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COMMUNICATIONS AND
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Agenda item 7

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GUIDELINES ON STANDARDIZED MODES OF OPERATION, S-MODE

Draft Guideline

**Submitted by Australia, the Republic of Korea, BIMCO, the Comité International Radio-
Maritime (CIRM), the International Association of Institutes of Navigation (IAIN), the
International Electrotechnical Commission (IEC), InterManager and
the Nautical Institute**

<table>
<tr><td colspan="2" align="center">**SUMMARY**</td></tr>
<tr><td>*Executive summary:*</td><td>This document provides a first draft guideline for the Standardized (or S) Mode of operation of navigational equipment. The draft guideline is underpinned by user needs and aims to improve the standardization of the human interface of electronic navigation equipment. When applied in the design process, the guideline enhances the safe and effective navigation of ships and reduces the time needed for familiarization with electronic navigation equipment. Proper familiarization with safety functions is a fundamental requirement under the ISM Code. The application of S-Mode will help to reduce the burden of seafarers becoming familiar with electronic navigation equipment</td></tr>
<tr><td>*Strategic direction:*</td><td>5.2</td></tr>
<tr><td>*High-level action:*</td><td>5.2.6</td></tr>
<tr><td>*Output:*</td><td>To be decided</td></tr>
<tr><td>*Action to be taken:*</td><td>Paragraph 15</td></tr>
<tr><td>*Related documents:*</td><td>Resolution A.714(18) as amended; SN.1/Circ.243/Rev.1; MSC 95/19/8, MSC 95/19/12, MSC 95/19/14; NCSR 3/28/1 and NCSR 4/INF.8</td></tr>
</table>

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Background

1   MSC 95 considered document MSC 95/19/8, annex 1, proposing the development of *Guidelines on standardized modes of operation* (S-Mode) for all navigational equipment, and documents MSC 95/19/12 and MSC 95/19/14 commenting on the proposal. The Committee agreed to include, in the post-biennial agenda of the Committee, an output on *Guidelines on standardized modes of operation*, S-Mode, with two sessions needed to complete the item, assigning the NCSR Sub-Committee as the coordinating organ. The guideline is due for completion at NCSR 6 in 2019.

2   MSC 95/19/12 drew attention to the importance and complex nature of this guideline and its planned progress in the 2018-2019 biennium (NCSR 5 and NCSR 6). Recognizing this, the sponsors of this document have made significant efforts in 2016 and 2017 to ensure that this initial draft S-Mode Guideline is based on researched user needs, and, that it adequately bridges the gap between the identified user needs and what manufacturers of equipment believe they can deliver effectively. Furthermore, the ISM Code requires that personnel are properly familiar with their duties on board a vessel. S-Mode aims to reduce the burden associated with becoming familiar with electronic navigation equipment through increased standardization, and the application of standardization design principles.

3   The sponsors, by way of correspondence and face-to-face meetings, have developed the draft guideline on S-Mode, as set out in the annex.

4   Australia et al. presented documents NCSR 3/28/1 and NCSR 4/INF.8 to the NCSR Sub-Committee, which provided information on the intent of the guideline and progress in its development.

5   NCSR 3/28/1 proposed an initial description of the content and scope of the guideline on standardized modes of operation, or S-Mode, as follows:

> "*Guidance on the standardization of design for navigation and communication systems, encompassing displays, interfaces, and functionalities able to provide the bridge team and the pilot with timely access to essential information for the conduct of navigation throughout the voyage, from berth to berth.*"

6   This was later further developed to an intent and purpose, which was included in NCSR 4/INF.8 as:

> .1   *S-Mode aims to reduce variation in navigation systems and equipment through the standardization of some aspects of the user interfaces. This in turn will help provide users with timely access to essential information and functions that support safe navigation. This guidance stems from a strong user need for consistency of essential information, to perform key tasks and functions, irrespective of an equipment's manufacturer.*
>
> .2   *While the operation of navigation equipment requires specialist training, specific training or familiarization should ideally be minimized where possible. S-Mode enables users to locate and interpret information quickly and react decisively, which is crucial to safe navigation.*

7   The above statements have shaped the development of the draft S-Mode Guideline. The co-sponsors are of the view that the draft in the annex is sufficiently mature for the Sub-Committee's initial consideration, and subsequent development and testing. The guideline is intended for electronic navigation equipment, specifically Electronic Chart Display and

Information System (ECDIS), Integrated Navigation System (INS) and radar. The usability of other electronic navigation equipment and systems may also be improved through the application of this guideline in the design process.

Developing the first draft S-Mode Guideline

8   There has been significant work to develop the first draft of this S-Mode Guideline. This work has included various workshops and meetings as outlined below:

Date	Progress and development activity
6 - 8 April 2016	**Ergoship 2016 Conference** *Melbourne, Australia,* Discussion and promotion of the S-Mode concept
11 - 12 April 2016	**International S-Mode workshop** *Launceston, Australia*
May 2016	Development of a "first draft" for circulation and comment based on previous workshops and subsequent feedback
24 August 2016	**Informal S-Mode workshop** *Sydney, Australia,* Australasian Maritime Pilots Institute
October 2016	Preliminary work by The Nautical Institute to facilitate user engagement, feedback, and an international survey
November 2016	Second draft S-Mode guideline circulated for comment
29 November 2016	**Online International S-Mode workshop** *Launceston, Australia (online),* Hosted by the Australian Maritime College
9 December 2016	**S-Mode testbed planning workshop** *Busan, Republic of Korea*
31 January – 02 February 2017	**e-Navigation Underway 2017** *MS Pearl Seaways* Informal discussions between delegates about the S-Mode initiative
February 2017	Nautical Institute commenced an International S-Mode survey
1 May 2017	**Australian S-Mode team workshop** *Canberra, Australia* Development of standardization principles
18-20 June 2017	**e-Navigation Underway 2017 Asia Pacific Conference,** *Jeju, Republic of Korea* S-Mode Presentation by Australia, and further discussion amongst delegates
21 June 2017	**S-Mode testbed workshop** *Jeju, Republic of Korea* Republic of Korea introduce the S-Mode testbed plan CIRM introduce detailed annexes for S-Mode Guideline
23 October 2017	**S-Mode Webinar** *Nautical Institute HQ, London, UK* Webinar hosted online to introduce and promote the guideline to end users
25 October 2017	**S-Mode document drafting working group,** *Nautical Institute HQ, London, UK* Final drafting of the S-Mode Guideline and Input paper for NCSR 5. This meeting was attended by: Australia, Norway, Republic of Korea, BIMCO, CIRM, IAIN, IEC, InterManager, and the Nautical Institute

Date	Progress and development activity
October - November 2017	**S-Mode user preference testing** Republic of Korea online user testing
November 2017 - ongoing	The Nautical Institute online testing and survey

Collaboration

9   Successful development of e-navigation outputs must include input from practising navigators. The co-sponsors have facilitated input from users and designers of navigation equipment. This collaborative effort, involving a wide range of stakeholders and testing, has resulted in a robust and well considered initial draft S-Mode Guideline.

Discussion

10   This guideline stems from a user need for more standardization and a reduction in the time needed for seafarers to become familiar with a variety of electronic navigation equipment. The guideline is provided primarily for designers and manufacturers of electronic navigation equipment.

11   The guideline includes a set of Standardization Design Principles which aim to improve usability of electronic navigation equipment. These principles are supported by four appendices that provide for standardization in the main components of navigation equipment. The members of the Comité International Radio-Maritime (CIRM) developed the appendices with support from the co-sponsors. The appendices will be subject to user testing, led by the Republic of Korea, CIRM and the Nautical Institute. The Nautical Institute will further test the principles and detailed appendices with seafarers through surveys to obtain user feedback.

12   The draft guideline contains four appendices:

 .1   **Appendix 1** – Navigation-related terminology and icons of functions (Hot keys and Shortcuts)

 .2   **Appendix 2** – Logical grouping of information ("essential information blocks")

 .3   **Appendix 3** – List of functions that must be accessible by single or simple operator action

 .4   **Appendix 4** – Standard and user settings

13   It is recommended that the symbols, icons, and abbreviations as developed under this guideline be included in the next revision of SN.1/Circ.243/Rev.1.

Testing and completing the guideline

14   Testing of this draft S-Mode Guideline is planned for 2018, and will involve the wider international maritime community. Critical appraisal of the test results will support the further development and completion of the guideline.

Action requested of the Sub-Committee

15   The Sub-Committee is invited to:

    .1   note the information provided in this document, including the draft S-Mode Guideline in the annex;

    .2   note that there is an ongoing testing process to evaluate and further develop the guideline, and encourage participation;

    .3   consider the recommendation that the symbols, icons, and abbreviations as developed under this guideline be included in the next revision of SN.1/Circ.243;

    .4   endorse in principle the draft S-Mode Guideline in the annex (including its four appendices) as the basis for an IMO guideline on S-Mode; and

    .5   consider the need to establish a formal intersessional correspondence group to coordinate the further development, including testing, and finalization of a guideline on S-Mode.

***

ANNEX

**GUIDELINE FOR THE STANDARDIZATION OF FUNCTIONS AND DISPLAY OF
NAVIGATION EQUIPMENT (S-MODE)**

Introduction

1   This guideline applies to Integrated Navigation Systems (INS), Electronic Chart Display and Information Systems (ECDIS) and Radar. It may be applied to other electronic navigation equipment, where it would improve standardization and usability. The aim of this guideline is to promote standardization of user interfaces for navigation equipment and systems to help meet user needs. The content of this guideline has been developed in close collaboration with equipment manufacturers to ensure the guidance can be implemented expeditiously. The guidance also aims to leave room for future innovation and development while still addressing the primary user need for standardization.

2   Standardization of the user interface and information used by seafarers to monitor, manage and perform navigation tasks will improve safe and effective navigation. Application of this guideline to the design and testing of navigation equipment aims to limit the need for familiarization of equipment as required by the ISM Code and STCW Convention.

Scope

3   This guidance stems from a strong user need for greater standardization to enhance usability across navigation equipment and systems. Significant variation between systems and equipment produced by different manufacturers has led to inconsistency in the way essential information is presented, understood and used to perform key navigation safety functions. Improved standardization of navigation systems will provide users with more timely access to essential information and functions that support safe navigation.

4   While the operation of navigation equipment requires specialist training or familiarization, variations across different manufacturers' equipment for mandatory functions should be minimized. The application of standardization principles enables users to locate and interpret important information quickly and enhance situational awareness.

5   There are a number of IMO instruments and other international standards that deal with system design and information portrayal. This guideline builds on such standards.

Definitions

6   This section provides definitions relevant to this guideline.

Further definitions to be added later including references to existing definitions in other relevant documents

a.   **Standardization Design Principles:** a set of general rules that encapsulate human abilities, characteristics and limitations to the design of an interface.

b.   **User interface**: all components of an interactive system (software and hardware) that provide information and controls for the user to accomplish specific tasks using the interactive system.

c.   **Navigational phase:** spatial characterization of typical navigation scenarios such as navigation in the open sea, in coastal areas, restricted waters, port entries, …docking, etc.

d.   **Navigational situation:** the situation of an individual ship taking into account the navigational phase as well as environment (geometric, bathymetric, traffic conditions, etc.).

e.   **Nautical task:** tasks covering nautical aspects, e.g. "Route planning" or "Route monitoring" or "Collision avoidance" or "Navigation control data" or "Status and data display" or "Alert management".

f.   **Nautical application(s):** defined as technical function(s) to assist or support the realization of a nautical task.

g.   **Mandatory Function:**

h.   **Training**:

i.   **Familiarization**:

j.   **Navigational Task** (to be taken from INS performance standard MSC.252(83))

k.   **Testing**: testing to be carried out by system designers and manufacturers to ensure compliance with this guideline.

User needs

7   This guidance is driven by user needs and is focussed on standardization of the functions of navigation relevant to INS, ECDIS and Radar and other relevant equipment.

8   Large variations in the user interfaces of electronic equipment can significantly inhibit an operator's effectiveness in performing navigation tasks. Where there is significant variation in buttons, icons, actions, workflows, processes, units of measure, location of information there is a commensurate increase in the need for equipment familiarization training. Users need to be better able to learn through experience and transfer skills between systems and equipment. To achieve this, essential information needs to be located in consistent locations, be of a similar size, recognizable colour and shape, and units of measurement.

9   Feedback from users and research indicates that users benefit from standardization, which provides for effectiveness, efficiency and satisfaction for the user, and supports overall system safety. This provides the user with an opportunity to transfer skills gained through experience between systems and equipment.

Standardization Design Principles for S-Mode

10   User feedback and testing has been utilized to develop a set of design principles, adapted from commonly recognized interface design heuristics. These principles align with the user need for more standardization. They should be applied in the design process for electronic navigation equipment, and to test conformance with this guideline. The standardization design principles for electronic navigation equipment are:

      a.   Consistency

            (1)   Standard vocabulary

            (2)   Standard symbols and icons

            (3)   Patterns, groupings

            (4)   Standard places

      b.   Recognition

      c.   Frequency of use

      d.   Visibility of system status

      e.   Map to real world

      f.   Prevent errors, emergency exit

      g.   Tailor to experience levels

      h.   Help, documentation

11   The above standardization design principles have been applied in the development of the technical content provided in the appendices to this guideline. The appendices include:

      a.   standard and user settings;

      b.   standardized terminology, abbreviations and icons for commonly-used functions (Hot Keys) and groups of functions (Shortcuts);

      c.   logical grouping of related information;

      d.   access requirements for essential information and functions ("single or simple operator action");

12   Vast amounts of information are made available to the user of electronic navigation

> The information in paragraphs 10 and 11 will be expanded, explained and rationalized with the information provided in paragraphs 12 to 15.

equipment. To a very large extent the navigation safety of a vessel depends on a user's ability to identify, understand and interpret essential information, in order to perform navigation

functions. Good decision-making depends on the effective and efficient use of essential information from across different pieces of equipment often produced by different manufacturers. The use of standardization design principles across key systems and equipment will improve design consistency and reduce Head Down Time (HDT) and provide users with more time to look out, evaluate situations and monitor a vessel's safe navigation.

13   Users generally follow a common, but often undocumented, workflow for the functions associated with their role. Standardization of information and the way it is presented makes this task easier. As an example, the standardization of essential information for common navigational tasks means that the user can comprehend information easily across different navigation systems and equipment. Standardization reduces the workload and simplifies the process, which increases efficiency, effectiveness and usability.

14   The following principles should be applied during the design and testing of equipment:

    a.   Consistency has been identified as the most significant standardization design principle. The use of consistency throughout the design process increases usability as well as standardization and is an enabling principle when optimizing standardization throughout the design process. The findings of user feedback and testing can be used to identify areas where further consistency can enhance standardization:

        (1)   Standard vocabulary – Consistency in naming, in conjunction with the (1) and (2), will aid search and identification. The naming protocol should be based on user needs of seafarers. Functions related to mandatory tasks should follow a standardized naming convention whereby the function name is transferred between systems (e.g. starboard and port, not right and left).

        (2)   Standard symbols and icons – Many function related icons vary across different navigation equipment and between manufacturers. Appendix 1 provides information on icons, symbols and abbreviations that require standardization. Consistency enables recognition and detectability across the user interfaces of different navigation systems.

        (3)   Patterns, grouping – Humans react positively to patterns and logical groups of items, and use categories to search for individual bits of information. User testing can identify groupings and patterns of information that should be prioritized for consistency. Patterns incorporate the way in which someone uses information and the types of information that are grouped together.

        (4)   Standard location – The search for information when monitoring can be greatly improved through the use of consistent location, which when coupled with consistent grouping greatly speeds up searches and contributes to recognition. User testing has been used to highlight high frequency use areas and can be used to identify places and locations that require standardization. Colocation of essential information is beneficial.

    b.   Recognition – [Using the location and grouping for consistency provides for recognition. Human perception and search works faster with cues than complete recall – which is aided by consistency. The user must recognize

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where information is, or how to perform a process. In performing functions, the user should not need to recall a process where something is located or the process for doing something. This is the ability for the user to recognize an event, process, or information flow rather than recall the detail of how to get to that point. This is integral to usability.]

    c.   Frequency of use – Sorting, grouping and locating of information according to frequency of use increases efficiency. This principle requires that the user can access those tasks which they frequently use. It includes the application of "hot keys", and single operator actions.

    d.   Visibility of system status – [Integration of humans and technology to support the ability to work as a team relies on being able to identify system status. Systems status provides confidence in the validity of information, and the performance of navigation equipment and sensors. Systems status includes visibility of "processing" information and the performance of system sensors to illustrate degraded information.

    e.   Map to real world – There are two elements to mapping to the real world.

        (1)   Whenever possible use images or wording that is contextually related to the task. This is applicable to the interaction with the interface, for example when increasing a number, twist a dial and show increase as "up"…,

        (2)   Geolocation of information to provide a linkage, or correlation, between the user, electronic equipment, and the real world; relative to the ship promotes correlation of information. When combined with recognition, the user intuitively links displayed information with physical reality.

    f.   Prevent errors, emergency exit – Continuous testing during development will identify possible error paths that can be removed. The user should also be aware of how to navigate back to the start of a process, and be aware of what stage they are at in a process.

    g.   Help functions – Design help functions embedded within systems to be logical, task focused, user friendly, easily accessed and understandable.

S-Mode Maintenance Methodology

Text to be developed

Conformance

15   Conformance with the Standardization Design Principles and user needs can be assessed using user feedback as described in the processes of human centred design.

16   Conformance with the requirements of the appendices can be assessed through observation and equipment testing.]

Appendices:

Appendix 1   Navigation-related terminology and icons of functions (hot keys and shortcuts)

Appendix 2   Logical grouping of information ("essential information blocks")

Appendix 3   List of functions that must be accessible by single or simple operator action

Appendix 4   Standard and user settings

Appendix 1

Navigation-related terminology and icons of functions (hot keys and shortcuts)

Introduction

This appendix identifies commonly-used functions on navigation equipment and for each function specifies the associated terminology, abbreviation and (where appropriate) icons. These terms, abbreviations and icons, if available, should be used for the display of navigation-related information, to promote consistency of presentation across navigational equipment.

The terminology and icons listed in appendix 1 should replace symbols which are currently contained in existing performance standards. Where a standard term or icon is not available, another icon or term may be used, but these should not conflict with the icons listed in the appendix.

All terms and abbreviations in this appendix are mandatory to implement. Use of icons is not mandatory; but if icons are implemented then they must meet the requirements specified.

The icons specified may indicate a status, may execute a specific function (hot key), or may provide access to a group of related functions (shortcut).
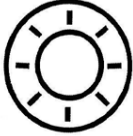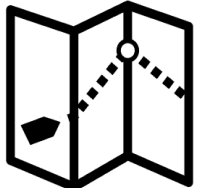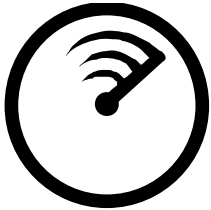
Only the shape of the icon is specified; this appendix does not specify a colour scheme for icons.

Note: For some functions, multiple icon options are suggested for consideration. The final S-Mode Guideline should provide only one icon for each function.

Icons and terminology for functions (hot keys)

Table 1: General navigation functions
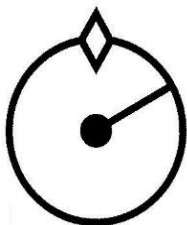
Explanation	Term	Abbreviation	Icon (hot key)
To set panel illumination	Panel illumination	PANEL	(Table E.3 of IEC 62288 Ed.2)

it is proposed by Japan to use the icon from table E.3 of IEC 62288 Ed.2 (agree 25/10/17)			
To set display brilliance	Display brilliance	BRILL	(Table E.3 of IEC 62288 Ed.2.)
it is proposed by Japan to use the icon from table E.3 of IEC 62288 Ed.2 (agree 25/10/17)			
To select ECDIS mode (for example required by INS)	ECDIS	ECDIS	
To select Radar mode (for example as required by INS)	Radar	RADAR	
To select Conning display mode (for example as required by INS)	Conning	CONN	
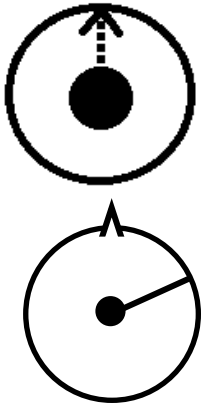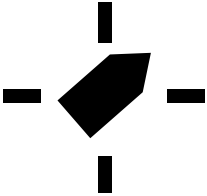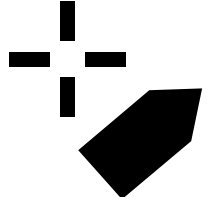
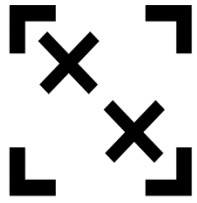| To select CAM-HMI as defined in Bridge Alert Management (BAM) (for example as required by INS)	CAM-HMI	CAM	**OR**
for discussion - users might misunderstand the meaning of this mark for example, "silent function switch", "buzzers" - agree - to be tested (25 Oct 17) [			
To select North Up display	North Up	N UP	
To select Head Up display	Head Up	H UP	
The centre circle of this icon is bigger than the "North Up" icon. The centre circle must be same as the "North Up" icon (agree 25/10/17)			
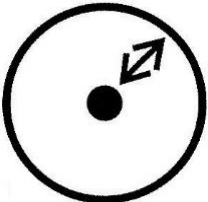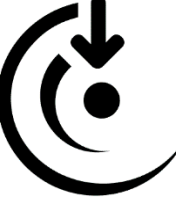
To select Course Up display	Course Up	C UP	
Above – The centre circle of this icon is bigger than the "North Up" icon. The centre circle must be same as the "North Up" icon. (agree 25/10/17) And the arrow should not be overhead. Because user may mistake "Head Up" (for discussion and testing with users – 25 Oct 17)			
To select True Motion mode	True Motion	TM	**TM**
To select Relative Motion mode	Relative Motion	RM	**RM**
To select ship centred mode	Centred	CENT	
To select ship off centred mode	Off centred	OFF CENT	
To perform True Motion reset	TM reset	TM R	**TM R**

Could be misinterpreted with the True Motion Relative (vectors) function – further discussion and testing (25 Oct 17)

To select range	Range	RANGE	
To perform Range up (for example, from 3nm to 6nm)	Up	UP +	
To perform Range down (for example, from 6nm to 3nm)	Down	DN -	
To identify the "heading line" off position	Heading Line Off	HL OFF	
To toggle Range Rings on and off	Range Rings	RR	(IEC)

Above - This icon should be same as table E.4of IEC 62288 Ed.2. Because the user is already familiar with this icon (agree 25/10/17)

To set Variable Range Marker	Variable Range Marker	VRM	**VRM**
To set Electronic Bearing Line	Electronic Bearing Line	EBL	**EBL**
To control simultaneous measurement of range and bearing	Electronic Range and Bearing Line	ERBL	**ERBL**
To perform Target Acquire	Acquire	ACQ	**ACQ**
To perform selection (for example, target or chart object)	Select	SEL	
To call up the information associated with an object by cursor pick on its symbol	Pick report	PICK	
To perform target cancellation (or to put an AIS target to sleep)	Cancel	CNCL	
To perform cancellation of all targets (or to put all AIS targets to sleep)	Cancel all	CNCL ALL	
To acknowledge an alert	Acknowledge	ACK	**ACK**
To silence alerts	Silence	SIL	
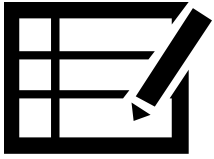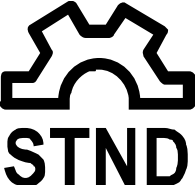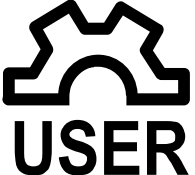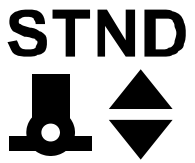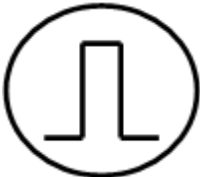
To record an event	Record event	REC EVENT	
To select standard settings (standardized configuration is defined in appendix 4)	Select standard	STND CONF	DEF OR STND
To select user settings	Select user	USR	USER
To save user settings	Save user	SAV USR	SAVE
To select standard display for chart	Standard Display	STND DISP	STND
To execute Trial Manoeuvre	Trial manoeuvre	TRIAL	T
To toggle Day/Night/Dusk mode	Day / Night	DAY / NT	

Table 2: Control of Radar functions

Explanation	Term	Abbreviations	Icon (Hot Key)
To select "radar stand-by"	Standby	STBY	
To select short pulse position of the pulse length selection control	Short Pulse	SP	
To select medium pulse position of the pulse length selection control	Medium Pulse	MP	*[Insert Symbol] (not agreed 25/10/17)*
To select long pulse position of the pulse length selection control	Long Pulse	LP	
To set tuning control	Tune	TUNE	
To set gain control	Gain	GAIN	
To set anti-clutter rain control	Rain	RAIN	
To set anti-clutter sea control	Sea	SEA	
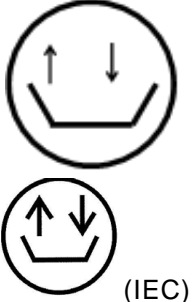
To select performance monitor	Performance Monitor	MON	(IEC)
Comment above - Arrows of this icon are too small. Should be corrected from "MON" to "PM" (agree 25/10/17) This icon should be same as table E.5 of IEC 62288 Ed.2. Because the user is already familiar with this icon (agree 25/10/17)			

Table 3: Control of Chart display functions

Explanation	Term	Abbreviation	Icon (Hot Key)
To show accuracy related symbols	Accuracy	Not applicable	Not applicable
Selector for viewing group layer	All isolated dangers	Not applicable	Not applicable
	Archipelagic sea lanes	Not applicable	Not applicable
	Boundaries and limits	Not applicable	Not applicable
	Buoys, beacons, aids to navigation	Not applicable	Not applicable
	Cautionary notes	Not applicable	Not applicable
Chart boundary shown	Chart boundary	Not applicable	Not applicable
Selector for viewing group layer	Chart scale boundaries	Not applicable	Not applicable
To show contour labels	Contour label	Not applicable	Not applicable
Date-dependant objects	Date dependent	Not applicable	Not applicable
Deep contour	Deep contour	Not applicable	Not applicable
Selector for viewing group layer	Display base	Not applicable	Not applicable
Selector for viewing group layer	Drying line	Not applicable	Not applicable
Use four shades	Four shades	Not applicable	Not applicable
Selector for full light sector lines	Full light lines	Not applicable	Not applicable
Show date dependent object	Highlight date dependent	Not applicable	Not applicable
Show symbol for INFORM and NINFOM	Highlight info	Not applicable	Not applicable
Show symbol for TXTDSC, NTXDS and PICREP	Highlight document	Not applicable	Not applicable
Selector for viewing group layer	Important text	Not applicable	Not applicable
	Magnetic variation	Not applicable	Not applicable
	Miscellaneous	Not applicable	Not applicable

Show national language NOBJNM, text group 2	National language	Not applicable	Not applicable
Selector for viewing group layer	Other text	Not applicable	Not applicable
Selection for point object style	Paper chart / Simplified symbols	Not applicable	Not applicable
Selection for line style	Plain / Symbolized boundaries	Not applicable	Not applicable
Selector for viewing group layer	Prohibited and restricted areas	Not applicable	Not applicable
To select safety contour	Safety contour	Not applicable	Not applicable
Depths in safety area shown, soundings in safe area shown	Safe depths shown	Not applicable	Not applicable
To select safety depth	Safety depth	Not applicable	Not applicable
To turn SCAMIN off	Scale min	Not applicable	Not applicable
Selector for viewing group layer	Seabed	Not applicable	Not applicable
Shallow contour	Shallow contour	Not applicable	Not applicable
To show shallow pattern	Shallow pattern	Not applicable	Not applicable
To show isolated dangers in shallow waters	Shallow water dangers	Not applicable	Not applicable
Selector for viewing group layer	Ships' routing systems and ferry routes	Not applicable	Not applicable
	Spot soundings	Not applicable	Not applicable
	Submarine cables and pipelines	Not applicable	Not applicable
	Tidal	Not applicable	Not applicable
Use two shades	Two shades	Not applicable	Not applicable
Selector for displaying unknown objects	Unknown	Not applicable	Not applicable
To highlight objects which have undergone modification	Update review	Not applicable	Not applicable

Table 4: Control of chart functionality
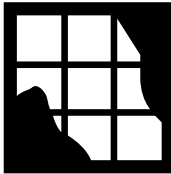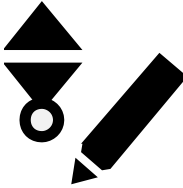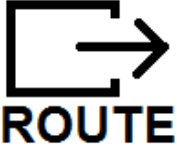
Explanation	Term	Abbreviations	Icon (Hot Key)
To select a date or date range for displaying all chart objects active at that date and time	Display date	DISP DATE	
To toggle latitude/longitude grid	Grid	GRID	
To perform manual update	Manual update	MAN UPD	
To toggle radar overlay	Radar overlay	RADAR OVR	

Table 5: Database functions
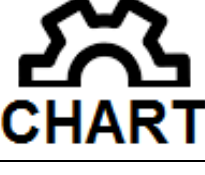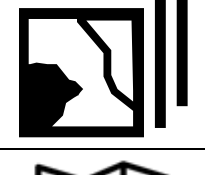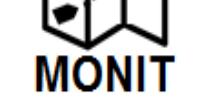
Function	Term	Abbreviation	Icon (Hot Key)
To import ENC	Import Chart	IMPORT CHART	Not applicable
To review ENC updates	Update review	UPD RVW	Not applicable
To view ENC update summary report	Update summary	UPD SUM	Not applicable
To view graphical index of ENC charts	Graphical index	GRAPH INDX	Not applicable
To view ENC update log	Update log	UPD LOG	Not applicable
To view ENC Update Status Report	ENC Update Status Report	ENC UPD STATUS	Not applicable
To view ENC Management Report	ENC Management Report	ENC MGT REP	Not applicable

Table 6: Route plan and monitoring functions

Function	Term	Abbreviation	Icon (Hot Key)
To export route plan	Export Route	Export	
To import route plan	Import Route	Import	
To set own-ship look ahead	Own ship look-ahead	LOOK AHEAD	Not applicable

Icons and terminology for groups of functions (Shortcuts)

Table 7: Groups of functions

Group of functions	Term	Abbreviation	Icon (Shortcut)
To set collision avoidance limits and other target-related parameters (including CPA, TCPA, etc.)	Target control	TGT CTRL	TGT
To set radar controls (including tunings, anti-clutter, etc.)	Radar control	RADAR CTRL	RADAR
To set chart related limits and other chart-related parameters (including safety contour, safety depth, areas with special conditions, own ship check area, etc.)	Chart control	CHART CTRL	CHART
To set trial manoeuvre parameters	Set Trial	SET TRIAL	TRIAL
To add or remove information from the ECDIS display. (This icon will provide access to the functionality included in table 3).	Chart display	DISP	
To provide additional mariner's information	User chart	USR CHT	USER
To access route plan settings	Route plan	ROUTE PLAN	PLAN
To access route monitoring settings	Route monitoring	ROUTE MON	MONIT

To access chart database management	Chart management	CHART MGMT	

Appendix 2

Logical grouping of information ("essential information blocks")

Introduction

This appendix defines clusters of related navigational information that shall be displayed together on the user interface, to enable the user to quickly locate and react to essential navigation information.

This appendix does not specify where the clusters of information should appear on the screen, or the order in which the individual information elements should be grouped.

Essential information blocks

Navigation (Own ship information)

COG: <value / sensor status> <unit> | <sensor source>
SOG: <value / sensor status> <unit> | <sensor source>
HDG: <value / sensor status> <unit> | <sensor source>
STW: <value / sensor status> <unit> | <sensor source>
<LAT value> | <LON value> | <sensor source> | < sensor accuracy>

Date and Time

<Date> | <Time> | <Time Zone>

Route

To WPT: <WPT name>
BRG to WPT/BRG to WOL/Leg Course: <bearing>
DIST to WPT/DIST to WOL: <distance>
TTG: <time>
XTD: <value>
Radius: <value>
Next leg course: <value>

TTG first, in order to have a high SA concerning the time left on the current leg. – Norway
Further research being conducted on groupings and locations will be considered for inclusion.

Further groupings and order of information to be added through testing, research and development of this appendix. This appendix is anticipated to grow (agree needs further testing 25/10/17).

Appendix 3

List of functions that must be accessible by single or simple operator action

Introduction

Where the equipment provides the functions listed in the table below, access shall be as defined as in the table. A requirement for information to be presented on single operator action may alternatively be met by a permanent indication.

Single operator action is defined as "A procedure achieved by no more than one hard-key or soft-key action, excluding any necessary cursor movements, or voice actuation using programmed codes.

Simple operator action is defined as "A procedure achieved by no more than two hard-key or soft-key actions, excluding any necessary cursor movements, or voice actuation using programmed codes."

(Both definitions taken from IMO resolution MSC.252(82)).

Requirements

Table 1: Existing requirements
(IEC 62388:2012, IEC 62288:2014, IEC 61174:2015)

[will reference in each function for example, select ECDIS Standard Display, IEC 61174:2015 clause 4.3.3 and IEC 62288:2014 clause 6.3.3.1] (agree 25/10/17 CIRM will provide a list of references.)

Function	Equipment	Access
Select ECDIS Standard Display	ECDIS	Single operator action
Remove radar (image and tracked target), AIS and other navigational information overlaid over the ENC chart.	ECDIS	Single operator action
Select route monitoring display covering own ship's position	ECDIS	Single operator action
Select default ECDIS settings	ECDIS	Single operator action
Present AIS filter criteria	ECDIS	Single operator action
Present excluded MSI coverage areas and message categories	ECDIS	Single operator action
Present date (or date range) of date dependent ENC objects	ECDIS	Single operator action
Select AIS target information	ECDIS	Simple operator action
Remove chart data	Radar	Single operator action
Reset VRM origin	Radar/ECDIS	Simple operator action
Reset EBL origin	Radar/ECDIS	Simple operator action
Reset ERBL origin	Radar	Simple operator action
Reset Parallel Index line to own ship's heading	Radar	Simple operator action
Remove user defined maps	Radar	Simple operator action

Function	Equipment	Access
Select default radar settings	Radar	Single operator action
Select presentation mode (radar, chart and other navigation information)	Radar/ECDIS	Simple operator action
Remove AIS Area Notice	Radar/ECDIS	Single operator action
see IMO Circ SN.1/Circ.289 for info on area notice (25 Oct 17)		
Remove additional information (including information for route planning, route monitoring, information overlays and supplementary navigation tasks)	ECDIS	Simple operator action

Table 2: New requirements

Function	Equipment	Access
Set panel illumination	Radar/ECDIS	Simple operator action
Set display brilliance / Toggle Day /Night mode	Radar/ECDIS	Simple operator action
Select ECDIS mode	INS	Simple operator action
Select Radar mode	INS	Simple operator action
Select Conning display mode	INS	Simple operator action
Select CAM-HMI as defined in Bridge Alert Management (BAM) (for example as required by INS)	INS	Simple operator action
Select North Up display	Radar/ECDIS	Simple operator action
Select ship's Head Up display	Radar/ECDIS	Simple operator action
Select ship's Course Up display	Radar/ECDIS	Simple operator action
Select True Motion mode	Radar/ECDIS	Single operator action
Select Relative Motion mode	Radar/ECDIS	Single operator action
Select Ship centred mode	Radar/ECDIS	Single operator action
Should be reconsidered Single/Simple operator action requirement for ECDIS functions from "Select True Motion mode to "Perform True Motion reset". (check what is intended 25/10/17)		
Select Ship off centred mode	Radar/ECDIS	Simple operator action
Perform True Motion reset	Radar/ECDIS	Single operator action
Select range	Radar/ECDIS	Simple operator action

Perform Range up	Radar/ECDIS	Single operator action
Perform Range down	Radar/ECDIS	Single operator action
Temporarily suppress the "heading line"	Radar	Simple operator action
Toggle Range Rings on and off	Radar/ECDIS	Simple operator action
Start Variable Range Marker adjustment	Radar/ECDIS	Simple operator action
Start Electronic Bearing Line adjustment	Radar/ECDIS	Simple operator action
Start Electronic Range and Bearing Line adjustment	Radar/ECDIS	Simple operator action
Perform Target Acquire	Radar	Simple operator action
Select tracked target	Radar/ECDIS	Simple operator action
Call up the information associated with an object by cursor pick on its symbol	ECDIS	Simple operator action
Perform target cancellation (or to put an AIS target to sleep)	Radar/ECDIS	Simple operator action
Perform cancellation of all targets (or to put all AIS targets to sleep)	Radar/ECDIS	Simple operator action
Acknowledge an Alert	Radar/ECDIS	Single operator action
Silence alerts	Radar/ECDIS	Single operator action
Record an event	ECDIS	Simple operator action
Set Trial Manoeuvre on	Radar	Simple operator action

Appendix 4

Standard and user settings

User settings

A facility shall be provided to store and recall user-specific settings to suit the conditions at hand. At least two such configurations shall be available to be stored for recall. Selection for recalling a stored configuration shall be followed by an action to confirm the selection.

Standard settings

A facility shall be provided to apply a set of standard settings to return the equipment to a known state.

ECDIS standard settings

The table below lists the standard settings for ECDIS.

Table 1: ECDIS control settings configured in response to "Default" selection

Function	Setting
Display category	ECDIS Standard display
Chart related selector: Accuracy	Off
Chart related selector: Date dependent objects	current date
Chart related selector: Highlight date dependent	Off
Chart related selector: Full light lines	Off
Chart related selector: Highlight info	Off
Chart related selector: Highlight document	Off
Chart related selector: Unknown	On
Chart related selector: Scale min	Off
Chart related selector: Shallow pattern	Off
Chart related selector: Shallow water dangers	On
Chart related selector: Contour labels, if provided	Off
Chart related selector: Four shades, if provided	Off
Chart related selector: National language, if provided	Remain unchanged
Chart related selector: Paper chart / Simplified symbols	Paper chart
Chart related selector: Plain / Symbolized boundaries	Plain
Chart related selector: Text group layer	Important text

Function	Setting
Selected sea area	Around own ship with appropriate off-set
Range	3 NM
Orientation	True motion, north-up
True motion reset	10 % from display edge
Geodetic datum, if selectable	WGS84
Manual updates	If applied, i.e. displayed if available
Mariner's notes	If applied, i.e. displayed if available
Selected route	Last selected route, including route parameters
Past track	On
Past track length, if selectable	12 h
Past track time-labels	On, 30 min
Look-ahead time	6 min
Any edit window (for example route plan)	Exit
Position data source	remain unchanged
Safety contour	remain unchanged
Safety depth	remain unchanged
Cross track limit	remain unchanged
Graphical indication of crossing safety contour during route planning, if selection provided	On
Graphical indication of prohibited areas, areas with special conditions and navigational hazards during route planning, if selection provided	On
Distance to prohibited areas, areas with special conditions and navigational hazards	remain unchanged
Graphical indication of crossing safety contour during route monitoring, if selection provided	On
Graphical indication of prohibited areas and areas with special conditions during route monitoring, if selection provided	On
Graphical indication of navigational hazards during route monitoring, if selection provided	On
Object highlight, selected object, track display from log	Cleared from display
Cursor pick	Closed

Function	Setting
Any additional window (dual view, 3d, tides, etc.)	Closed
Any additional information layer, proprietary layer (weather, tides, AML, etc.)	Cleared from display
Chart update, Chart information exchange	Aborted
Colour differentiation test diagrams	Closed
Update review	Off
Chart 1	Closed
Units	m, NM, kn
Crossing a navigational hazard in route monitoring mode	Caution
Vector time (length)	6 min
Vector mode	True
Vector stabilization	Ground
Symbol for target association, if provided	AIS
Collision warnings, if provided	ON (limits, CPA = 2 NM; TCPA = 12 min)
Radar and AIS target association, if provided	ON
Radar and AIS target association primacy	radar
AIS target filtering, if provided	target range = 6 NM target CPA = 4 NM target TCPA = 24 min target display = Off sleeping target display = Off AtoN display = On SART display = On repeated target display= Off
AIS true target outline	Off
Display of Radar image overlay, if provided	Off
Display of Radar tracked targets, if provided	On
Display of AIS reported targets, if provided	Off
Target past positions, if provided	Off
Target trails, if provided	Off
Lost target warning, if provided	Off
Lost target warning range, if provided	12 NM

Function	Setting
AIS interrogation, if provided	Off
Own ship true outline	Off
LOP source indication	Off
User selected time for warning escalation	60 s
Suppression of indication of user selected MSI messages based on first character of NAVTEX code field, if provided	Remain unchanged
Suppression of indication of user selected messages based on time and distance from own ship, monitored route or planned route	No
Brightness and contrast controls, if software controlled	Calibrated setting

Radar standard settings

The table below lists the standard settings for Radar.

Table 2: Radar control settings configured in response to "Default" selection

Function	Setting
Band	X-band, if selectable
Gain and anti-clutter functions (Sea, Rain)	Automatically optimized, where provided or leave manual controls set "as is"
	There are several radar manufacturers which have not got a good auto function when it comes to tuning the radar. It should thus not be put in auto, as this must be a conscious choice by the navigator so that he/she is aware of it. This requires testing, analysis, and feedback from experts- tbc (agree leave comment 25/10/17)
Tuning	Automatically optimized where provided
Range	6 NM

Fixed range rings	Off
VRMs	One VRM on, 0.25NM
EBLs	One EBL on
Parallel index lines	Off or last setting, if applied
Display mode of the radar picture	True motion, north-up
Stabilization Sea/Ground	Ground (SOG, COG)
Off-centring	Appropriate look-ahead
Target trails	On, 6 minute (same as vector)
Past positions	Off
Radar target tracking	Continued
Vector mode	Relative
Vector time	6 min
Automatic radar target acquisition	Off
Graphical AIS reported target display	On
Radar and AIS Target fusion	Association on
Operational alerts (except collision warnings)	Off
Collision warnings	On (limits CPA 2 nm; TCPA 12 min)
Display of maps, navigation lines and routes	Last setting
Display of charts	Off

Additional notes on what else may need to be considered for the Appendices
(Decision of 25/10/17 to keep information here but to consider where in the guideline it should be placed)

Navigation related terminology, Icons, and functions

The majority of symbols and terminology is previously defined, however there are specific functions and commonly used workflows in electronic navigation equipment that can be further defined and developed. This appendix will build on the standardization delivered through IEC 62288 and MSC 191(79). It may offer new symbols and of terminology and/or abbreviations….

Anything included in this appendix should be specific to the equipment covered by S-Mode. Standardization of frequently used icons, symbology, and workflows is aligned to the standardization design principles. The following terminology and icons should be used as a standardized library for use in electronic navigation equipment.

[This appendix is aimed at including …………]

- Standardized terminology and symbology for and look ahead, anti-grounding, guard zone, grounding alarm

- Verify route, check route, scan route, validation

- XTE, XTD

- Over zoom, over scale

- SCAMIN, scale filter, conditionally displayed features

- Tools section of menu

- Fixing and line of position icons

- Tuning functions

- Brilliance and gain

- Mode change, or switch between systems

- Display orientation

- Range symbols, where the vary

- Cancel target tracking

- Predicted position and curved heading

- Different icons and symbols for the modes of INS equipment and or ECDIS, and changing between the different mandated functions of INS and ECDIS.

- When overlaying radar, or other additional layer to the chart.

- Import and export of data

- Icons to indicate systems status

- Different elements of the set up menu

Through user feedback and testing, the following functions of electronic navigation equipment require further standardization:

- Cross Track Distance (XTD)/ Cross Track Error (XTE) information (naming needs to be standardized, as does icon/ symbol)

  o [should be presented visually so that the mariner can recognize the limit of the cross track corridor, and its position relevant to the vessel. Distance should be measured from track to the vessel location and indicate where it is increasing or decreasing. XTD/ XTE should be measured in standard units;

  o colour, shading, texture should be used to visually differentiate between safe/ pre-scanned water and un-scanned areas; and

  o it should be easy to differentiate by alarm and warning for when the vessel is approaching limits of XTD].

- Function - Look ahead Function (may also be known as anti-grounding, guard zone, safety frame….)

  o name of this function needs to be standardized, as does the shape, icon, symbol for this function;

  o this function should always be visually represented ahead and around the vessel shape to visually illustrate the area that it is scanning;

  o it should be set from the same location/ menu and appear the same, including shape, colour, etc.;

  o the shape should indicate clearly if it is based on time, or distance;

  o the function should clearly indicate when it is not scanning ahead for dangers, such as when in RCDS mode;

  o dangers should be highlighted within the scan cone/ shape and alarm to the user; and

  o dangers should visually alert the user by enlargement, pulsing, colour, or a clear symbol.(at present the look ahead does not have a defined shape, nor is it required to cover the stern of the vessel. It is a function of INS and ECDIS that varies significantly. Some systems do cover the whole vessel and its predicted position, but not all. There is no universal or standard convention).

- Standard settings and information such as

  o North and head up
  o Rel and True Vectors
  o Mode indicators
  o Depth

     ○   Heading, vs COG, vs CMG, and the order they appear in
     ○   Speed through water vs over ground

Consistency through grouping of essential information

This section includes the grouping, ordering and sequence of logical information between systems, equipment, and different manufacturers.

User feedback and testing can be used to build a section whereby grouping, order, scaling and display of essential information can deliver improved usability. This is closely aligned to the user's recognition, not recall.

Areas where logical and consistent grouping of information can be standardized across systems and equipment are listed below. These clusters of information promote recognition of information, and an instantaneous understanding of such information through recognition.

Some examples may include:

The way in which the route monitoring functions of ECDIS and INS displays track related information.

The order and means of which anti-collision information is presented, and the prioritization of such information.

Waypoint monitoring information and display conventions. Order, location, display conventions, units are important in this area.

The way in which cross track distance, look ahead, anti-collision data is presented.

The order of ships dynamic information is presented.

Trackpilot countdown information when included in an INS.

How text and information appears on the screen:

- Standard method for recognizing what Mode the system is in, i.e. SAR, MOB, DR, EP, GNSS, manoeuvring?, coastal, pilotage?

- The order and comparative size in which essential information will appear on the screen

- The size of information noting its importance and ease of recognition

- Position and sensor information

- The colour of information such as Red for port of track XTD to improved recognition

- What information is displayed?

- How integrity of sensor information is displayed (traffic light, accuracy scale, colour, and graphical information)

- How many decimal places are used for different measurements?

- The prioritization of information such as:

  o distance to go (DTG);
  o distance to Destination (DTD);
  o distance to Waypoint or wheel over point; and
  o time information (for example zone and UT).

- How monitoring information on XTD warnings and alarms if fitted is displayed, where it is displayed and in what format.

- Critical vs informative warning and alarm information – this will require further exploration and developmental work through user testing.

- Method of setting essential safety related information such as:

  o look ahead or anti grounding cone;
  o UKC alarm;
  o draught, safety depth, UKC; and
  o Vectors (true and relative).

- The order in which anti- collision information appears and its location on the screen.

- The ability and method of accessing anti- collision information easily and quickly

  o Determining the difference between AIS, Radar information and fusion of info.

For Navigation control information that supports the safe control of the vessel, the information presented needs to be clear, concise, recognizable, useable, and enable safe decision making and movement of the ship:

- How to discriminate between the information that is essential for the safe movement of the vessel such as:

  o current and next leg information including info from the passage plan and that set by the user;

  o the direction of turn indication;

  o Colour co-ordination of information that supports safe navigation; and

  o standard method for the display of information as in MSC 252(83) 7.5.2.1.

- Standardized colour scheming for the improvement of recognition

- Standard display for integrity information

- Standardized means of identifying difference between Alarm, Warning and Caution

- Standardized methods or display techniques for drawing attention

- Methods of acknowledgment in a standardized way

- Possible exploration of standardizing and improving consequence analysis?

- Focus on essential information related to alert management

- Expand on consistency as described in the Para 21 of the INS Performance Standard (MSC 252(83))

Standardization of data and status information as prescribed in MSC 252(83) and will focus on the following areas:

- the way in which mode and status data information is displayed and used such as text size, colour co-ordination, order of presentation, etc.;

- the standardization of ships data including static and dynamic data;

- standardized display of measured motion data and set values;

- safety-related information;

- standardization of "Master Display" etc.;

- Cross Track Distance information should be presented visually so that the mariner can recognize the limit of the cross track corridor. It should use the same unit of measure and visually resembles a safe area through colour, texture;

- look ahead should visually present the area that is being scanned by the system and illustrate the safety area. It should be set from the same location and appear the same, including shape, colour, etc.;

- dangers should appear in the "look ahead" in the same manner. It should be easily recognized when it is set to distance ahead and time ahead; and

- look ahead should indicate when Scan is not possible for example 'flash' when in RCDS mode to indicate that it is not providing a scan ahead function.

Standard and default settings

A set of standardized setting, refined from user feedback and testing, that provide a default or expected standard setup and functionality for the user. This may include:

Some chart enabled features as a standard base settings
Orientation

Units for distance, speed, heading

Settings for look ahead functions, default track length, etc.

Default System Status

Safety settings- may be based on vessel max draft???

Colours and shading for dangers to navigation

Vector length, direction true or relative

Correlated information between RADAR, ECDIS, AIS, Chart?

CPA alarms- standard

**This list is an indication of relevant references used/consulted in drafting this guideline:
IMO references:**

1	MSC.1/Circ.1512	Guideline on Software Quality Assurance and Human-Centred Design for e-navigation
2	MSC.232(82)	Adoption of the revised performance standards for Electronic Chart Display and Information Systems (ECDIS)
3	MSC.252(83)	Adoption of the revised performance standards for Integrated Navigation Systems (INS)
4	MSC.302(87)	Adoption of performance standards for bridge alert management
5	MSC.191(79)	Performance standards for the presentation of navigation-related information on shipborne navigational displays
6	MSC/Circ.982	Guidelines on ergonomic criteria for bridge equipment and layout
7	MSC.1/Circ.1394/Rev.1	Generic guidelines for developing IMO goal-based standards
8	SN.1/Circ.243/Rev.1	Amended guidelines for the presentation of navigational-related symbols, terms and abbreviations
9	SN.1/Circ.265	Guidelines on the application of SOLAS regulation V/15 to INS, IBS and bridge design

ISO/IEC Standards:

10. ISO 9241:110 – Dialogue Principles

11. ISO 8468 – Bridge Layout and Equipment

12. ISO 9241-210-2010 Ergonomics of HSI HCD for interactive systems

13. ISO 20282 Part 1 Ease of operation of everyday

14. ISO 20282 Part 3 Ease of Use of everyday products – Test Methods

15. IEC 61174(ECDIS)

16. IEC 61924(INS)

17. IEC 62388(Radar)

18. IEC 62288 (Maritime Nav and Rad equip)

19. IEC 61174 Testing standard for type approval of ECDIS

20. IEC 60945

21. ISO/IEC 25010 System and software quality models (QIU model is included)

22. ISO/IEC 25060 General framework for usability-related information

23. ISO/IEC 25062 Common industry format (CIF) for usability test reports

24. ISO/IEC 25063 User needs report

25. ISO/IEC 25064 Context of use description

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