating costs and the potential reduction of the negative externalities (GHG emissions) because of optimized routes and port call synchronization. The socio-economic analysis shows that the included services are generating a positive welfare change. Further the obtained results show that the related maritime services are desirable from a socio-economic perspective meaning that the society would benefit if they were to be implemented. This is backed up and demonstrated by the economic analysis results and by achieving a positive Economic Net Present Value (ENPV).

6.16 Legislative burden

Any associated legislative and/or administrative burden, such as making amendments to national legislation to include new/revised Performance Standard for ECDIS, have been assessed to be minimal.

6.17 Training needs

No revision of the IMO ECDIS model course 1.27 on Generic ECDIS Training is considered necessary. However, a limited training need is to be anticipated and ECDIS familiarisation would need to include the new functionality of standardised digital exchange of route plans. The estimated time needed for familiarisation and training for ship´s officers is in the order of one (1) hour. No separate courses or training is anticipated.

6.18 The completed checklist for identifying administrative requirements (MSC-MEPC.1/Circ.5/Rev.2) is set out in annex 2.

7 Benefits

7.1 As part of the improved provision of services to ships through e-navigation, maritime services have been identified as the means of providing electronic information in a harmonised way. The exchange of route plans could act as support and an integrated part of several of the Maritime Services (MSC.1/Circ.1595, Annex, Table 6 and MSC.1/Circ.1610, Annex, Pages 1 and 4 refer), namely VTS Information Service (INS), VTS Navigational Assistance Service (NAS), Traffic Organization Service (TOS), Port Support Service (PSS) Maritime Safety Information Service (MSI), Pilotage Service, Tug Service, Vessel Shore Reporting, Ice Navigation Service, Meteorological Information Service and Search and Rescue Service (SAR).

7.2 Currently, there are 16 IMO adopted Mandatory Ship Reporting Systems (MRS) and more than 100 VTS areas in European waters where ships are required to report data, according to resolution A.851(20) on *General principles for ship reporting systems and ship reporting requirements, including guidelines for reporting incidents involving dangerous goods, harmful substances and/or marine pollutants*, to shore-based authorities. Most of the information is reported via voice communication and recorded by the coastal stations' operators in their respective databases. The route plan (sailing plan) of a ship must be reported to a coastal station in some of the MRS/VTS areas e.g BELTREP and SOUNDREP. Digitally exchanged route plans shall be reused

to minimise the reporting burden. This is being tested under the “Facilitation of ship to shore reporting” pilot project which is executed under the “Interoperability Project” of the Euroepan Martiem Safety Agency (EMSA). At an initial phase the route plan will be made available to coastal stations participating in the pilot project and at a later stage this data would be included in the Integrated Ship Report (ISR) which will be provided to Member States Authorities by the new Integrate Report Distribution system developed for the pilot project.

7.3 During discussions on Maritime Autonomous Surface Ships (MASS) it has been identified that it is crucial for other ships to know the intentions of MASS ships. Although not in focus in this proposal sharing of route plans between ships could be one of the solutions to share intentions.

7.4 The benefits, related to the Maritime Services in the context of e-Navigation, in terms of safety, environmental improvements and efficiency have, as mentioned briefly above, been studied and validated in large-scale testbeds[13] with approximately 400 ships and a dozen shore center systems from several different manufacturers´. The benefits with implementation in real systems used in everyday operations is evident as it pushes the solutions developed to be as mature as possible, facilitates future implementation and safeguards that the chosen technical solutions are not proprietary, as they have to be accepted and approved by others.

7.5 Examples of operational services that have been digitalised and distributed by new means, where digital exchange of route plans have been an enabler include, route optimization (weather routing), pilot routes, ice routes, enhanced monitoring from shore, SAR search patterns, selected navigational warnings and Just In Time Arrivals.

7.6 The findings mainly come from end-user feedback collected within the STM Validation Project and indicate that sharing of route plans both ship-shore and shore-ship can enhance common situational awareness and improve port call processes. According to questionnaires and interviews with navigation officers and shore centre operators the exchange of route plans directly from ECDIS has been useful. For navigation officers the benefits of integrating information of higher quality (i.e. accuracy and timeliness) are similar for most services. For example, the route optimization services have been found useful to insert the optimised routes directly into an ECDIS without having to use stand-alone applications. This is also the case for winter navigation where ice-waypoints and ice routes are made available directly in the navigation system.

7.7 The operational benefits are related to easier route planning which generates reduced administrative burden, and human errors in form of misunderstandings. For example, an average of 75% of test-bed participants perceived navigational operational safety to be increased and 74% experienced that route plan exchange supported tools and services assisted their ordinary bridge duties[14]. At the same time, shore centers and VTS centers can improve the quality of services and information to ships.

7.8 Sharing route plans from ships to VTS clearly indicated a positive change in the work of the VTS that participated in the STM Validation Project. Given the possibility to review the intentions of the ships well in advance before entering the surveillance area of the VTS made it possible for the VTS to work more proactively. The fact that the same data, the route plan, is used on board and ashore creates a common situational awareness that can be used to make operations and monitoring more effective.

[13] https://s3-eu-west-1.amazonaws.com/stm-stmvalidation/uploads/20190709125520/STM-Validation-Final-report.pdf

[14] https://s3-eu-west-1.amazonaws.com/stm-stmvalidation/uploads/20200225090150/STMVal_D2.6-D2.10-D2.12-Voyage-management-testbed-report-1.pdf

7.9 The service with the biggest potential impact on efficiency in terms of reduced costs is port call synchronisation between ship and port, to achieve JIT. It has been demonstrated in testbeds by the possibility to provide updated arrival times in a digital two-way communication, which means that both the ship and port can inform each other about planned and preferred arrival times.

7.10 The arrival time of a ship is taken directly from the source in the route plan and presented in the planning system of the port. This has proven the ability to provide earlier information about ports earliest possible time to handle the ship. An efficient, digitalized and automated exchange of planned, requested and estimated arrival times is an enabler for the implementation of new standard contracts[15] for JIT recently established by BIMCO. The information can be used to reduce the speed of ships to eco-speed, thereby reducing costs for bunker consumption, and at the same time reduce emissions of greenhouse gases (GHG).

7.11 A bi-directional exchange of route plans would also be able to provide and suggest real time ETA information to a wide variety of other functions such as Maritime Single Window and time slot allocation in dense traffic areas. Given the variety of services that require not only ships´ geographical routes but also planned arrival times it is essential to share not only route plan geography but also route plan schedule (ETA at waypoints/arrival) information.

7.12 The underlying technology for the exchange of route plans could also facilitate and support transmission, receipt and response of information required for the arrival, stay and departure of ships, persons and cargo, including notifications and declarations for customs, immigration, port and security authorities, via electronic data exchange, making the transition to full-fledged Maritime Single Windows.

7.13 The suggested amendments could also contribute to other IMO initiatives such as the Global Industry Alliance (GIA), the Just In Time Arrival (JIT) Guide and the GreenVoyage-2050 Project as it would complement to a certain extent the project activities by encouraging JIT steaming and consequently less GHG emissions.

8 Industry standards

8.1 The suggested amendments of the Revised ECDIS Performance Standards rely on international standards, e.g. within IHO (International Hydrographic Organization) and IEC (International Electrotechnical Commission) domains, for technical details regarding how the exchange of route plans should be implemented.

8.2 A route plan exchange format (RTZ) is standardised by IEC and included in the IEC 61174 ed.4 standard (*Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results*). The RTZ format is also updated by CIRM (Comité International Radio-Maritime) and made available in an IEC Publicly Available Specification (PAS), IEC PAS 61174-1:2021. The two versions of RTZ have preserved compatibility and provides standardised data formats that could be used for exchange of route plans.

8.3 The route plan exchange format is currently being updated by IEC to become S-100 compliant and has been assigned as the S-421 Route plan. The new standard, IEC 63173-1 Maritime navigation and radio communication equipment and systems - Data Interface - Part 1: S-421 Route Plan Based on S-100, is expected to be released by end of 2021.

[15] https://www.bimco.org/contracts-and-clauses/bimco-clauses/current/just-in-time-arrival-clause-for-voyage-charter-parties-2021

8.4 To reach the full potential of a standardized exchange of route plans it is necessary to specify not only what format (i.e. RTZ/S-421) the data should have but also how the exchange should be done with which cyber security measures. This is crucial in order to achieve information security and interoperability in machine-to-machine communication. This is within scope of a new standard being elaborated within IEC. IEC 63173-2, Secure communication between ship and shore (SECOM). In addition, the new standard, expected to be released towards the end of 2022, will enable wider technical interoperability where the same service interface can be used for exchanging information regardless of operational use. This can thus support the E-navigation *Strategy Implmentation Plan – Update 1* (MSC.1/Circ.1595) of IMO and Maritime Services in the context of e-Navigation, as means of providing electronic information in a harmonised way.

9 Output

9.1 The proposed output is to amendment resolution MSC.232(82) *The Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS)* to facilitate a standardised digital exchange of vessels' route plans.

1. Specific: Amend resolution MSC 232(82) - Revised performance standards *for Electronic Chart Display and Information Systems (ECDIS)* to facilitate a standardised digital exchange of vessels' route plans.
2. Measurable: Completed, approved and adopted standard.
3. Achievable: MSC's subsidiary bodies have the expertise required.
4. Realistic: Ample time is proposed to complete the work.
5. Time-Bound: The work should take place in 2022-2023 in order to be approved by the MSC in 2022-2023

9.2 The suggested amendments to include digital exchange of route plans in the Revised ECDIS Performance Standards are of limited number. Given the limited amendments, it is estimated that the work can be completed in one session. The proposal to facilitate Route Plan Exchange should also be coordiated with the ongoing IHO initiative to submit a draft amendment to NSCR9 on ECDIS Performance Standards due to the new ENC format S-101 and S-100, which was approved by NCSR 8 but awaits the subsequent approval by MSC 104.

9.3 As an alternative, the Committee may decide to include the work under the existing post-biennial output 164 "Revision of ECDIS Guidance for good practice (MSC.1/Circ.1503/Rev.1) and amendments to ECDIS performance standards (resolution MSC.232(82))", which would then have to be included in the biennial agenda of the Sub-Committee for 2022-2023 and in the provisional agenda for NCSR 9, as proposed by NCSR 8. If the Committee decides on this option, it may also consider if the output should also make reference to strategic direction 2 – Integrate new and advancing technologies in the regulatory framework.

10 Human element

10.1 Risks associated with the introduction and misuse of technology as a new aid to navigation, for example so called radar and ECDIS assisted collisions and groundings, are well known and must be taken into account. The envisaged digital exchange of route plans is meant to be used ship-shore and shore-ship where testbed results have validated reduced risks related to insufficient route planning and better possibilties for monitoring of ships reduces the overall navigational risks. The testbeds

on exchange of route plans that have preceded the envisaged amendment proposal have followed recommended Software Quality Assurance (SQA) and Human-Centred Design (HCD) principles to further minimise potential risks. These methods are described in IMO guideline on *Software Quality Assurance and Human-Centred Design for e-navigation* (MSC.1/Circ.1512).

10.2 It is also recognised that harmonisation of the user interface for navigation equipment and information used by seafarers to monitor, manage and perform navigational tasks will help to enhance common situational awareness and consequently enhance safe and effective navigation.

10.3 For some functions, related to exchange of route plans, the variations across different equipment of manufacturers of ECDIS should be minimal. The functions should be incorporated as detailed in SN.1/Circ.243/Rev.2 on *Guidelines for the presentation of navigational-related symbols, terms and abbreviations,* amendments to the *Recommendation on performance standards for the presentation of navigation-related information on shipborne navigational displays* (resolutions MSC.466(101) and MSC.191(79) as appropriate) and also MSC.1/Circ.1609 on *Guidelines for the standardization of user interface design for navigation equipment*.

10.4 Any associated legislative and/or administrative burden, such as making amendments to national legislation to include the envisaged amended/revised Performance Standards for ECDIS, have been assessed to be minimal.

10.5 The completed checklist for considering human element issued by IMO bodies (MSC-MEPC.7/Circ.1) is set out in annex 3.

11 Urgency

11.1 With direct relevance to the objective of enhancing technical, operational and safety standards, it is believed that this work is important to be undertaken in the near future.

11.2 The Organization clearly defined e-navigation is for safety and security at sea and protection of the marine environment. The European Union believes that the delay of the implementation of e-navigation may cause a negative effect for safety and security at sea and protection of the marine environment.

11.3 Considering that the technical standards for digital route exchange are being developed by the IEC and that the IHO has declared 2020-2030 the S-100 Implementation Decade IMO performance standards are needed to support its operation and to harmonize its implementation worldwide.

11.4 In respect to above reasons, although the European Union well understands the heavy workload of the NCSR Sub-Committee, it proposes to complete the work on possible amendments at NCSR 9 or 10 with a view to its approval by the subsequent MSC.

11.5 It is recommended that a new output is included in the work programme of the NCSR Sub-Committee for the upcoming biennium and the completion of the work in one session, or decide to include the work under the existing post-biennial output 164, which would then have to be included in the biennial agenda of the Sub-Committee for 2022-2023 and in the provisional agenda for NCSR 9, as proposed by NCSR 8.

12 Action required

12.1 The Committee is invited to consider the above proposal for a new output and agree to include the proposed new output to amend resolution MSC.232(82) *The Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS)* to facilitate a standardised digital exchange of vessels' route plans in the 2022-2023 biennium of the NCSR Sub-Committee, with a target completeion year of 2023, or;

12.2 As an alternative, the Committee may decide to include the work under the existing post-biennial output 164 "Revision of ECDIS Guidance for good practice (MSC.1/Circ.1503/Rev.1) and amendments to ECDIS performance standards (resolution MSC.232(82))", which would then have to be included in the biennial agenda of the Sub-Committee for 2022-2023 and in the provisional agenda for NCSR 9, as proposed by NCSR 8. If the Committee decides on this option, it may also consider if the output should also make reference to strategic direction 2 – Integrate new and advancing technologies in the regulatory framework.

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ANNEX 24

RESOLUTION MSC.232(82)

(adopted on 5 December 2006)

ADOPTION OF THE REVISED PERFORMANCE STANDARDS FOR ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEMS (ECDIS)

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO resolution A.886(21), by which the Assembly resolved that the function of adopting performance standards and technical specifications, as well as amendments thereto shall be performed by the Maritime Safety Committee and/or the Marine Environment Protection Committee, as appropriate, on behalf of the Organization,

RECALLING ALSO regulations V/19 and V/27 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, which requires all ships to carry adequate and up-to-date charts, sailing directions, lists of lights, notices to mariners, tide tables and all other nautical publications necessary for the intended voyage,

NOTING that the up-to-date charts required by SOLAS regulations V/19 and V/27 can be provided and displayed electronically on board ships by electronic chart display and information systems (ECDIS), and that the other nautical publications required by regulation V/27 may also be so provided and displayed,

RECOGNIZING the need to improve the previously adopted, by resolution A.817(19), as amended, performance standards for ECDIS in order to ensure the operational reliability of such equipment and taking into account the technological progress and experience gained,

HAVING CONSIDERED the recommendation made by the Sub-Committee on Safety of Navigation, at its fifty-second session,

1. ADOPTS the Revised performance standards for electronic chart display and information systems (ECDIS), set out in the Annex to the present resolution;

2. RECOMMENDS Governments ensure that ECDIS equipment:

~~(a)~~ TBD ~~if installed on or after 1 January 2009, conform to performance standards not inferior to those specified in the Annex to the present resolution; and~~

~~(b)~~ TBD ~~if installed on or after 1 January 1996 but before 1 January 2009, conform 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).~~

ANNEX

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

1 SCOPE OF ECDIS

1.1 The primary function of the ECDIS is to contribute to safe navigation.

1.2 ECDIS with adequate back-up arrangements may be accepted as complying with the up-to-date charts required by regulations V/19 and V/27 of the 1974 SOLAS Convention, as amended.

1.3 ECDIS should be capable of displaying all chart information necessary for safe and efficient navigation originated by, and distributed on the authority of, government authorized hydrographic offices.

1.4 ECDIS should facilitate simple and reliable updating of the electronic navigational chart.

1.5 ECDIS should reduce the navigational workload compared to using the paper chart. It should enable the mariner to execute in a convenient and timely manner all route planning, route monitoring and positioning currently performed on paper charts. It should be capable of continuously plotting the ship's position.

1.6 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.

1.7 ECDIS should have at least the same reliability and availability of presentation as the paper chart published by government authorized hydrographic offices.

1.8 ECDIS should provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment (see appendix 5).

1.9 When the relevant chart information is not available in the appropriate form (see section 4), some ECDIS equipment may operate in the Raster Chart Display System (RCDS) mode as defined in appendix 7. RCDS mode of operation should conform to performance standards not inferior to those set out in appendix 7.

2 APPLICATION OF THESE STANDARDS

2.1 These performance standards should apply to all ECDIS equipment carried on all ships, as follows:

- dedicated standalone workstation.
- a multifunction workstation as part of an INS.

2.2 These performance standards apply to ECDIS mode of operation, ECDIS in RCDS mode of operation as specified in appendix 7 and ECDIS backup arrangements as specified in appendix 6.

2.3 Requirements for structure and format of the chart data, encryption of chart data as well as the presentation of chart data are within the scope of relevant IHO standards, including those listed in appendix 1.

2.4 In addition to the general requirements set out in resolution A.694(17) , the presentation requirements set out in resolution MSC.191(79), ECDIS equipment should meet the requirements of these standards and follow the relevant guidelines on ergonomic principles adopted by the Organization[1].

3 DEFINITIONS

For the purpose of these performance standards:

3.1 *Electronic Chart Display and lnformation System (ECDlS)* means a navigation information system which with adequate back-up arrangements can be accepted as complying with the up-to-date chart required by regulations V/19 and V/27 of the 1974 SOLAS Convention, as amended, 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.

3.2 *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.

3.3 *System Electronic Navigational Chart (SENC)* means a database, in the manufacturer's internal ECDIS format, resulting from the lossless transformation of the entire 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 an up-to-date paper chart. The SENC may also contain information added by the mariner and information from other sources.

3.4 *Standard Display* is the display mode intended to be used as a minimum during route planning and route monitoring. The chart content is listed in appendix 2.

3.5 *Display Base* means the chart content as listed in appendix 2 and which cannot be removed from the display. It is not intended to be sufficient for safe navigation.

3.6 Further information on ECDIS definitions may be found in IHO Hydrographic Dictionary Special Publication S-32 (see appendix 1).

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* Refer to Publication IEC 60945.

1 MSC/Circ.982.

MODULE A - DATABASE

4 PROVISION AND UPDATING OF CHART INFORMATION

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[2].

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

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

4.4 Updates should be stored separately from the ENC.

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.

4.6 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.

4.7 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.

4.8 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.

4.9 ECDIS should be capable of accepting both non-encrypted ENCs and ENCs encrypted in accordance with the IHO Data Protection Scheme[3].

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2 IHO Special Publication S-52 and S-57 (see appendix 1).
3 IHO Special Publication S-63 (see appendix 1).

MODULE B - OPERATIONAL AND FUNCTIONAL REQUIREMENTS

5 DISPLAY OF SENC INFORMATION

5.1 ECDIS should be capable of displaying all SENC information. An ECDIS should be capable of accepting and converting an ENC and its updates into a SENC. The ECDIS may also be capable of accepting a SENC resulting from conversion of ENC to SENC ashore, in accordance with IHO TR 3.11[4]. This method of ENC supply is known as SENC delivery.

5.2 SENC information available for display during route planning and route monitoring should be subdivided into the following three categories, Display Base, Standard Display and All Other Information (see appendix 2).

5.3 ECDIS should present the Standard Display at any time by a single operator action.

5.4 When an ECDIS is switched on following a switch off or power failure, it should return to the most recent manually selected settings for display.

5.5 It should be easy to add or remove information from the ECDIS display. It should not be possible to remove information contained in the Display Base.

5.6 For any operator identified geographical position (e.g. by cursor picking) ECDIS should display on demand the information about the chart objects associated with such a position.

5.7 It should be possible to change the display scale by appropriate steps e.g. by means of either chart scale values or ranges in nautical miles.

5.8 It should be possible for the mariner to select a safety contour from the depth contours provided by the SENC. ECDIS should emphasize the safety contour over other contours on the display, however:

.1 if the mariner does not specify a safety contour, this should default to 30m. If the safety contour specified by the mariner or the default 30 m contour is not in the displayed SENC, the safety contour shown should default to the next deeper contour;

.2 if the safety contour in use becomes unavailable due to a change in source data, the safety contour should default to the next deeper contour; and

.3 in each of the above cases, an indication should be provided.

5.9 It should be possible for the mariner to select a safety depth. ECDIS should emphasize soundings equal to or less than the safety depth whenever spot soundings are selected for display.

5.10 The ENC and all updates to it should be displayed without any degradation of their information content.

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[4] IHO Miscellaneous Publication M-3.

5.11 ECDIS should provide a means to ensure that the ENC and all updates to it have been correctly loaded into the SENC.

5.12 The ENC data and updates to it should be clearly distinguishable from other displayed information, including those listed in appendix 3.

6 SCALE

6.1 ECDIS should provide an indication if:

.1 the information is displayed at a larger scale than that contained in the ENC; or

.2 own ship's position is covered by an ENC at a larger scale than that provided by the display.

7 DISPLAY OF OTHER NAVIGATIONAL INFORMATION

7.1 Radar information and/or AIS information may be transferred from systems compliant with the relevant standards of the Organization. Other navigational information may be added to the ECDIS display. However, it should not degrade the displayed SENC information and it should be clearly distinguishable from the SENC information.

7.2 It should be possible to remove the radar information, AIS information and other navigational information by single operator action.

7.3 ECDIS and added navigational information should use a common reference system. If this is not the case, an indication should be provided.

7.4 Radar

7.4.1 Transferred radar information may contain a radar image and/or tracked target information.

7.4.2 If the radar image is added to the ECDIS display, the chart and the radar image should match in scale, projection and in orientation.

7.4.3 The radar image and the position from the position sensor should both be adjusted automatically for antenna offset from the conning position.

8 DISPLAY MODE AND GENERATION OF THE NEIGHBOURING AREA

8.1 It should always be possible to display the SENC information in a "north-up" orientation. Other orientations are permitted. When such orientations are displayed, the orientation should be altered in steps large enough to avoid unstable display of the chart information.

8.2 ECDIS should provide for true motion mode. Other modes are permitted.

8.3 When true motion mode is in use, reset and generation of the chart display of the neighbouring area should take place automatically at own ship's distance from the edge of the display as determined by the mariner.

8.4 It should be possible to manually change the displayed chart area and the position of own ship relative to the edge of the display.

8.5 If the area covered by the ECDIS display includes waters for which no ENC at a scale appropriate for navigation is available, the areas representing those waters should carry an indication (see appendix 5) to the mariner to refer to the paper chart or to the RCDS mode of operation (see appendix 7).

9 COLOURS AND SYMBOLS

9.1 IHO recommended colours and symbols should be used to represent SENC information[5].

9.2 The colours and symbols other than those mentioned in 9.1 should comply with the applicable requirements contained in the IMO standards for navigational symbols[6].

9.3 SENC information displayed at the scale specified in the ENC should use the specified size of symbols, figures and letters[5].

9.4 ECDIS should allow the mariner to select whether own ship is displayed in true scale or as a symbol.

10 DISPLAY REQUIREMENTS

10.1 ECDIS should be capable of displaying information for:

.1 route planning and supplementary navigation tasks; and

.2 route monitoring.

10.2 The effective size of the chart presentation for route monitoring should be at least 270 mm x 270 mm.

10.3 The display should be capable of meeting colour and resolution recommendations of IHO[5].

10.4 The method of presentation should ensure that the displayed information is clearly visible to more than one observer in the conditions of light normally experienced on the bridge of the ship by day and by night.

10.5 If information categories included in the Standard Display (See appendix 2) are removed to customize the display, this should be permanently indicated. Identification of categories which are removed from the Standard Display should be shown on demand.

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[5] Special Publication S-52, Appendix 2 (see appendix 1)

11 ROUTE PLANNING, MONITORING AND VOYAGE RECORDING

11.1 It should be possible to carry out route planning, ~~and~~ route monitoring and sharing of route plans in a simple and reliable manner.

11.2 The largest scale data available in the SENC for the area given should always be used by the ECDIS for all alarms or indications of crossing the ship's safety contour and of entering a prohibited area, and for alarms and indications according to appendix 5.

11.3 Route Planning

11.3.1 It should be possible to carry out route planning including both straight and curved segments.

11.3.2 It should be possible to adjust a planned route alphanumerically and graphically including:

.1 adding waypoints to a route;

.2 deleting waypoints from a route; and

.3 changing the position of a waypoint.

11.3.3 It should be possible to plan one or more alternative routes in addition to the selected route. The selected route should be clearly distinguishable from the other routes.

11.3.4 It should be possible to exchange both selected and alternative route plans with other actors in an automated manner. The exchange should be in accordance with standard formats for route plan exchange[16] and with standard service interfaces including information security protection[17] to allow for secure machine-machine communication.

11.3.5 The exchanged route plan should consist of both route geometry, route info and a route schedule as soon as time of departure and estimated time of arrival can be determined with reasonable accuracy.

11.3.6 An indication is required if the mariner plans a route across an own ship's safety contour.

11.3.7 An indication should be given if the mariner plans a route closer than a user-specified distance from the boundary of a prohibited area or a geographic area for which special conditions exist (see appendix 4).An indication should also be given if the mariner plans a route closer than a user-specified distance from a point object, such as a fixed or floating aid to navigation or isolated danger.

11.3.8 It should be possible for the mariner to specify a cross track limit of deviation from the planned route at which an automatic off-track alarm should be activated.

11.4 Route monitoring

11.4.1 For route monitoring the selected route and own ship's position should appear whenever

[16] IEC 61174/ IEC 63173-1
[17] IEC 63173-2

the display covers that area.

11.4.2 It should be possible to display a sea area that does not have the ship on the display (e.g. for look ahead, route planning), while route monitoring. If this is done on the display used for route monitoring, the automatic route monitoring functions (e.g. updating ship's position, and providing alarms and indications) should be continuous. It should be possible to return to the route monitoring display covering own ship's position immediately by single operator action.

11.4.3 ECDIS should give an alarm if, within a specified time set by the mariner, own ship will cross the safety contour.

11.4.4 ECDIS should give an alarm or indication, as selected by the mariner, if, within a specified time set by the mariner, own ship will cross the boundary of a prohibited area or of a geographical area for which special conditions exist (see appendix 4).

11.4.5 An alarm should be given when the specified cross track limit for deviation from the planned route is exceeded.

11.4.6 An indication should be given to the mariner if, continuing on its present course and speed, over a specified time or distance set by the mariner, own ship will pass closer than a user-specified distance from a danger (e.g. obstruction, wreck, rock) that is shallower than the mariner's safety contour or an aid to navigation.

11.4.7 The ship's position should be derived from a continuous positioning system of an accuracy consistent with the requirements of safe navigation. Whenever possible, a second independent positioning source, preferably of a different type, should be provided. In such cases ECDIS should be capable of identifying discrepancies between the two sources.

11.4.8 ECDIS should provide an alarm when the input from position, heading or speed sources is lost. ECDIS should also repeat, but only as an indication, any alarm or indication passed to it from position, heading or speed sources.

11.4.9 An alarm should be given by ECDIS when the ship reaches a specified time or distance, set by the mariner, in advance of a critical point on the planned route.

11.4.10 The positioning system and the SENC should be on the same geodetic datum. ECDIS should give an alarm if this is not the case.

11.4.11 It should be possible to display alternative routes in addition to the selected route. The selected route should be clearly distinguishable from the other routes. During the voyage, it should be possible for the mariner to modify the selected sailing route or change to an alternative route.

11.4.12 If the selected route plan is changed during the voyage it should be possible to exchange the updated route plan in an automated manner.

11.4.13 It should be possible to display:

.1 time-labels along a ship's track manually on demand and automatically at intervals selected between 1 and 120 minutes; and

.2 an adequate number of: points, free movable electronic bearing lines, variable and fixed range markers and other symbols required for navigation purposes and specified in appendix 3.

11.4.14 It should be possible to enter the geographical co-ordinates of any position and then display that position on demand. Also, it should be possible to select any point (features, symbol or position) on the display and read its geographical co-ordinates on demand.

11.4.15 It should be possible to adjust the displayed geographic position of the ship manually. This manual adjustment should be noted alpha-numerically on the screen, maintained

until altered by the mariner and automatically recorded.

11.4.15.1 ECDIS should provide the capability to enter and plot manually obtained bearing and distance lines of position (LOP), and calculate the resulting position of own ship. It should be possible to use the resulting position as an origin for dead-reckoning.

11.4.15.2 ECDIS should indicate discrepancies between the positions obtained by continuous positioning systems and positions obtained by manual observations.

11.5 Voyage recording

11.5.1 ECDIS should store and be able to reproduce certain minimum elements required to reconstruct the navigation and verify the official database used during the previous 12 hours. The following data should be recorded at one minute intervals:

.1 to ensure a record of own ship's past track: time, position, heading, and speed; and

.2 to ensure a record of official data used: ENC source, edition, date, cell and update history.

11.5.2 In addition, ECDIS should record the complete track for the entire voyage, with time marks at intervals not exceeding 4 hours.

11.5.3 It should not be possible to manipulate or change the recorded information.

11.5.4 ECDIS should have a capability to preserve the record of the previous 12 hours and of the voyage track.

12 CALCULATIONS AND ACCURACY

12.1 The accuracy of all calculations performed by ECDIS should be independent of the characteristics of the output device and should be consistent with the SENC accuracy.

12.2 Bearings and distances drawn on the display or those measured between features already drawn on the display should have accuracy no less than that afforded by the resolution of the display.

12.3 The system should be capable of performing and presenting the results of at least the following calculations:

.1 true distance and azimuth between two geographical positions;

.2 geographic position from known position and distance/azimuth; and

.3 geodetic calculations such as spheroidal distance, rhumb line, and great circle.

13 PERFORMANCE TESTS, MALFUNCTIONS ALARMS AND INDICATIONS

13.1 ECDIS should be provided with means for either automatically or manually carrying out on-board tests of major functions. In case of a failure, the test should display information to indicate which module is at fault.

13.2 ECDIS should provide a suitable alarm or indication of system malfunction.

14 BACK-UP ARRANGEMENTS

Adequate back-up arrangements should be provided to ensure safe navigation in case of an ECDIS failure; see appendix 6.

.1 Facilities enabling a safe take-over of the ECDIS functions should be provided in order to ensure that an ECDIS failure does not develop into a critical situation.

.2 A back-up arrangement should provide means of safe navigation for the remaining part of a voyage in the case of an ECDIS failure.

MODULE C - INTERFACING AND INTEGRATION

15 CONNECTIONS WITH OTHER EQUIPMENT [7]

15.1 ECDIS should not degrade the performance of any equipment providing sensor inputs. Nor should the connection of optional equipment degrade the performance of ECDIS below this standard.

15.2 ECDIS should be connected to the ship's position fixing system, to the gyro compass and to the speed and distance measuring device. For ships not fitted with a gyro compass, ECDIS should be connected to a marine transmitting heading device.

15.3 ECDIS may provide a means to supply SENC information to external equipment.

16 POWER SUPPLY

16.1 It should be possible to operate ECDIS and all equipment necessary for its normal functioning when supplied by an emergency source of electrical power in accordance with the appropriate requirements of chapter II-1 of the 1974 SOLAS Convention, as amended.

16.2 Changing from one source of power supply to another or any interruption of the supply for a period of up to 45 seconds should not require the equipment to be manually re-initialized.

7 Publication IEC 61162.

Appendix 1

REFERENCE DOCUMENTS

The following international organizations have developed technical standards and specifications, as listed below, for use in conjunction with this standard. The latest edition of these documents should be obtained from the organization concerned:

INTERNATIONAL MARITIME ORGANIZATION (IMO)

Address: International Maritime Organization
4 Albert Embankment
London SE1 7SR
United Kingdom

Phone: +44 207 735 76 11
Fax: +44 207 587 32 10
E-mail:info@imo.org
Web: http://www.imo.org

Publications

IMO resolution MSC.191(79) on Performance Standards for the presentation of navigation related information on shipborne navigational displays

IMO resolution A.694(17) on Recommendations on general requirements for shipborne radio equipment forming part of the Global Maritime Distress and Safety System (GMDSS) and for electronic navigational aids

SN.Circ/207 (1999) on Differences between RCDS and ECDIS

IMO SN/Circ.243 (2004) on Guidelines for the Presentation of Navigation-related Symbols, Terms and Abbreviations

IMO MSC/Circ.982 (2000) on Guidelines on ergonomic criteria for bridge equipment and layout

INTERNATIONAL HYDROGRAPHIC ORGANIZATION (IHO)

Address: Directing Committee
International Hydrographic Bureau
BP 445
MC 98011 Monaco Cedex
Principality of Monaco

Phone: +377 93 10 81 00
Fax: +377 93 10 81 40
E-mail:info@ihb.mc
Web: http://www.iho.shom.fr

Publications

Special Publication No. S-52, Specifications for Chart Content and Display Aspects of ECDlS

Special Publication No. S-52 appendix 1, Guidance on Updating the Electronic Navigational Chart

Special Publication No. S-52 appendix 2, Colour and Symbol Specifications for ECDIS

Special Publication No. S-32, Hydrographic Dictionary

Special Publication No. S-57, IHO Transfer Standard for Digital Hydrographic Data

Special Publication No. S-61, IHO Product specification for Raster Navigational Charts (RNC)

Special Publication No. S-63, IHO Data Protection Scheme

Miscellaneous Publication No. M-3, *Resolutions of the lHO*

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

Address: IEC Central Office
3 rue de Varembe
PO Box 131
CH-1211 Geneva 20
Switzerland

Phone: +41 22 734 01 50
Fax: +41 22 733 38 43

Publications

TBC IEC Publication 63173-1, Maritime navigation and radiocommunication equipment and systems – Data Interface – Part 1: S-421 Route Plan Based on S-100

TBC IEC Publication 63173-2, Maritime navigation and radiocommunication equipment and systems – Data interface – Part 2: Secure communication between ship and shore

IEC Publication 61174, Electronic Chart Display and Information Systems (ECDIS) - Operational and Performance Requirements, Method of Testing and Required Test Results.

IEC Publication 60945, General Requirements for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System and Marine Navigational Equipment.

IEC Publication 61162, *Digital lnterfaces - Navigation and Radiocommunication Equipment On board Ship*.

[IEC Publication 62288, Maritime Navigation and Radiocommunication Equipment and

Systems - Presentation of navigation related information - General requirements, methods of test and required test results.]

Appendix 2

SENC INFORMATION AVAILABLE FOR DISPLAY DURING ROUTE PLANNING AND ROUTE MONITORING

1 Display base to be permanently shown on the ECDIS display, consisting of:

.1 coastline (high water);
.2 own ship's safety contour;
.3 isolated underwater dangers of depths less than the safety contour which lie within the safe waters defined by the safety contour;
.4 isolated dangers which lie within the safe water defined by the safety contour, such as fixed structures, overhead wires, etc.;
.5 scale, range and north arrow;
.6 units of depth and height; and
.7 display mode.

2 Standard display consisting of:

.1 display base
.2 drying line
.3 buoys, beacons, other aids to navigation and fixed structures
.4 boundaries of fairways, channels, etc.
.5 visual and radar conspicuous features
.6 prohibited and restricted areas
.7 chart scale boundaries
.8 indication of cautionary notes
.9 ships' routeing systems and ferry routes
.10 archipelagic sea lanes.

3 All other information, to be displayed individually on demand, for example:

.1 spot soundings
.2 submarine cables and pipelines
.3 details of all isolated dangers
.4 details of aids to navigation
.5 contents of cautionary notes
.6 ENC edition date
.7 most recent chart update number
.8 magnetic variation
.9 graticule
.10 place names.

Appendix 3

NAVIGATIONAL ELEMENTS AND PARAMETERS

1 Own ship.

- **.1** Past track with time marks for primary track.
- **.2** Past track with time marks for secondary track.

2 Vector for course and speed made good.

3 Variable range marker and/or electronic bearing line.

4 Cursor.

5 Event.

- **.1** Dead reckoning position and time (DR).
- **.2** Estimated position and time (EP).

6 Fix and time.

7 Position line and time.

8 Transferred position line and time.

- **.1** Predicted tidal stream or current vector with effective time and strength.
- **.2** Measured tidal stream or current vector with effective time and strength.

9 Danger highlight.

10 Clearing line.

11 Planned course and speed to make good.

12 Waypoint.

13 Distance to run.

14 Planned position with date and time.

15 Visual limits of lights arc to show rising/dipping range.

16 Position and time of "wheel over".

Appendix 4

AREAS FOR WHICH SPECIAL CONDITIONS EXIST

The following are the areas which ECDIS should detect and provide an alarm or indication under sections 11.3.5 and 11.4.4:

Traffic separation zone
Inshore traffic zone
Restricted area
Caution area
Offshore production area
Areas to be avoided
User defined areas to be avoided
Military practise area
Seaplane landing area
Submarine transit lane
Anchorage area
Marine farm/aquaculture
PSSA (Particularly Sensitive Sea Area)

Appendix 5

ALARMS AND INDICATORS

Section	Requirements	Information
11.4.3	Alarm	Crossing safety contour
11.4.4	Alarm or Indication	Area with special conditions
11.4.5	Alarm	Deviation from route
11.4.8	Alarm	Positioning system failure
11.4.9	Alarm	Approach to critical point
11.4.10	Alarm	Different geodetic datum
13.2	Alarm or Indication	Malfunction of ECDIS
5.8.3	Indication	Default safety contour
6.1.1	Indication	Information overscale
6.1.2	Indication	Larger scale ENC available
7.3	Indication	Different reference system
8.5	Indication	No ENC available
10.5	Indication	Customized display
11.3 4	Indication	Route planning across safety contour
11.3.5	Indication	Route planning across specified area
11.4.6	Indication	Crossing a danger in route monitoring mode
13.1	Indication	System test failure

In this Performance Standard the definitions of Indicators and Alarms provided in the IMO resolution A.830(19) "Code on Alarms and Indicators, 1995" apply.

Alarm: An alarm or alarm system which announces by audible means, or audible and visual means, a condition requiring attention.

Indicator: Visual indication giving information about the condition of a system or equipment.

Appendix 6

BACK-UP REQUIREMENTS

1 INTRODUCTION

As prescribed in section 14 of this performance standard, adequate independent back-up arrangements should be provided to ensure safe navigation in case of ECDIS failure. Such arrangements include:

.1 facilities enabling a safe take-over of the ECDIS functions in order to ensure that an ECDIS failure does not result in a critical situation;

.2 a means to provide for safe navigation for the remaining part of the voyage in case of ECDIS failure.

2 PURPOSE

The purpose of an ECDIS back-up system is to ensure that safe navigation is not compromised in the event of ECDIS failure. This should include a timely transfer to the back-up system during critical navigation situations. The back-up system shall allow the vessel to be navigated safely until the termination of the voyage.

3 FUNCTIONAL REQUIREMENTS

3.1 Required functions and their availability

3.1.1 Presentation of chart information

The back-up system should display in graphical (chart) form the relevant information of the hydrographic and geographic environment which are necessary for safe navigation.

3.1.2 Route planning

The back-up system should be capable of performing the route planning functions, including:

.1 taking over of the route plan originally performed on the ECDIS;

.2 adjusting a planned route manually or by transfer from a route planning device.

3.1.3 Route monitoring

The back-up system should enable a take-over of the route monitoring originally performed by the ECDIS, and provide at least the following functions:

.1 plotting own ship's position automatically, or manually on a chart;

.2 taking courses, distances and bearings from the chart;

.3 displaying the planned route;

.4 displaying time labels along ship's track;

.5 plotting an adequate number of points, bearing lines, range markers, etc., on the chart.

3.1.4 Display information

If the back-up is an electronic device, it should be capable of displaying at least the information equivalent to the standard display as defined in this performance standard.

3.1.5 Provision of chart information

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

.2 It should not be possible to alter the contents of the electronic chart information.

.3 The chart or chart data edition and issuing date should be indicated.

3.1.6 Updating

The information displayed by the ECDIS back-up arrangements should be up-to-date for the entire voyage.

3.1.7 Scale

If an electronic device is used, it should provide an indication:

.1 if the information is displayed at a larger scale than that contained in the database; and

.2 if own ship's position is covered by a chart at a larger scale than that provided by the system.

3.1.8 If radar and other navigational information are added to an electronic back-up display, all the corresponding requirements for radar information and other navigation information of this performance standard should be met.

3.1.9 If an electronic device is used, the display mode and generation of the neighbouring area should be in accordance with section 8 of this performance standard.

3.1.10 Voyage recording

The back-up arrangements should be able to keep a record of the ship's actual track, including positions and corresponding times.

3.2 Reliability and accuracy

3.2.1 Reliability

The back-up arrangements should provide reliable operation under prevailing environmental and normal operating conditions.

3.2.2 Accuracy

Accuracy should be in accordance with section 12 of this performance standard.

3.3 Malfunctions, warnings, alarms and indications

If an electronic device is used, it should provide a suitable alarm or indication of system malfunction.

4 OPERATIONAL REQUIREMENTS

4.1 Ergonomics

If an electronic device is used, it should be designed in accordance with the ergonomic principles of ECDIS.

4.2 Presentation of information

If an electronic device is used:

.1 Colours and symbols should be in accordance with the colours and symbols requirements of ECDIS.

.2 The effective size of the chart presentation should be not less than 250 mm x 250 mm or 250 mm diameter.

5 POWER SUPPLY

If an electronic device is used:

.1 the back-up power supply should be separate from the ECDIS; and

.2 conform to the requirements in this ECDIS performance standard.

6 CONNECTIONS WITH OTHER EQUIPMENT

6.1 If an electronic device is used, it should:

.1 be connected to systems providing continuous position-fixing capability; and

.2 not degrade the performance of any equipment providing sensor input.

6.2 If radar with selected parts of the ENC chart information overlay is used as an element of the back-up, the radar should comply with resolution MSC.192(79).

Appendix 7

RCDS MODE OF OPERATION

Whenever in this appendix reference is made to any provisions of the annex related to ECDIS, the term ECDIS should be substituted by the term RCDS, SENC by SRNC and ENC by RNC, as appropriate.

This appendix refers to each paragraph of the performance standards for ECDIS (i.e. the Annex to which this part is appendix 7) and specifies which paragraphs of the Annex either:

.1 apply to RCDS; or

.2 do not apply to RCDS; or

.3 are modified or replaced as shown in order to apply to RCDS.

Any additional requirements applicable to RCDS are also described.

1 SCOPE

1.1 Paragraph applies to RCDS.

1.2 When operating in RCDS-mode, an appropriate portfolio of up-to-date paper charts (APC) should be carried on board and be readily available to the mariner.

1.3 - 1.7 Paragraphs apply to RCDS.

1.8 RCDS should provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment (see Table 1 of this appendix).

1.9 Refers to Appendix 7 and applies to RCDS.

2 APPLICATION OF THESE STANDARDS

2.1 - 2.4 Paragraphs apply to RCDS.

3 DEFINITIONS

3.1 *Raster Chart Display System* (RCDS) means a navigation information system displaying RNCs with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and if required, display additional navigation-related information.

3.2 *Raster Navigational Chart* (RNC) means a facsimile of a paper chart originated by, or distributed on the authority of, a government-authorized hydrographic office. RNC is used in these standards to mean either a single chart or a collection of charts.

3.3 *System Raster Navigational Chart Database* (SRNC) means a database resulting from the transformation of the RNC by the RCDS to include updates to the RNC by appropriate means.

3.4-3.5 Paragraphs do not apply to RCDS.

3.6 Paragraph applies to RCDS.

3.7 Appropriate Portfolio of up to date paper Charts (APC) means a suite of paper charts of a scale to show sufficient detail of topography, depths, navigational hazards, aids to navigation, charted routes, and routeing measures to provide the mariner with information on the overall navigational environment. The APC should provide adequate look-ahead capability. Coastal States will provide details of the charts which meet the requirement of this portfolio, and these details are included in a worldwide database maintained by the IHO. Consideration should be given to the details contained in this database when determining the content of the APC.

MODULE A - DATABASE

4 PROVISION AND UPDATING OF CHART INFORMATION

4.1 The RNC used in RCDS should be the latest edition of that originated by, or distributed on the authority of, a government authorized hydrographic office and conform to IHO standards. RNCs not on WGS 84 or PE-90 should carry meta-data (i.e., additional data) to allow geo-referenced positional data to be displayed in the correct relationship to SRNC data.

4.2 The contents of the SRNC should be adequate and up-to-date for that part of the intended voyage not covered by ENC.

4.3 It should not be possible to alter the contents of the RNC.

4.4 – 4.8 All paragraphs apply to RCDS.

4.9 Paragraph does not apply to RCDS

MODULE B - OPERATIONAL AND FUNCTIONAL REQUIREMENTS

5 DISPLAY OF SRNC INFORMATION

5.1 RCDS should be capable of displaying all SRNC information.

5.2 SRNC information available for display during route planning and route monitoring should be subdivided into two categories:

.1 the RCDS standard display consisting of RNC and its updates, including its scale, the scale at which it is displayed, its horizontal datum, and its units of depths and heights; and

.2 any other information such as mariner's notes.

5.3- 5.4 Paragraphs apply to RCDS.

5.5 It should be easy to add to, or remove from; the RCDS display any information additional to the RNC data, such as mariner's notes. It should not be possible to remove any information from the RNC.

5.6 - 5.9 Paragraphs do not apply to RCDS.

5.10 - 5.12 Paragraphs apply to RCDS.

5.13 There should always be an indication if the ECDIS equipment is operating in RCDS mode.

6 SCALE

This section applies to RCDS.

7 DISPLAY OF OTHER NAVIGATIONAL INFORMATION

7.1 - 7.4 All paragraphs apply to RCDS.

8 DISPLAY MODE AND GENERATION OF THE NEIGHBOURING AREA

8.1 It should always be possible to display the SRNC in "chart-up" orientation. Other orientations are permitted.

8.2 - 8.4 All paragraphs apply to RCDS.

8.5 Paragraph refers to RCDS mode of operation.

9 COLOURS AND SYMBOLS

9.1 IHO recommended colours and symbols should be used to represent SRNC information.

9.2 Paragraph applies to RCDS.

9.3 Paragraph does not apply to RCDS.

9.4 Paragraph applies to RCDS.

10 DISPLAY REQUIREMENTS

10.1-10.2 Paragraphs apply to RCDS.

10.3 Paragraph does not apply to RCDS.

10.4 Paragraph applies to RCDS.

10.5 Paragraph does not apply to RCDS.

10.6 RCDS should be capable of displaying, simply and quickly, chart notes which are not located on the portion of the chart currently being displayed.

11 ROUTE PLANNING, MONITORING AND VOYAGE RECORDING

11.1 Paragraphs apply to RCDS.

11.2 Paragraph does not apply to RCDS.

11.3 Route Planning

11.3.1-11.3.3 Paragraphs apply to RCDS.

11.3.4-11.3.5 Paragraphs do not apply to RCDS.

11.3.6 Paragraph applies to RCDS.

11.3.7 It should be possible for the mariner to enter points, lines and areas which activate an automatic alarm. The display of these features should not degrade the SRNC information and it should be clearly distinguishable from the SRNC information.

11.4 Route monitoring

11.4.1 Paragraph applies to RCDS.

11.4.2 It should be possible to display a sea area that does not have the ship on the display (e.g. for look ahead, route planning), while route monitoring. If this is done on the display used for route monitoring, the automatic route monitoring functions in 10.4.6 and 10.4.7 should be continuous. It should be possible to return to the route monitoring display covering own ship's position immediately by single operator action.

11.4.3-11.4.4 Paragraphs do not apply to RCDS.

11.4.5 Paragraph apply to RCDS.

11.4.6 Paragraphs do not apply to RCDS.

11.4.7-11.4.9 Paragraphs apply to RCDS.

11.4.10 The RCDS should only accept positional data referenced to the WGS 84 or PE-90 geodetic datum. RCDS should give an alarm if the positional data is not referenced to one of these datum. If the displayed RNC cannot be referenced to the WGS 84 or PE-90 datum then a continuous indication should be provided.

11.4.11-11.4.15 Paragraphs apply to RCDS.

11.4.16 RCDS should allow the user to manually align the SRNC with positional data. This can be necessary, for example, to compensate for local charting errors.

11.4.17 It should be possible to activate an automatic alarm when the ship crosses a point, line, or is within the boundary of a mariner entered feature within a specified time or distance.

11.5 Voyage recording

11.5.1-11.5.4 All paragraphs apply to RCDS.

12 CALCULATIONS AND ACCURACY

12.1-12.3 All paragraphs apply to RCDS.

12.4 RCDS should be capable of performing transformations between a local datum and WGS 84 Datum.

13 PERFORMANCE TESTS, MALFUNCTION ALARMS AND INDICATIONS

13.1-13.2 All paragraphs apply to RCDS.

14 BACK-UP ARRANGEMENTS

All paragraphs apply to RCDS.

MODULE C - INTERFACING AND INTEGRATION

15 CONNECTIONS WITH OTHER EQUIPMENT

15.1-15.3 All paragraphs apply to RCDS.

16 POWER SUPPLY

16.1-16.2 All paragraphs apply to RCDS.

Table 1

ALARMS AND INDICATORS IN THE RCDS MODE OF OPERATION

Paragraph	Requirement	Information
11.4.5	Alarm	Deviation from route
11.4.17	Alarm	Approach to mariner entered feature, e.g. area, line
11.4.8	Alarm	Position system failure
11.4.9	Alarm	Approach to critical point
11.4.10	Alarm or indication	Different geodetic datum
13.2	Alarm or indication	Malfunction of RCDS mode
5.13	Indication	ECDIS operating in the raster mode
6.1	Indication	Larger scale information available, or overscale
6.1.2	Indication	Larger scale RNC available for the area of the vessel

Note: The definitions of alarms and indicators are given in appendix 5.