

SUB-COMMITTEE ON NAVIGATION,
COMMUNICATIONS AND SEARCH AND
RESCUE
4th session
Agenda items 6,7,8, 22(part)

NCSR 5/WP.4
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**GUIDELINES FOR THE HARMONIZED DISPLAY OF NAVIGATION INFORMATION
RECEIVED VIA COMMUNICATIONS EQUIPMENT (ITEM 6)**

GUIDELINES ON STANDARDIZED MODES OF OPERATION, S-MODE (ITEM 7)

**DEVELOP GUIDANCE ON DEFINITION AND HARMONIZATION OF THE FORMAT AND
STRUCTURE OF MARITIME SERVICE PORTFOLIOS (MSPS) (ITEM 8)**

ANY OTHER BUSINESS (ITEM 22 – PART)

Draft Report of the Navigation Working Group

1 INTRODUCTION

1.1 As instructed by the Sub-Committee, the Navigation Working Group (the Group) met from 19 to 22 February 2018 under the chairmanship of Mr. Moises De Gracia (Panama).

1.2 The Group was attended by representatives from the following Member States:

AUSTRALIA	NEW ZEALAND
BRAZIL	NORWAY
CANADA	NIGERIA
CHINA	PERU
DENMARK	PHILIPPINES
FINLAND	POLAND
FRANCE	PORTUGAL
GERMANY	REPUBLIC OF KOREA
GREECE	RUSSIAN FEDERATION
ICELAND	SINGAPORE
INDIA	SWEDEN
INDONESIA	TURKEY
IRELAND	UKRAINE
JAPAN	UNITED KINGDOM
MARSHALL ISLANDS	UNITED STATES
NETHERLANDS	

1.3 The following United Nations and specialized agencies were also represented:

WORLD METEOROLOGICAL ORGANIZATION (WMO)

1.4 The Group was also attended by observers from the following intergovernmental organizations:

INTERNATIONAL HYDROGRAPHIC ORGANIZATION (IHO)

1.5 The session was also attended by observers from the following non-governmental organizations in consultative status:

INTERNATIONAL CHAMBER OF SHIPPING (ICS)
INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)
INTERNATIONAL ASSOCIATION OF MARINE AIDS TO NAVIGATION AND
LIGHTHOUSE AUTHORITIES (IALA)
COMITE INTERNATIONAL RADIO-MARITIME (CIRM)
BIMCO
INTERNATIONAL MARITIME PILOTS' ASSOCIATION (IMPA)
INTERNATIONAL ASSOCIATION OF INSTITUTES OF NAVIGATION (IAIN)
INTERNATIONAL FEDERATION OF SHIPMASTERS' ASSOCIATIONS (IFSMA)
INTERTANKO
CRUISE LINES INTERNATIONAL ASSOCIATION (CLIA)
WORLD SAILING
INTERNATIONAL TRANSPORT WORKERS' FEDERATION (ITF)

2 TERMS OF REFERENCE

2.1 The Navigation Working Group, taking into account decisions of, and comments and proposals made in plenary, should:

Agenda item 6 – GUIDELINES FOR THE HARMONIZED DISPLAY OF NAVIGATION INFORMATION RECEIVED VIA COMMUNICATIONS EQUIPMENT

- .1 taking into account the outcome of the discussion under the related agenda items 7 and 8, consider the draft guidelines for the harmonized display of navigation information received via communications equipment, using the annex to document NCSR 5/6 as the basis to work from, taking into account document NCSR 5/6/1, and advise the Sub-Committee, as appropriate;

Agenda item 7 – GUIDELINES ON STANDARDIZED MODES OF OPERATION, S-MODE

- .2 consider document NCSR 5/7 and provide comments and advice, as appropriate;
- .3 consider which e-navigation related output would most benefit of having a Correspondence Group in preparation for NCSR 6, bearing in mind that only one Correspondence Group could be established on one single e-navigation related output, and advise the Sub-Committee, including draft Terms of Reference for this Correspondence Group, as appropriate;

Agenda item 8 – DEVELOP GUIDANCE ON DEFINITION AND HARMONIZATION OF THE FORMAT AND STRUCTURE OF MARITIME SERVICE PORTFOLIOS (MSPS)

- .4 further develop the draft Guidance on the definition and harmonization of the format and structure of maritime services within the Maritime Service Portfolio (MSP), as contained in the annex to document NCSR 5/8, taking into account documents NCSR 5/8/3 (IALA), NCSR 5/22/3 (IEC) and, as appropriate, the related IALA Guideline on the specification of e-navigation technical services, with a view to finalization of the draft guidance by HGDM 2;
- .5 consider the need for the template for maritime services, and advise the Sub-Committee, as appropriate;
- .6 further consider the scope of the Organization's lead role on e-navigation, including what management and control functions the Organization should assume, and the consequences this would entail for the Organization;
- .7 consider the proposed draft terms of reference for the second meeting of the Harmonization Group on Data Modelling, using the text in the annex to document NCSR 5/8/1 as the basis to work from;

Agenda item 22 – ANY OTHER BUSINESS

- .8 finalize the update of the e-navigation Strategy Implementation Plan (SIP) using the annex of document NCSR 5/22/1 as the basis to work from;
- .9 identify potential new outputs, including timelines, to progress the work on e-navigation, in line with the five (prioritized) e-navigation solutions; and
- .10 submit a report on Thursday, 22 February 2018.

3 GUIDELINES FOR THE HARMONIZED DISPLAY OF NAVIGATION INFORMATION RECEIVED VIA COMMUNICATIONS EQUIPMENT
Agenda item 6

3.1 The Group, as instructed, considered document NCSR 5/6 (Norway) containing the draft *Guidelines for the harmonized display of navigation information received via communications equipment*, as well as document NCSR 5/6/1 (Ukraine).

3.2 The Group, as instructed by plenary, discussed the further development of the draft Guidelines bearing in mind the interrelated work under agenda item 7 (Standardized mode of operation, S-mode) and agenda item 8 (Guidance on the definition and harmonization of the format and structure of maritime services within the Maritime Service Portfolio (MSP)).

3.3 Given the abovementioned interrelation with agenda items 7 and 8, the Group discussed whether the draft Guidelines were mature enough to be considered for approval and if so, if they added any value to those which are supposed to read them, including shipowners and equipment manufacturers.

3.4 Some delegations were of the view that the draft Guidelines were not sufficiently developed and may therefore have no effect, or could even cause confusion to the industry.

3.5 The large majority of the Group, however, was of the view that the work reflected in the draft Guidelines was useful as an interim solution and a good indication of the future way to harmonize navigation information received from communications equipment.

3.6 The Group also recognized that conclusion of the work on the Guidelines would free up resources of the Sub-Committee to consider and focus on other prioritized e-navigation solutions. Hence the Group expressed strong views on the need to facilitate the finalization of the Guidelines after completion of the work on S-mode and MSPs and included some text to this effect in the cover sheet of the draft Interim Guidelines. The need for finalization of the Interim Guidelines was also included in the draft updated SIP (see section 6 below).

3.7 In discussing the section of the draft Guidelines on *Presentation of navigation-related information*, the Group, despite of being in favour of deleting the provisions on *Alterations to own ship route*, acknowledged that this text may be useful at a later stage and therefore agreed to retain the draft text in this report, as set out below:

Alterations to own ship route

- .1 *Graphical presentation of alterations received from external source should be clearly displayed and differentiate from the monitored route.*
- .2 *It should be possible to display additional information of the alterations received from an external source on demand. (At least the source of the alterations received).*

3.8 Concerns were raised by some delegations on the potential consequences in relation to Additional Displays (paragraph 7.2 of annex 1) that may be used in order to manage increasing amounts of information received by ships and to ensure segregation of information on different displays. It was argued that this section could be construed as a new carriage requirement for additional displays requiring type-approval. Furthermore concerns were raised regarding the appropriateness of relying on additional displays for information management on the navigation bridge and the fundamental need to ensure that Maritime Services, when implemented, included a means of ensuring that only relevant information, in manageable volumes, was provided to ships by service providers. After some discussion the group modified the text and agreed that the purpose of raising the issue of additional displays was only an indication of future needs to manage large amount of data by providing additional displays and not intended to introduce a new carriage requirement.

3.9 Concerns were also expressed with regards to paragraph 1.2 of annex 1 where it is stated that the guidelines supplemented resolution MSC.191(79), as that may be premature at this stage.

3.10 The Group, in considering the document NCSR 5/6/1 (Ukraine), noted the value of formalizing in an IMO instrument addressing the integration of VHF/MF/HF DSC in an information display.

3.11 The observer from the IEC updated the Group on the status of the current IEC standards on DSC controllers which are required to provide the functionality to send the information to navigation equipment. However, so far no IMO instruments had been developed that required that the DSC information needed to be displayed on navigation equipment.

3.12 The Group further noted that the proposal in document NCSR 5/6/1, while addressing a crucial aspect, was only part of a wider solution needed to allow information received from any communications equipment to be routed onto navigation equipment. It was therefore agreed to consider incorporating the Ukraine proposal at a later stage, prior to finalizing the guidelines.

3.13 The Group noted that some of the provisions in the draft Guidelines were left in square brackets by the intersessional correspondence group and agreed to the deletion of those parts of the draft where no agreement had been reached, or which had not been finalized, including the deletion of the appendices. It was the common understanding that the work on the appendices would continue and be included in the final Guidelines.

3.14 After further consideration, the Group finalized the draft interim guidelines and prepared the associated draft MSC circular, as set out in annex 1.

4 GUIDELINES ON STANDARDIZED MODES OF OPERATION, S-MODE

Agenda item 7

4.1 The Group, as instructed, considered document NCSR 5/7 (Australia et al) containing the draft Guidelines on standardized modes of operation, S-mode.

4.2 The Group noted some inconsistencies in the use of some terms in the draft Guidelines and the observer from CIRM offered to address those when taking part in the work to finalize the Guidelines, including ensuring consistent use of non-mandatory language.

4.3 In addressing the concerns raised in plenary with respect to the purpose of the standardization being to limit the time for training and familiarization, the Group concurred that paragraph 2 of the draft Guidelines could be misconstrued and therefore agreed to delete the second sentence in paragraph 2 of the draft Guidelines which reads: " "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".

4.4. The Group also noted that the ECDIS mode was not referenced in the revised performance standards for INS (resolution MSC.252(83)) and therefore references to ECDIS mode in the draft Guidelines was incorrect. It was further noted that the logical grouping in Appendix 2 of the draft Guidelines may not be appropriate to equipment other than ECDIS and radar, such as conning and other navigation equipment. CIRM confirmed to address these observations when taking part in the finalization of the draft Guidelines for submission to NCSR 6.

4.5 The Group agreed that with the completion of the S-mode guidelines, a consequential revision to SN.1/Circ.243/Rev.1 on *Amended guidelines for the presentation of navigational-related symbols, terms and abbreviations* was necessary. Hence the Group agreed that the intersessional Correspondence Group should also be tasked with the revision of SN.1/Circ.243/Rev.1.

4.6 The Group agreed to the draft Guidelines and, given the little change to the text, did not reproduce them in this report.

4.7 As instructed by plenary, the Group discussed what e-navigation item would warrant the establishment of an intersessional correspondence group, bearing in mind that only one such group could be established on one single e-navigation-related output. After consideration of the matter the group concluded that it was most appropriate to establish an intersessional Correspondence Group on S-mode with the following draft terms of reference:

The Correspondence Group for the development of *Guidelines on the standardized mode of operation of navigation equipment, S-Mode*, under the coordination of Australia¹ should:

- .1 further develop the Guidelines on standardized mode of operation, S-mode, using the annex to document NCSR 5/7 as the base document, taking into account documents NCSR 5/INF.13 and NCSR 5/INF.15, and relevant IHO documents;
- .2 while carrying out the work in .1, prepare consequential updates to SN.1/Circ.243/Rev.1;
- .3 take into account the instructions and comments at NCSR 5, including the interrelated e-navigation items (NCSR 5/23 - report of the Sub-Committee);
- .4 consider the findings of user verification testing in the drafting of the S-Mode guidelines, as described in document NCSR 5/7, paragraphs 11 and 14;
- .5 consider a more appropriate name for the guidelines given the preferred approach to have an always-on form of standardization; and
- .6 submit to NCSR 6 the following:
 - a. a report of the correspondence group's work,
 - b. a consolidated draft S-Mode guidelines, and
 - c. consequential draft amendments to SN.1/Circ.243./Rev.1.

5 DEVELOP GUIDANCE ON DEFINITION AND HARMONIZATION OF THE FORMAT AND STRUCTURE OF MARITIME SERVICE PORTFOLIOS (MSPS)

Agenda item 8

5.1 The Group, as instructed, considered document NCSR 5/8 (Secretariat) containing the draft Guidance on definition and harmonization of the format and structure of maritime service portfolios (MSPs), as well as documents NCSR 5/8/3 (IALA) and NCSR 5/22/1 (Australia and Norway).

5.2 The Group made some minor modification to the draft Guidance and the template, including a change to the title of the template.

5.3 The Group also considered the proposal by IALA (NCSR 5/8/3) and, after some modification, agreed that the description of the specification of e-navigation technical services was useful to be included and inserted the text in appendix 2 of the draft Guidance.

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5.4 In discussing the need for the template for maritime services, the Group agreed unanimously that the use of a standardized high-level template was a means for harmonization of maritime services and thus retained the template in the draft Guidance.

5.5 In this respect the discussion at HGDM 1 was recalled and the Group agreed that, in order to facilitate progress on the draft guidance, it was important to test the draft template first so as to gain some experience in reviewing those draft templates before finalizing the draft guidance. The Group therefore proposed to invite domain coordinating bodies to submit descriptions of the maritime services that are within their remit using the current draft template (appendix 1 of annex 2) to the HGDM 2, if established.

5.6 The observer from IALA informed the Group that they had already developed a draft descriptions of maritime services for VTS Services using the draft template and introduced it to the Group. While it was noted that this was still work in progress, the Group concurred that it would serve as a good example and tool for other domain coordinating bodies. Therefore the Group agreed to include the draft descriptions of the VTS Services in annex 3.

5.7 In order to reach out to domain coordinating bodies, the Group agreed to invite the Sub-Committee to include, in its report, the call for the following domain coordinating bodies to submit descriptions of the maritime services that are within their remit, using the current draft template, to the HGDM 2, if established:

- IALA for maritime service No.1 (VTS Information Service (INS))
- IALA for maritime service No.2 (Navigational Assistance Service (NAS))
- IALA for maritime service No.3 (Traffic Organization Service (TOS))
- IHMA for maritime service No.4 (Local Port Service (LPS))
- IHO for maritime service No.5 (Maritime Safety Information Service (MSI))
- IMPA for maritime service No.6 (Pilotage service)
- IHO for maritime service No.11 (Nautical Chart Service)
- IHO for maritime service No.12 (Nautical Publications Service)
- WMO for maritime service No.13 (Ice Navigation Service)
- WMO for maritime service No.14 (Meteorological Information Service)
- IHO for maritime service No.15 (Real-time hydrographic and environmental information Service)

5.8 For the following maritime services the domain coordinating bodies have not yet been identified:

- Maritime service No.7 (Tug service)
- Maritime service No.8 (Vessel Shore Reporting)
- Maritime service No.9 (Telemedical Assistance Service (TMAS))
- Maritime service No.10 (Maritime Assistance Service (MAS))
- Maritime service No.16 (Search and Rescue Service)

5.9 The Group also considered the need for establishing a robust future process for the review of the descriptions of the maritime services using the templates received after finalization of the Guidance to ensure the harmonization of maritime services (the first review of the draft templates received, as described in paragraph 5.4, would serve only as a means to finalize the template and Guidance). In this respect, the Group discussed at length the role of the Organization, particularly in respect to the extra workload and responsibilities. However, it became clear that at the current stage it was not feasible for the Group to quantify the extra workload and extent of the review process for received descriptions of the maritime services that are within their remit using the templates from domain coordinating bodies.

5.10 In discussing a possible way forward, the Group welcomed a proposal by the delegation of the Netherlands providing a schematic flow chart illustrating the review process for the descriptions of the maritime services using the templates received from domain coordinating bodies, as well as associated draft criteria for each step of the process.

5.11 The Group agreed on the usefulness of the schematic flow chart as it was a good depiction of a possible future process for ensuring harmonization of digitalized maritime services. The flow chart should not be regarded to establish the HGDM permanently but was a first proposal and to be considered work in progress. It also illustrated the leadership and coordinating role of the Organization in respect to e-navigation while also taking into account the limited capacity of the Secretariat and the workload for the Organization. The proposed sequence of the harmonization process can be described as follows:

The Secretariat receives the descriptions of the maritime services from domain coordinating bodies, using the template, and provides them to the HGDM who would undertake the detailed review for subsequent consideration and approval by the NCSR Sub-Committee. The approved descriptions of the maritime service would serve national administrations and service providers as reference for the harmonized implementation of the maritime service in question. If this process was to be agreed to, then criteria needed to be developed describing each step of the process including the responsibilities for the various bodies involved. The draft flow chart and a first proposal for associated draft criteria are set out in annex 4.

5.12 The delegation of Japan expressed its appreciation for the proposal by the delegation of the Netherlands, particularly the work flow (annex 4) and agreed, in general to the necessity of prescribing the work flow for harmonization of maritime services. However, the consequence of the work flow required careful consideration and the delegation of Japan therefore invited the delegation of the Netherlands to submit an input paper on the work flow to the second session of the IMO/IHO Harmonization Group on Data Modeling (HGDM 2), if established.

Draft terms of reference for the second meeting of the HGDM

5.13 In discussing the draft terms of reference for the second meeting of the HGDM, as set out in the annex to document NCSR 5/8/1, the Group agreed to some changes as set out in annex 5.

5.14 In order to allow for the HGDM 2 to make progress on the development of the draft Guidance, the Group proposes to relax the deadline for submissions from domain coordinating bodies on descriptions of the maritime services that are within their remit, using the current draft template, to HDGM 2, if established, until 16 October 2018.

6 ANY OTHER BUSINESS – UPDATE OF THE IMO E-NAVIGATION STRATEGY IMPLEMENTATION PLAN (SIP)
Agenda item 24

6.1 The Group, as instructed, considering the Update of the IMO e-navigation Strategy Implementation Plan (SIP), as set out in document NCSR 5/22/1 (Australia and Norway).

6.2 The Group considered the SIP with particular focus on the tables therein and the timeline for each of the tasks. As instructed, the Group identified the status, the need and the prioritizations for current and envisaged future tasks.

6.3 The revised table 8 was re-organized and updated and a new column was added to indicate the prioritization of each tasks, ordered by high, medium and low. In considering a timeline for those tasks for which no proposals for an output had been received or announced, the Group agreed that it was not feasible to identify a timeline for completion and therefore did not include a timeline for tasks for which no output proposal had been received.

6.4 The Group noted the statement of the delegation of Canada proposing, given that some maritime services had not yet an identified coordinating body and that the update of the SIP provided a good opportunity, to add the maritime service on Aids to Navigation (AtoN) under the remit of IALA.

6.5 After some further modifications to the draft updated SIP, the Group agreed to the text as set out in annex 6.

6.6 The Group considered the status of the SIP and agreed that it should be elevated to have a wider visibility so as to facilitate the process of prioritization of e-navigation tasks and encourage new output proposals from member States. The Group concurred that a stand-alone document would provide for the aforementioned objectives and agreed to request the Sub-Committee to forward it to the Committee for approval as an MSC Circular, requesting the Secretariat to prepare a cover sheet.

7 ACTION REQUESTED OF THE SUB-COMMITTEE

7.1 The Sub-Committee is invited to:

- .1 note the discussion on the development of *Interim guidelines for the harmonized display of navigation information received via communications equipment* (paragraphs 3.2 to 3.9);
- .2 endorse the draft *Interim Guidelines for the harmonized display of navigation information received via communications equipment* and the associated draft MSC circular, for approval by the Committee (paragraph 3.14 and annex 1);
- .3 note the discussion on the development of *Guidelines on standardized modes of operation, S-Mode* (paragraphs 4.2 to 4.4);
- .4 note that the completion of the S-mode guidelines requires consequential revision to SN.1/Circ.243/Rev.1 (paragraph 4.5);
- .5 agree to the Group's proposal to establish an intersessional correspondence group to continue the development of the draft *Guidelines on standardized modes of operation, S-Mode* with the associated terms of reference (paragraph 4.7);
- .6 note the progress made on the development of the draft *Guidance on the definition and harmonization of the format and structure of maritime services within the Maritime Service Portfolio (MSP)* (paragraphs 5.2 to 5.4 and annex 2);
- .7 agree to retain the template for maritime service descriptions in the draft *Guidance* (paragraph 5.4 and appendix 1 of annex 2);

- .8 note the description of the VTS services developed by IALA, using the draft template, which would serve as a good example and tool for other domain coordinating bodies (paragraph 5.6 and annex 3);
- .9 agree to invite domain coordinating bodies to submit the description of maritime services under their remit, using the draft template, to HGDM 2, if established, and to include the invitation in the Sub-Committee's report (paragraph 5.7);
- .10 note the Group's deliberations on establishing a robust future process for the review of the received description of maritime services, using the templates, after finalization of the Guidance (paragraph 5.9);
- .11 agree, in principle, to establish the review process on the descriptions of maritime services, using the template, and in accordance with the schematic flow chart and its clarification (paragraphs 5.9 to 5.11 and annex 4);
- .12 agree to the draft terms of reference for the second meeting of the IMO/IHO Harmonization Group on Data Modelling (HGDM) (paragraph 5.13 and annex 5);
- .13 agree to relax the deadline for submissions from domain coordinating bodies to HGDM 2, if established, in respect to submissions of maritime service descriptions (paragraph 5.14);
- .14 note the Group's discussion on the prioritization of each e-navigation task in the updated IMO e-navigation Strategy Implementation Plan (SIP) (paragraphs 6.2 to 6.3);
- .15 agree to the updated IMO e-navigation Strategy Implementation Plan (SIP) (paragraph 6.4 and annex 6);
- .16 agree to forward the draft updated SIP to the Committee for approval as an MSC Circular (paragraph 6.5);
- .17 approve the report in general.

ANNEX 1

MSC.1/Circ.XXXX
25 May 2018

DRAFT MSC CIRCULAR

**INTERIM GUIDELINES FOR THE HARMONIZED DISPLAY OF NAVIGATION
INFORMATION RECEIVED VIA COMMUNICATION EQUIPMENT**

1 The Maritime Safety Committee, at its ninety-ninth session (MSC 99) (16 to 25 May 2018), approved the *Interim Guidelines for the harmonized display of navigation information received via communication equipment*, prepared by the Sub-Committee on Navigation, Communications and Search and Rescue at its fifth session (NCSR) (19 to 23 February 2018), as set out in the annex.

2 The Maritime Safety Committee, at its ninety-ninth session, noted the interrelated work on e-navigation currently undertaken by the NCSR Sub-Committee, particularly on the development of *Guidance on the definition and harmonization of the format and structure of maritime services within the Maritime Service Portfolio (MSP)* and the development of *Guidance on the standard mode of operation, S-mode* and confirms, in principle, on revising the annexed *Interim guidelines for the harmonized display of navigation information received via communication equipment* once the aforementioned interrelated work has been completed.

3 Member Governments are invited to bring the present circular to the attention of all parties concerned.

ANNEX

1 Purpose

1.1 This document provides interim guidance on the display of navigation-related information received by communications equipment. It aims to ensure that information is displayed in an efficient, reliable and consistent format, in a manner that is easily interpreted to support decision-making.

1.2 These Guidelines supplement resolution MSC.191(79) *Performance standards for the presentation of navigation- related information on shipborne navigational displays* in regard to the presentation of navigation information received via communication equipment.

1.3 The use of these Guidelines will ensure that navigation information received via communications equipment is displayed in a harmonized manner on the ships' navigational bridge.

2 Scope

2.1 The availability of electronic data that enhances the safe and efficient navigation of ships necessitates that shipborne systems capable of presenting this information to the user should do so in a harmonized and readily assimilated way.

2.2 This information will be presented to shipborne users through a combination of primary navigational displays, such as ECDIS, radar and INS, together with any additional display facilities that may be considered appropriate to assist the safe and efficient navigation of the ship.

2.3 Reception of Maritime Safety Information (MSI) by means of direct printing has always been an important part of the GMDSS. However, it is clear from user requirements, such as those gathered during the user needs analysis of e-navigation, that there is a need to portray such information in a harmonized way on appropriate navigation displays.

2.4 To ensure effective decision-making and safe navigation, the proper integration and presentation of information received via communication equipment is essential.

3 Application

3.1 This Guideline is applicable to the information obtained from, but not limited to, communications equipment defined in SOLAS.

4 General presentation requirements

4.1 Human-Centred Design (HCD)

- .1 The type and volume of information displayed should be appropriate to the voyage phase and should not overload the user. Therefore, this Guideline should be read in conjunction with MSC.1/Circ.1512 in order to ensure that measures to prevent information overload take into account relevant human-centred design principles.

- .2 The type and level of information displayed should complement the user's capabilities, and should take into consideration human factors principles as specified in section 5 (see MSC.1/Circ.1512, paragraph 6). Higher levels of integration mean that systems should be carefully evaluated to ensure that complexity and workload are compatible with the ability of the user (OOW).
- .3 In designing systems and equipment that will incorporate navigation information received via communications equipment, due consideration should be given for the ability of the operator to manage information. Any information received requires careful prioritization based on human-centred design principles.
- .4 The receipt, display and use of navigation information received via communications equipment should be tested by the user and incorporated into the HCD process.
- .5 Navigation information received via communications equipment should be manageable through the application of user preferences. The system should assist the user in reducing clutter and in enhancing situational awareness.
- .6 The integration of navigation information received via communications equipment should not distract from the user's primary task of maintaining the safe navigation of the ship.

4.2 Display of information

- .1 Navigation information received via communications equipment should be displayed in a timely, unambiguous and harmonized manner.
- .2 Navigation information received via communications equipment should be displayed according to resolution MSC.191(79) and, if applicable, based on the relevant S-100 based Product Specification.
- .3 Information should, where applicable, be geo-located and integrated with other navigation and charted information. Where possible, the graphical geo-located display of areas, points, lines and other information received via communications equipment should assist the user in developing greater situational awareness.
- .4 The additional display of information from communications equipment must not degrade the primary information on a particular display but contribute to the overall navigational safety of the ship.
- .5 Data should be appropriately filtered according to the selected scale/display range of the display. Only critical information should be displayed at all ranges, if practicable.
- .6 The source of the received information should be readily identifiable.
- .7 Where navigation information indicate a direct risk to the ship's planned route and or movement, the information should be indicated as an alert. This may be determined based on the safety settings available within the electronic navigation equipment such as ECDIS, radar or INS.

5 Functional requirements for presentation of information

5.1 General

- .1 Information that has been received by onboard communication equipment should include an integrity testing process.

5.2 Data Routing

- .1 The user should be able to route data to another display if fitted,
- .2 There should be a clear indication of the routing of data in use.
- .3 Routing should allow the user to route the data according to the navigational situation and task.

5.3 Selection and filtering

- .1 Navigation information should be displayed in such a manner that information overload is prevented. Selectable functions should be included to allow for display of only the required information necessary for safe navigation and the task at hand.
- .2 It should be possible to select and filter (categorize) of information and data received on board in accordance with urgency and sea area.
- .3 Information relevant to planned route and situation should be identified using adequate filtering processes.
- .4 Means should be available enabling the user to select the information needed for the current operational task and situation.
- .5 There should be a clear indication of the selection and filtering parameters in use.
- .6 It should be possible to manually select the information for automatic presentation on the navigational displays.
- .7 Information that presents a danger to safe navigation and requires an alert should be identified.

5.4 Prioritization

- .1 It should be possible to prioritize information and data received on board. This should be prioritized in accordance with urgency and sea area.

5.5 Indication of new information

- .1 An alert or indication should draw attention to the presence of new and/or relevant information related to the ship's movements or operating area.

6 Presentation of navigation-related information

6.1 MSI or other geo-referenced locations impacting safety

- .1 New information should be indicated on a route planning, route monitoring or collision avoidance display by an icon or symbol and an alert should be given.
- .2 It should be possible to present additional information upon selection (request) via pick-report functionality on ECDIS and radar displays or INS tasks route monitoring, route planning and collision avoidance.

7 Operational display

7.1 General

- .1 Information received from communications equipment should not obscure the primary information of an operational display.
- .2 The information received from communications equipment should be clearly distinguishable as being additional information that has been added to the display.

7.2 Possible additional display – INS task "navigation status and data display" – or other means

- .1 The increasing amount of data received from communications equipment may require an additional display on board;
- .2 Human-Machine-Interface (HMI) for displaying and evaluating received information as well as for specifying filtering, routing, and presentation parameters (selection for presentation) should be considered.
- .3 The user should be able to view information items and their filtering, routing, and selection (presentation) properties.
- .4 The user should be able to edit the filtering, routing, and selection (presentation) properties of information items.

ANNEX 2

DRAFT MSC RESOLUTION

**GUIDANCE ON THE DEFINITION AND HARMONIZATION OF THE FORMAT AND
STRUCTURE OF MARITIME SERVICES WITHIN THE MARITIME SERVICE PORTFOLIO
(MSP)**

[1 The Maritime Safety Committee, at its 101st session (XX May/June 2019),

Xx This guidance should be reviewed in order to ensure that future Maritime Services follow a uniform general format and structure data model, based on the S-100 standard.

[MORE TO COME]

XX Member States are invited to apply and bring the annexed Guidance to the attention of Administrations, national and regional providers of maritime safety information (MSI), ship equipment manufacturers, shipowners, operators and all other parties concerned for application to all....]

ANNEX

[1 Introduction

1.1 Modern shipping relies on a large amount of data and information to safely navigate from berth to berth. A very important set of information is promulgated as maritime safety information (MSI), as defined in resolution A.705(17)*, as amended. MSI include navigational warnings, meteorological information and other urgent safety-related information. In addition to being safety-relevant, marine information services are used for optimizing voyage routes, which can include the best passage through ice, a security-risk area or avoiding the known path of marine mammals. Route optimization may also include taking advantage of favourable winds and currents and engine loads may be adjusted accordingly.

1.2 To assess the dynamic effects mentioned above, the ship's bridge team needs up to date information on all relevant marine information along the planned route, as well as information on any security risks, wave heights, swell and any information affecting the safe transit. The information flow also comprises ship to shore communications, particularly prior to entering the coastal waters of a State, a ship is usually requested to provide details of her voyage, cargo, crew and passengers on board, advising on the next port of call and other information. Ship to ship, ship to shore and shore to shore information exchange enable new services and technologies to improve safety and efficiency of shipping. All those marine information services are being considered to be transitioned from conventional transmission methods to contemporary digital technologies.

1.3 IMO as the lead organization for implementing e-navigation has agreed to take on the oversight work on providing marine information services for ships in a unified, digital format. Such marine information have been termed "Maritime Services" and this guidance envisages to harmonize the structure and formats of digitally-transmitted data and information and to display them in a harmonized way on the ship's bridge or shore-based facilities broadcasting and receiving marine information.

1.4 This Guidance envisages to harmonize the format and structure of a sub-set of marine information, namely Maritime Service Portfolios (MSPs). There are currently 16 Maritime Service Portfolios described in the SIP, each of them covering a certain service available to the ship (see NCSR 1/9 for the full list of MSPs). For example, MSI are promulgated as required by the functional requirement of the GMDSS, an internationally (WWRNWS and WWMIWS) and nationally coordinated network of broadcasts providing necessary information to ships for safe navigation, received by equipment which automatically monitors the appropriate transmissions, displays the information relevant for the voyage and provides a print capability.

1.5 MSI are transmitted using narrow band direct printing (NBDP) over NAVTEX, SafetyNet and HF within the GMDSS. As part of the current modernization of the GMDSS, new technologies are being considered that use digital information exchange, opening up the possibility to receive MSI in a more user-friendly way. Hence this Guidance is intended to provide an all-encompassing guidance to ensure that the format and structure for each of the data elements for each MSP follows the same structure and format. Therefore, SIP requires that all data models are S-100 conformant. The S-100 standard specifies the method for data modelling, developed and overseen by the International Hydrographic Organization (IHO). Based on the S-100 data modelling method a common maritime data structure (CMDS) is to be developed which forms the basis of developing specifications for digital data products.

* A.705(17), as amended on *Promulgation of maritime safety information (MSI)*. MSC.1/Circ.1310/Rev.1 on *Revised Joint IMO/IHO/WMO Manual on Maritime Safety Information (MSI)*.

1.6 This Guidance set out the general requirements for a service data model which, when a S-100 product specification exists for an MSP (e.g. S-124 on product specification for navigational warnings), then such S-xxx structures should be used and each data item of the service.

1.7 As not all operational data can be easily incorporated into the CMD5 based on a S-100 data model, this guidance provides a harmonized solution for the format and structure of all data models used as part for of a Maritime Service. Future Maritime Services will need to follow the format and structure of data elements already described in this Guidance.

2 Purpose

2.1 The purpose of this Guidance is to foster and to harmonize the implementation of the maritime services by providing templates for the description of these operational services, including references to their associated technical services, which should be used to implement them.

[3 Three levels of control or leadership

Overarching coordination level

3.1 The Organization, in its role as leading e-navigation development and implementation, is responsible for guiding the establishment and harmonization of information and data transfers relating to maritime services. This includes providing leadership and overarching control and harmonization of information and data transfers relating to maritime services through the provision of guidance.

Functional and operational level

3.2 International organizations propose the definition of a specific maritime service, using the template as provided in annex [1], to the Organization and manage and maintain the agreed definition through harmonized operational and technical specifications.

3.3 International organizations as domain coordinating bodies, such as the IHO, IALA, WMO and others, provide guidelines to stakeholders and provide domain management. This should include description of current and future operational maritime services and identification and specification of associated technical services.

3.3bis When domain coordinating bodies for maritime services are unknown or may not exist, specifications derived from other maritime services may assist with harmonizing operational and technical specifications.

Service level

3.4 Service providers – Member States and authorities within Member States (e.g. port authorities, Hydrographic Offices, SAR services, etc.)]

4 Application of the Guidance

4.1 This Guidance is recommended for Administrations, international organizations as domain coordinating bodies and service providers.

4.2 For further information on a specific maritime service, other relevant standards and publications should be taken into account.

5 Information on associated technical services

[5.1 The interoperability of technical services is ensured by a coordinated approach of the domain coordinating bodies to define needed communication means and data models.]

[5.2 Technical services should follow the appropriate guidance and product specification developed by the appropriate domain coordinating body and, where appropriate, be based on the S-100 framework with associated S-XXX product specifications.]

5.3 Appendix 2 provides the Description for the harmonized specification of e-navigation technical services and can be used by domain coordinating bodies to develop their own technical specification.

6 Terminology used

For the purpose of the Guidance, unless expressly provided otherwise:

- .1 *Maritime Service Portfolio (MSP)* ~~defines and describes the~~ a set of operational and technical Maritime Services and associated technical services provided in digital format ~~their level of service provided by a stakeholder in a given sea area, waterway, or port, as appropriate. Hence, a "Maritime Service Portfolio" may also be construed as a set of "products" provided by a stakeholder in a given sea area, waterway, or port, as appropriate.~~
- .2 *[Common Maritime Data Structure (CMDs)]* is based on the S-100 Universal Hydrographic Model of the International Hydrographic Organization. The S-100 standard is a method for data modelling by the International Hydrographic Organization (IHO). Based on the S-100 data modelling method, a common maritime data structure (CMDs) is to be developed which forms the basis of developing specifications for digital data products.]
- .3 *Maritime Service.....*
- .4 *Operational Service...* [means the specification of a service from the operational perspective. This covers purpose and application of the service, stakeholders, regulations and processes and information exchanged. Operational Services are implemented with the assistance by a set of Technical Services.]
- .5 *Technical Services...* [are developed to implement the operational services. For example, the promulgation of tidal information from shore to ship by broadcasting data which is structured and encoded as specified by the IHO's S-104 standard. For Technical Services a specification should be given which contains services overview, service identification, operational Context, Service Data Model, Interface Specification including communication mechanisms, Dynamic Behaviour for example]

- .6 S-100[(to be provided by IHO – Anthony Pharaoh) is a data modelling, encoding and portrayal framework that uses and extends the ISO 19000 series of geographic standards for hydrographic, maritime and related issues. By using the framework, specific data models and portrayals are defined by a set of "S-100 Product Specifications" which are named by 3-digit numbers (S-XXX).]
- .7 [A *Data Model* is an abstract model that organizes elements of data and standardizes how they relate to one another and to properties of the real world entities. For instance, a data model may specify that the data element representing an Aid to Navigation (AtoN) specification be composed of a number of other elements which, in turn, represent the position, colour and lights of the AtoN and define its owner.]

APPENDIX 1

TEMPLATE FOR A MARITIME SERVICE IN DIGITAL FORMAT

This template should be used by international organizations to describe the maritime services that are within their remit. Descriptions of maritime services provided to IMO using this template will enable IMO to exercise leadership and overarching oversight and to provide a globally harmonized list of maritime services.

To ensure a standardized approach in the development and implementation of maritime services, the content should include a general description of the operational services, and a reference to associated technical services that will enable the exchange of information in digital format.

1. Title of the maritime service (Maritime Service number)

2. Submitting Organization

3. Description of the maritime service

Stating the exact nature and scope of the maritime service in accordance, if applicable, with existing IMO instruments. Additional details might be added for clarity as required.

4. Purpose

What is the purpose of the maritime service?

What value does it bring to its intended stakeholders?

Is the maritime service compliant with regulatory requirements, if applicable?

In the case that the maritime service covers existing services, a description of the steps required to transition from analogue to digital information promulgation must be included.

5. Operational approach

How is the purpose of the maritime service achieved, taking into account existing guidance of the Organization and other international bodies?

6. User needs

Describe the user needs the maritime service addresses. In so doing make reference to any relevant IMO instruments and, where applicable, include one or more use cases.

7. Information to be provided

List the information elements the maritime service provides. The information elements will be the starting point for data modelling, as part of the technical services to access, promulgate or exchange the information.

8. Associated technical services

Using the table below list existing or potential technical services associated with this maritime service.

Name	ID (MRN) *	Description <i>(incl. measure for quality assurance[‡])</i>	Architect(s)	Standardization body

9. Relation to other maritime services

Describe any relationships between this and other maritime services such as interdependencies or areas of overlap. This section should clarify the nature of interdependencies, overlaps and provide recommendations for their resolution.

* Maritime Resource Name (MRN); see <http://mrnregistry.org>

‡ MSC.1/Circ.1512 on Guideline on Software Quality Assurance and Human-Centred Design for e-navigation or others, as appropriate.

APPENDIX 2

Description for the harmonized specification of e-navigation technical services

1 Maritime Services are high-level/operational services, such as organizing a tug service, VTS service or providing MSI information. Maritime Services are implemented by a set of Technical Services. For harmonization, the Maritime Services are described by using a common template, as set out in Appendix 1 uniformly. Part of this template are the references to technical services relating in a standardized way to a specific Maritime Service. For harmonization these technical services should be specified.

2 The specifications is split into three parts:

- a **service specification**;
- a **service design description**; and
- a **service instance description**.

3 The (technical) **service specification** covers the technical/digital service on a general level to implement the maritime services. The service specification is still technology-agnostic. The service specification should include the following information:

- MRN ID for the service specification;
- reference to the Maritime Services which make usage of the Technical Services;
- the operational context of the service in (e.g. requirements, use cases);
- the service interface descriptions (operations, parameters);
- the information provided and used by the service (the service data model);
- the dynamic behaviour of the service (sequence of operations, behaviour description); and
- author of the service specification (organization, contact person).

4 A (technical) service specification will have one or several associated (technical) **service design descriptions**. Each technical design describes how the service is implemented using specific technologies. Service design descriptions should include the following information:

- MRN ID for the service design description;
- reference to the service specification;
- description of the chosen technologies (data processing, communication technologies, infrastructure, networks, etc.);
- detailed description of the used data structures and types (service physical data model, encoding);

- mapping of the used data structures to the service specification's service data model; and
- author of the technical design (organization, contact person).

5 A (technical) service design will have one or several associated (technical) **service instance descriptions**. Each instance description is a reference (endpoint) to a specific service provider for this specific service following the specific design description. The instance description also contains additional information such as coverage area for the service providers' instance of the service. A service instance includes the following information:

- MRN ID for the service instance description;
- reference to the service technical design (and thus, implicitly, to the service specification);
- information about service provider;
- access/information (e.g. URL, frequencies etc.); and
- geographical coverage information.

6 The relationship between the different levels of service descriptions are shown in this example for a VTS service:

Maritime Service	Technical Service specification	Technical service design description	Technical service instance description
VTS service	Inter VTS information exchange	Web service using REST	Provided by Sound VTS
			Provided by Helsinki VTS
		Web service using SOAP	Provided by Zandvliet VTS
		Other technical design for VTS information exchange	Another instance of that design provided by someone somewhere
	Route exchange ship to shore	Some technical design	Some instance
		Another design	Another instance
	Another technical VTS service
Another Maritime service
...

7 IALA has developed a detailed Guideline for the specification of e-navigation technical services in accordance with the abovementioned structure and information elements (ref. IALA Guideline G1128). The Guideline is intended for use by engineers and developers that are responsible for making specifications of technical e-navigation services.

ANNEX 3

IALA DRAFT TEMPLATE

TEMPLATE FOR A MARITIME SERVICE

This is an example of the template brought to IMOS NCSR5 from IMO/IHO HGDM describing MSP's 1 to 3.

General description of Maritime Services (MSP) is included in the original Draft Guideline on MSP, Digitizing Maritime Services.

Comments from VTS committee WG 1. task 1.1.4 are included.

1. MSP1 VTS INFORMATION SERVICE (INS)

1.1 SUBMITTING ORGANISATION

IALA VTS committee

1.2 DESCRIPTION OF THE MARITIME SERVICE

To establish a VTS Contracting Government or Governments or the competent authority should set the objectives for the types of services, areas and the categories of vessels required or expected to participate.

The VTS Information Service is defined by IMO as "a service to ensure that essential information becomes available in time for on-board navigational decision-making" (Res. A.857(20)).

The *information service* is provided by broadcasting information at fixed times and intervals or when deemed necessary by the VTS or at the request of a vessel, and may include for example reports on the position, identity and intentions of other traffic; waterway conditions; weather; hazards; or any other factors that may influence the vessel's transit. (IMO Res. A.857(20))

In some VTS areas the provision of VTS Information Service is not limited to SOLAS vessels and it should include all participating vessels. Other means to promulgate safety critical information to vessels unable to receive digital information may be considered.

IALA Guideline No. 1089 defines the "Provision of Vessel Traffic Services" (INS, TOS & NAS).

Table 1 Examples of the types of information that may be provided by the VTS operating an Information Service

Information related to:	Examples:
Navigational situations (including traffic and route information)	<ul style="list-style-type: none"> Position, identity, destination of vessels and the intention of other traffic; Amendments and changes in promulgated information concerning the VTS area such as boundaries, procedures, radio frequencies, reporting points; the mandatory reporting of movements; Limited maneuverability that may impose restrictions on the navigation of other vessels, or any other potential hindrances; Suspension or change of routes; etc.

Information related to:	Examples:
Navigational warnings	<ul style="list-style-type: none"> Dangerous wrecks, obstacles not otherwise promulgated, diving operations, vessels not under command, etc.
Meteorology	<ul style="list-style-type: none"> Information that will include the speed and direction of the prevailing wind, direction and height of the waves, visibility, atmospheric pressure, the formation of ice, etc.
Meteorological warnings	<ul style="list-style-type: none"> Gale, storm, tsunami, restricted visibility, etc.
Hydrography	<ul style="list-style-type: none"> Information that will include factors such as the stability of the seabed, sea depth, the accuracy of surveys, tidal ranges, tidal streams, prevailing currents and swell, etc.
Electronic navigational aids	<ul style="list-style-type: none"> The availability of electronic navigational aids such as: GNSS, Loran, DGPS, AIS, RACON etc.
Other information	<ul style="list-style-type: none"> Port information, pilot or tug request, cargo information, health condition, PSC, ISPS etc.

1.3 PURPOSE

An VTS Information Service provides relevant information at appropriate times and on request for the promulgated VTS area. An Information Service involves maintaining a traffic image and allows interaction with traffic and response to developing traffic situations. (IALA Guideline No.1089 defines the "Provision of Vessel Traffic Services" (INS, TOS & NAS))

The purpose is to provide VTS Information Service (INS) digitally to create means to reduce administrative burden and information overload, reduce miscommunication due to external interference, simplify work procedures, and increase navigational safety.

Information provided digitally (non-verbal means) could complement and/or replace verbal/voice communication. The steps to achieve this transition to digital information exchange will vary in different areas and for different types of vessels. Depending on the categories of the Information Service in annex A, (MSP 1, Information Service Template) and its discoverability, new equipment may be required both on board and on shore side. Details about digital information exchange available should be published by the VTS authority.

1.4 OPERATIONAL APPROACH

Information provided digitally (non-verbal means) could complement and/or replace verbal/voice communication.

The digitalization of information will diversify the communication means between shore authorities and vessels and will affect VTS procedures regarding information provision. VTS may no longer be the focal or relay point for all vessel-shore authority-vessel communications or the other way around VTS could have a larger information-coordinating role.

Even though information in the near future could be made accessible directly to vessels, VTS will remain the primary contact with vessels for urgent and important messages, including as a back-up for electronic failure.

1.5 USER NEEDS

In IMO resolution A.857(20) are examples of information that can be provided to vessels. The use case below are based on the information from table 1

1.5.1 USE CASE – VESSEL ARRIVAL

Before the vessel arrives to the VTS area, a data collecting system on board to send all details regarding the arrival via relevant infrastructure to the VTS. The VTS collects the vessel's data directly into its system, and automatically updates the vessel's pre-registered data. Both vessel and VTS use chart systems as a graphic interface to present details that are of interest to the voyage, such as reporting point line and VHF channel.

Upon arrival to the VTS area the vessel use a data collecting system on board, and sends Actual Time of Arrival via relevant infrastructure to VTS.

The example is generic and simplified through an example for description purposes only. Actions and template categories may differ for different countries. *Content in the column named "Template Info (technical)" is pending submissions from relevant stakeholders.*

The categories of services and the associated details are listed in annex 1, MSP1 Information Service template.

Time	Vessel Action	VTS Action	Template Info (category)	Template Info (technical)
01:00	Provides pre-arrival info	Replying with information on weather	Environmental	Annex 1
02:00	Enters VTS Area, provides sailing route	Traffic information to vessels	Traffic and Route information	
02:30	Passes reporting point line	Provides information on current, wave height, etc.	Hydrographical information	
03:00	Requires port information	Provides quay details	Traffic and Route information	
03:30	Passes second reporting point	Provides operational information on AtoNs	Navigation Hazards	
04:00	Vessel along side	Gives information on wind speeds, visibility	Environmental	

1.6 INFORMATION TO BE PROVIDED

See annex 1, MSP1 Information Service template

1.7 ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body
Voyage Information Service	urn:mrn:stm:service:specification:sma:vis	The service supports exchange of voyage plans, text		IEC?

		messages and area messages.		
Weather Service				

To be filled later

NOTE! Annex 1 could be complimented with required information regarding this table

1.8 RELATIONVESSEL TO OTHER MSPS

MSP1 has relationvessels with other MSPs where it affects the VTS:

Examples may be different depending on the coastal state arrangements.

Description	Examples of data that could be of interest for MSP 1
MSP 1 VTS INS	See annex 1, MSP 1, Information Service Template
MSP 2 VTS NAS	See annex 2, MSP 2, Navigation Assistance Service Template
MSP 3 VTS TOS	See annex 3, MSP 3, Traffic Organisation Service Template
MSP 4 Local Port Service	Delays, obstruction, cargo operations, port availability and anchorage area in the port, ISPS state, Marsec level
MSP 5 Maritime Safety Information	All information depending on structure of MSI
MSP 6 Pilotage Service	Pilot orders and updates
MSP 7 Tug Service	Tug order and updates
MSP 8 Vessel Shore Reporting	Notification of arrival, dangerous cargo etc.
MSP 9 Telemedical	Delays
MSP 10 Maritime Assistance Service	Notifications, routing, places of refuge
MSP 11 Nautical Chart Service	Local Area updates, chart updates
MSP 12 Nautical Publication Service	Updates to publication
MSP 13 Ice Navigation Service	Ice routes, ice conditions, ice breaking assistance
MSP 14 Meteorological Service	VTS area weather
MSP 15 Real Time Hydro and Inf Service	Horizontal and vertical Tidal information in VTS area, available water column
MSP 16 Search and Rescue service	Search pattern and vessel of opportunity

2. MSP2 NAVIGATIONAL ASSISTANCE SERVICE (NAS)

2.1 SUBMITTING ORGANISATION

IALA VTS committee

2.2. DESCRIPTION OF THE MARITIME SERVICE

To establish a VTS Contracting Government or Governments or the competent authority should set the objectives for the types of services, areas and the categories of vessels required or expected to participate.

The VTS Navigational Assistance Service is defined by IMO as "a service to assist on-board navigational decision-making and to monitor its effects." (IMO Res.A857(20))

The *navigational assistance service* is especially important in difficult navigational or meteorological circumstances or in case of defects or deficiencies. This service is normally rendered at the request of a vessel or by the VTS when deemed necessary. (IMO Res.A857(20))

IALA guideline 1089 gives guidance on the delivery of the three different types of services provided by a VTS; Information Service (INS), Traffic Organization Service (TOS) and Navigational Assistance Service (NAS).

Table 2 Examples of the types of information that may be provided by a VTS operating a Navigational Assistance Service

Information related to NAS	Examples
Request and identification	<ul style="list-style-type: none"> availability of NAS, start and end of NAS; request for vessel identification such as position, course made good and speed over the ground; status of vessel's equipment; etc.
Navigational information (including position and course information)	<ul style="list-style-type: none"> Examples provided to an individual vessel: provide range and bearing from fixed objects, fairway/channel or way-points; proximity to navigational hazards, etc. provide information related to navigating into a channel/fairway/lane (i.e. track is parallel/diverging/converging with/from/to reference line); etc.
Advice (or instruction)	<ul style="list-style-type: none"> advise (or instruct) a vessel to alter the course, speed; advise (or instruct) to keep clear from area/position, close up/drop back on/from vessels; etc.
Warning	Diverging from the recommended track towards dangerous wrecks, obstacles not otherwise promulgated; diving operations; vessels not under command; etc.

2.3 PURPOSE

The purpose is to provide information related to Navigational Assistance Service (NAS) digitally to create means to reduce administrative burden and information overload, reduce miscommunication due to external interference, simplify work procedures, and increase navigational safety.

Information provided digitally (non-verbal means) could complement voice communications in time critical situations and in addition partly replace voice communications in non-time critical situations.

The steps to achieve this transition to digital information exchange will vary in different areas and for different types of vessels. Depending on the categories of the Navigational Assistance Service in annex 2, (MSP 2, Navigation Assistance Service Template) and its discoverability, new equipment may be required both on board and on shore side. Details about digital information exchange available should be published by the VTS authority.

2.4. OPERATIONAL APPROACH

VTS will remain the primary contact with vessels for urgent and important messages necessary for the decision-making for the vessels, even though information in the near future could be made accessible directly to vessels from other stakeholders. MSP2 Navigational Assistance Service should be delivered only by VTS authorities

Information provided digitally (non-verbal means)-could complement voice communications in time critical situations and in addition partly replace voice communications in non-time critical situations.

Note: Example of time critical situation:

- Risk of grounding; In addition, to voice communications, vessel can be provided with an electronic route recommendation.

Note: Example of non-time critical situation:

- Assist a vessel to an anchoring position; provide the vessel with an electronic route recommendation without voice communications.

The identity of the vessel receiving Navigational Assistance Service should be assured. Also other items listed in the IALA Guideline 1089 On Provision of Vessel Traffic Service, annex B should be taken into consideration for digital transmission of information.

All information related to this service should be displayed in real time. Measures should be taken to ensure that the information is received and acknowledged.

2.5. USER NEEDS

The use case below are based on the information from table 4

The use case is generic and simplified through example for description purposes only. Actions and template categories may differ for different countries. *Content in the column named "Template Info (technical)" is pending submissions from relevant stakeholders.*

For example:

- Pre arrival reporting can be done digitally without voice communication for update of route of voyage plan in order to avoid collisions, groundings and assist in safe navigation.
- The content of the voice communication can be provided digitally and be displayed as text in parallel / in addition to voice communication.

2.5.1. USE CASE VESSEL APPROACHING VTS AREA

Vessel approaches VTS area according to received voyage plan. The VTS application observes and analyses the situation. It alerts the VTS operator, who then confirms that the vessel has deviated from its route. For example based on statistical data/deep learning, the

application then provides decision support to the VTS operator on the next course of action. The VTS operator validates and acknowledges the advice, and informs, warns and if necessary instructs / advises the vessel to change course via voice communication. The proposed solution is also presented on the vessel's own navigation system. The VTS operator confirms that the vessel has changed course accordingly to the solution. The VTS application continues to monitor the vessel's voyage. It will alert the VTS operator if new deviation occurs.

The categories of services and the associated details are listed in annex 2, MSP2 Navigational Assistance Service template.

The use case is generic and simplified through example for description purposes only. Actions and template categories may differ for different countries. *Content in the column named "Template Info (technical)" is pending submissions from relevant stakeholders.*

Time	Vessel Action	VTS Action	Template Info (category)	Template Info (technical)
01:00	Approaches VTS area	Receive voyage plan and monitor vessels progress	Traffic and Route Information	
01:30	Deviates from her route	Informs, warns and advises / instructs the vessel to change course/speed	Navigational advice	
01:35	Changes course	Confirms that vessel has changed course and no longer is in danger		

2.5.2. USE CASE – VESSEL APPROACHES SHALLOW WATERS

The VTS operator concludes that the vessel wanted to make a lee for the pilot boat. Course taken by the vessel would put the vessel into an even worse situation regarding shallow waters. VTS interrupted the boarding operation and gave instruction and guided the vessel into a safe area for the embarkation of the pilot.

The VTS requests that the vessel states its intention in the VTS area. In response the vessel provides its sailing route. In the template, this action is categorized as Navigational information. The VTS gives a warning when the vessel has run into shallow waters, upon which the vessel confirms that the information has been received. In the template, this action is categorized as Navigational warning.

The VTS advises the vessel to change course. The vessel confirms. In the template, this action is categorized as Navigational advice.

The VTS instructs the vessel to alter its course, upon which the vessel confirms. In the template, this action is categorized as Navigational instruction.

Time	VTS Action	Vessel Action	Template Info (category)	Template Info (technical)
00:00	Question: What is your intention?	Provides sailing route	Navigation Information	
02:00	Warning: You are running into danger - shallow waters...	Confirms	Navigational warning	
02:10	Advice: Recommended course to make good...	Confirms	Navigational advice	
02:20	Instruction: Alter course to south-west...	Confirms	Navigational advice	

The VTS application indicate to the VTS operator the situation and suggests an appropriate decision. The VTS operator selects the correct decision from the VTS application and provides it digitally to the vessel .The vessel verifies the decision and takes appropriate action.

2.6. INFORMATION TO BE PROVIDED

See annex 2, MSP2 Navigational Assistance Service template

2.7 ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body
Voyage Information Service	urn:mrn:stm:service:specification:sma:vis	The service supports exchange of voyage plans, text messages and area messages.		IEC?

2.8. RELATION TO OTHER MSPS

MSP2 has relation vessels with other MSPs where it affects the VTS:

Examples may be different depending on the coastal state arrangements.

Description	Examples of data that could be of interest for MSP 2
MSP 1 VTS INS	See annex 1, MSP 1, Information Service Template
MSP 2 VTS NAS	See annex 2, MSP 2, Navigation Assistance Service Template
MSP 3 VTS TOS	See annex 3, MSP 3, Traffic Organisation Service Template
MSP 4 Local Port Service	Delays, obstruction, cargo operations, port availability and anchorage area in the port, ISPS state, Marsec level
MSP 5 Maritime Safety Information	All information depending on structure of MSI
MSP 6 Pilotage Service	Pilot orders and updates
MSP 7 Tug Service	Tug order and updates
MSP 8 Vessel Shore Reporting	Notification of arrival, dangerous cargo etc.
MSP 9 Telemedical	Delays
MSP 10 Maritime Assistance	Notifications, routing, places of refuge

Description	Examples of data that could be of interest for MSP 2
Service	
MSP 11 Nautical Chart Service	Local Area updates, chart updates
MSP 12 Nautical Publication Service	Updates to publication
MSP 13 Ice Navigation Service	Ice routes, ice conditions, ice breaking assistance
MSP 14 Meteorological Service	VTS area weather
MSP 15 Real Time Hydro and Inf Service	Horizontal and vertical Tidal information in VTS area, available water column
MSP 16 Search and Rescue service	Search pattern and vessel of opportunity

3. MSP3 TRAFFIC ORGANIZATION SERVICE (TOS)

3.1. SUBMITTING ORGANISATION

IALA VTS committee

3.2. DESCRIPTION OF THE MARITIME SERVICE

To establish a VTS Contracting Government or Governments or the competent authority should set the objectives for the types of services, areas and the categories of vessels required or expected to participate.

Traffic Organization Service (TOS) is defined by IMO as "a service to prevent the development of dangerous maritime traffic situations and to provide for the safe and efficient movement of vessel traffic within the VTS area" (IMO Res.A857(20)).

The traffic organisation service concerns the operational management of traffic and the forward planning of vessels movements to prevent congestion and dangerous situations, and is particularly relevant in times of high traffic density or when the movement of special transports may affect the flow of other traffic. The service may also include establishing and operating a system of traffic clearances or VTS sailing plans or both in relation to priority of movements, allocation of space, mandatory reporting of movements in the VTS area, routes to be followed, speed limits to be observed or other appropriate measures which are considered necessary by the VTS authority. (IMO Res. A.857(20))

IALA Guideline No. 1089 defines the Provision of Vessel Traffic Services (INS, TOS & NAS).

Table 3 Examples of types of information that may be provided by the VTS within a Traffic Organization Service:

Information related to:	Examples
Traffic clearance	<p>Give authorization under conditional circumstances to a vessel when: prior to or entering a VTS area;</p> <ul style="list-style-type: none">• departing from a berth or an anchorage position within a VTS area;• entering into a fairway within a VTS area; or• prior to commencing a manoeuvre that may be detrimental to safe navigation. <p>Examples of conditions:</p> <ul style="list-style-type: none">• a VTS sailing plan before entering a VTS area;• lock and bridge passage planning;• report position at determined reporting point/line/pilot station;• use a second fairway in case of bad visibility/weather;• use a tug boat in case of strong wind;• dredging or compass swing in confined waterway.
Anchorage	<p>Examples of anchorage situations:</p> <ul style="list-style-type: none">• organizing the movements to/from an anchorage position/area;• assignment of an anchorage position;• assisting vessels into anchorage position.
Enforcement	Examples of enforcement:

	<ul style="list-style-type: none"> • speed limits; • adherence to rules regarding traffic routing measures; • pilotage requirements; • other traffic regulations and possibly local by-laws
Waterway channels (sea, and fairway) management	<p>Examples of management measures:</p> <ul style="list-style-type: none"> • the use of one-way traffic as an alternative of two way traffic, depending on the dimensions of vessel or the weather conditions; • organizing other traffic when a vessel has passed point of no return; • slot management to allocate vessels in a time window; • organizing the traffic concerning vessel dimensions in comparison to fairway restrictions; • instruct vessels when overtaking is not permitted; • establish and organize vessel safety zones in case of particular operations; • establish and organize exclusion zones; • instruct vessels to keep clear from special areas/positions; • organizing the traffic as regards to meteorological, hydrographical or other restrictions such as visibility, wind speed, current, sea state and under keel clearance.

3.3. PURPOSE

The purpose is to provide information related to Traffic Organisation Service (TOS) digitally, to create means to reduce administrative burden and information overload, reduce miscommunication due to external interference, simplify work procedures, and increase navigational safety.

All information provided digitally can complement and/or replace verbal/voice communication and would be distributed in real time to the vessel

The steps to achieve this transition to digital information exchange will vary in different areas and for different types of vessels. Depending on the categories of the Traffic Organisation Service in annex 3, (MSP 3, Traffic Organisation Service template.) and its discoverability, new equipment may be required both on board and on shore side. Details about digital information exchange available should be published by the VTS authority.

Utilization of electronic communication may apply to elements of the Traffic Organization Service that are not implying risky situations. For instance, AIS Application Specific Messages (IMO SN.1/Circ.289) can be used to provide information related to:

3.4. OPERATIONAL APPROACH

A Traffic Organization Service should be responsible for separating traffic in the interest of safety. This separation could be defined in space, time and/or distance.

Enforcement may also be carried out within a Traffic Organization Service where the VTS should monitor adherence to applicable rules and regulations and to take appropriate action where required and within the authority of the VTS. (IALA Guideline 1089 On Provision of Vessel Traffic Service)

Examples:

- Slot management; provide vessels digitally with priority of arrival and distance between two vessels
- Traffic clearance; provide vessels digitally with permission to proceed, impose conditions or deny entry
- Route information; provide vessels digitally with recommended route information
- Traffic information; vessel provide VTS digitally their intentions, such as overtaking of another vessel
- Information regarding restricted or no go area, the content (draft, closed fairway/port/quay etc.) can be provided digitally to vessels without using voice communication.

All information provided digitally can complement and/or replace verbal/voice communication and would be distributed in real time to the vessel

3.5. USER NEEDS

The use case below are based on the information from table 5

The use case is generic and simplified through example for description purposes only. Actions and template categories may differ for different countries. *Content in the column named "Template Info (technical) " is pending submissions from relevant stakeholders.*

3.5.1. USE CASE – VESSEL LEAVES QUAY

Vessel sends planned ETD digitally to VTS where it is presented in the VTS application and the VTS operator takes action and instructs vessel digitally to remain alongside for five more minutes. The instructions are graphically displayed in applications, acknowledged and provided to other traffic via digital and/or verbal means for non MSP-ready vessels. The application alerts operator on upcoming traffic conflicts and advice on a solution, which is acknowledged and transmitted to vessels.

Detailed information can be found in the annex 3, MSP 3, Traffic Organisation Service Template.

Time	Vessel Action	VTS Action	Template Info (category)	Template Info (technical)
00:00	Requests permission to leave quay	Deny clearance. Give permission to leave in five minutes	Waterway management	
02:00	Vessel passing reporting point before entering fairway A	Provides sequence slot due to other traffic	Waterway management	
02:10	Vessel had exceeded speed limit in the fairway	Request to keep speed limit in fairway Speed limit xx knots	Enforcement	
02:20	Requests anchorage	Assign position for anchorage	Waterway management	

3.6 INFORMATION TO BE PROVIDED

See annex 3, MSP 3, Traffic Organisation Service template.

3.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardization Body

3.8 RELATION TO OTHER MSPS

MSP3 has relationvessels with other MSPs where it affects the VTS:

Examples may be different depending on the coastal state arrangements.

Description	Examples of data that could be of interest for MSP 3
MSP 1 VTS INS	See Annex 1, MSP 1, Information Service Template
MSP 2 VTS NAS	See Annex 2, MSP 2, Navigation Assistance Service Template
MSP 3 VTS TOS	See Annex 3, MSP 3, Traffic Organisation Service Template
MSP 4 Local Port Service	Delays, obstruction, cargo operations, port availability and anchorage area in the port, ISPS state, Marsec level
MSP 5 Maritime Safety Information	All information depending on structure of MSI
MSP 6 Pilotage Service	Pilot orders and updates
MSP 7 Tug Service	Tug order and updates
MSP 8 Vessel Shore Reporting	Notification of arrival, dangerous cargo etc.
MSP 9 Telemedical	Delays
MSP 10 Maritime Assistance Service	Notifications, routing, places of refuge
MSP 11 Nautical Chart Service	Local Area updates, chart updates
MSP 12 Nautical Publication Service	Updates to publication
MSP 13 Ice Navigation Service	Ice routes, ice conditions, ice breaking assistance
MSP 14 Meteorological Service	VTS area weather
MSP 15 Real Time Hydro and Inf Service	Horizontal and vertical Tidal information in VTS area, available water column
MSP 16 Search and Rescue service	Search pattern and vessel of opportunity

ANNEX 4

PROPOSED SCHEMATIC FLOW CHART FOR THE HARMONIZATION PROCESS OF MARITIME SERVICES



CLARIFICATION FOR EACH STEP OF THE REVIEW PROCESS FOR THE DESCRIPTION OF MARITIME SERVICES SHOWN IN THE FLOW CHART FOR THE HARMONIZATION PROCESS OF MARITIME SERVICES

The schedule of the flow chart above reflects a simplified process of steps, recommended to be followed, with the following clarification:

- With reference to NCSR 5/8, annex, appendix 1, first paragraph the international organizations are invited (1) to provide the Organization/HGDM with completed descriptions of maritime services, using the templates for the development of digitalized maritime services based on the prioritized Maritime Service Portfolio's under their merit as domain coordinating bodies (2) as well as eventual future maritime services to be developed;
- These descriptions of maritime services, using the templates, should contain references to relevant international Standards, Recommendations and Guidelines, which may contain criteria for the eventual implementation of these maritime services as well as identified user requirements for data and information;
- The domain coordinating bodies will submit the descriptions of maritime services, using the templates, to the Organization as the recipient (3), using the IMO Secretariat as a mailbox for automated registration and forwarding to potential HGDM meetings (to be decided by NCSR) (4);
- HGDM will study and evaluate the submitted descriptions of maritime services, using the templates, and identify potential harmonized data models (5) and finally report to NCSR (6) with a request for consideration (7) to incorporate, where appropriate, an approved description of a maritime service, using the template, into a relevant IMO instrument (e.g. Resolution, Guideline or Circular) (8);
- Once the IMO instrument has been finalized and consequently, in accordance with IMO procedures, be approved by MSC, the Organization can provide guidance to the member states and the domain organizers (relevant NGO's and IGO's) to their members (9) on how to implement maritime services.

ANNEX 5

DRAFT TERMS OF REFERENCE FOR THE IMO/IHO HARMONIZATION GROUP ON DATA MODELLING (HGDM)

1 As part of the IMO e-navigation Strategy Implementation Plan (SIP) (NCSR 1/28, annex 7), the Organization listed "Improved communication of VTS service portfolio (not limited to VTS stations)" as one of five prioritized e-navigation solutions (solution 9). Paragraph 17 of the SIP states "As part of the improved provision of services to vessels through e-navigation, MSPs have been identified as the means of providing electronic information in a harmonized way, which is part of solution 9". Table 6 of the SIP contains a list of 16 proposed maritime services. Task T17 (contained in table 7) amplifies information on the task and states the expected deliverable.

2 In general terms, maritime services are considered as the framework for the electronic exchange of harmonized maritime-related information between shore and ships globally. Consequently, a common data structure is needed to optimize the use, interoperability, flow and accessibility of relevant information in the maritime domain. It is therefore important to coordinate the data modelling work with the aim of creating and maintaining a harmonized, robust and extendable common maritime data structure.

3 Bearing in mind the aforementioned objectives, and taking into account the outcome of NCSR 5 (NCSR 5/23, section 8), at its second meeting the Harmonization Group on Data Modelling (HGDM) should:

- .1 finalize the draft Guidance on the definition and harmonization of the format and structure of maritime services within a Maritime Service Portfolio. The guidance should:
 - .1 include a definition for "maritime service";
 - .2 describe the format and operational structure of maritime services using the template;
 - .3 describe in general the means of collection, exchange and distribution of data;
 - .4 describe the intended use of technical specifications while avoiding duplication of work already undertaken by international organizations such as IHO, IEC, IALA and others;
- .2 finalize the template as a priority;
- .3 take into account that the harmonized digitalization and provision of maritime services should be independent of the choice of the communication technology used;
- .4 study and evaluate the submitted descriptions of maritime services, using the templates, and identify potential harmonized data models and finally report to NCSR;

- .5 further consider the role of the Organization in exercising its leadership in the harmonization of digitalized maritime services as set out in section 3 of the draft Guidance;
- .6 review and further develop the preliminary flow chart for the harmonization of maritime services and associated criteria for each process step and consider the expected additional workload for the Sub-Committee and the Secretariat (NCSR 5/WP.4, annex 4);
- .7 consider for the purpose of harmonization, as a baseline, IHO's S-100 Geospatial Information Registry, where appropriate;
- .8 consider that the Guidance need to be flexible to accommodate future maritime services, currently not included in the SIP;
- .9 prepare a report for consideration by NCSR 6.

ANNEX 6

UPDATE OF THE E-NAVIGATION STRATEGY IMPLEMENTATION PLAN

Introduction

1 As shipping moves into the digital world, e-navigation is expected to provide digital information and infrastructure for the benefit of maritime safety, security and protection of the marine environment, reducing the administrative burden and increasing the efficiency of maritime trade and transport.

2 The Organization defines e-navigation as the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment (*in*: Strategy for the development and implementation of e-navigation (MSC 85/26/Add.1, annex 20)). e-navigation is intended to meet present and future user needs through harmonization of marine navigation systems and supporting shore services. Hence the implementation of e-navigation should be based on user needs and not be technology-driven. The user needs were agreed upon by the Sub-Committee on Safety of Navigation² at its 56th session (NAV 56/WP.5/Rev.1, annexes 2 to 4) and reproduced in annex 4 of this document.

3 The e-navigation Strategy (MSC 85/26/Add.1, annex 20) assigns the governance of the e-navigation concept to the IMO as the organization responsible for establishing mandatory standards for enhancing the safety of life at sea, maritime security and protection of the marine environment, as well as having global remit. In accordance with the strategy, the implementation of e-navigation is a phased iterative process of continuous development taking into account the evolution of user needs and the lessons learned from the previous phase.

4 It is important to understand that e-navigation is not a static concept and that development of logical implementation phases will be ongoing as user requirements evolve and as technology develops, enabling more efficient and effective systems. If sufficient progress is made in the implementation, an e-navigation enabling Performance Standard may be envisaged (see also Sub-solution S4.1.10), providing a single-reference for e-navigation solutions.

5 The initial e-navigation Strategy Implementation Plan (SIP) was developed by the Correspondence Group on e-navigation and endorsed by the Sub-Committee on Navigation, Communications and Search and Rescue at its first session on 4 July 2014 (NCSR 1), and subsequently approved by MSC 94 on 21 November 2014. The SIP introduces a vision of e-navigation which is embedded in general expectations for the onboard, onshore and communications elements.

6 The main objective of the SIP is to implement the five e-navigation solutions, resulting from taking into account the IMO Formal Safety Assessment (FSA), from which identified a number of required tasks have been identified. These tasks should, when completed in the period 2015–2019, provide the industry with harmonized information, in order to start designing products and services to meet the e-navigation solutions.

² The NAV Sub-Committee was replaced by the Sub-Committee on Navigation, Communications and Search and Rescue (NCSR).

4 ~~———— The present SIP identifies the list of tasks which would need to be performed during the coming years in order to achieve the five prioritized e-navigation solutions.~~

7 Following the provision of the aforementioned strategy that states that the implementation strategy elements remain under review, and in light of recent technological developments, evolved user needs, new trends in the industry and progress made in the implementation of the SIP, NCSR 4 agreed to an update of the plan, including prioritization of the outputs and their reorganization so as to avoid duplication. [Consequently the work to update the SIP was undertaken and completed by NCSR [5 in February 2018] and the revised SIP approved by MSC [99 in May 2018.]]

8 According to the SIP, the approved implementation plan asks for periodic updates, for example in paragraph 14 of the SIP: "Whilst the first steps involve implementing the five prioritized e-navigation solutions, it is important to recognize that further e-navigation development will be a continuous process following user needs for additional functionalities of existing and possible future systems (e.g. implementation of onboard and/or ashore navigational decision support systems). As user needs evolve and new technology is introduced, other e-navigation solutions may be incorporated into the strategy, as appropriate."

9 It seems to be obvious that any work plan (and the SIP is a plan to implement e-navigation) needs periodic revision and updates so reflect the work already carried out and decisions taken for some of the action items (tasks) therein, however, it has been agreed that it should not be a revision at this point in time, but only into updating it.

10 ~~It should be noted that, a~~Although the need to use existing equipment in a more holistic way was identified early on, some onboard equipment may need modifications to interfaces and controls. However, in the future, the need for new equipment for the deployment of future e-navigation solutions and applications cannot be disregarded.

11 ~~Tasks listed in the SIP~~ The tasks listed in table 7 should be incorporated in the High-level Action Plan of the Organization as ~~planned/unplanned~~ outputs, taking into account the provisions of the *Guidelines on the organization and method of work of the Maritime Safety Committee and the Marine Environment Protection Committee and their subsidiary bodies*, as set out in MSC-MEPC.1/Circ.5, as may be revised (the Committee's Guidelines).

12 In line with the provisions of the Committee's Guidelines, ~~any further e-avigation-related work would require the Committee's approval and should be clearly incorporated as planned/unplanned output(s) in the High-level Action Plan of the Organization. Therefore, each one of the approved tasks would need to be approved at the same time as a planned/unplanned output, as appropriate, with clear indication of:~~

- ~~–IMO's objectives;~~
- ~~–Analysis of the issue;~~
- ~~–Analysis of implications;~~
- ~~–Compelling need;~~
- ~~–Benefits;~~
- ~~–Industry standards;~~
- ~~–The intended output;~~
- ~~–Human element consideration;~~
- ~~–Priority/urgency, including expected target completion year; and~~
- ~~–Action required.~~

proposals for the Organization to undertake e-navigation-related tasks will need to be submitted to the Committee for approval and inclusion as output(s) in the High-level Action Plan of the Organization.

13 ~~In line with the above,~~ Interested Member States may submit proposals to the Committee for the inclusion of new outputs in the High-level Action Plan of the Organization based on the identified tasks contained in this SIP.

14 Proposals for the further development of e-navigation solutions and tasks which are not listed in the SIP may also be submitted by Member States to the Committee for consideration; however priority should be given to the tasks identified in the SIP.

15 Member States willing to lead a specific task should ensure the timely delivery of the task by requesting the assistance of other Member States and/or relevant Organizations.

Strategy Implementation Plan (SIP) for the five e-navigation solutions

16 The basis of the SIP are the following e-navigation solutions³:

- S1: improved, harmonized and user-friendly bridge design;
- S2: means for standardized and automated reporting;
- S3: improved reliability, resilience and integrity of bridge equipment and navigation information;
- S4: integration and presentation of available information in graphical displays received via communication equipment; and
- S95: improved communication of VTS Service Portfolio (not limited to VTS stations).

17 Solutions S2, S4 and ~~S9~~ S5 focus on efficient transfer of maritime information and data between all appropriate users (ship-ship, ship-shore, shore-ship and shore-shore). Solutions S1 and S3 promote the workable and practical use of the information and data on board.

18 As part of each of the above e-navigation solutions, several sub-solutions were identified. These are listed in tables 1 to 5 below.

19 While the first steps involve implementing the five e-navigation solutions, it is important to recognize that the e-navigation development is a continuous process following user needs for additional functionalities of existing and possible future systems (e.g. implementation of onboard and/or ashore navigational decision support systems). As user needs evolve and new technology is introduced, other e-navigation solutions may be incorporated into the strategy, as appropriate.

20 During the FSA process, the following Risk Control Options (RCO) were identified in order to aid the assessment of the e-navigation solutions and some of the sub-solutions:

³ A total of nine e-navigation solutions were considered for the first SIP, contained in NAV/58/WP6/Rev.1, annex 2, but NAV 59 endorsed just five prioritized potential e-navigation solutions. These five prioritized potential e-navigation solutions have been included here, but since only prioritized e-navigation solutions are listed in paragraph 11 in this revised SIP; the term "prioritized" has become redundant and therefore has been omitted.

RCO 1: Integration of navigation information and equipment including improved software quality assurance (related to sub-solutions S1.6, S1.7, S3.1, S3.2, S3.3, S4.1.2, and S4.1.6);

RCO 2: Bridge alert management (related to sub-solution S1.5);

RCO 3: Standardized mode(s) for navigation equipment (related to sub-solution S1.4);

RCO 4: Automated and standardized ship-shore reporting (related to sub-solutions S2.1, S2.2, S2.3 and S2.4);

RCO 5: Improved reliability and resilience of onboard PNT systems (related to sub-solution S3.4);

RCO 6: Improved shore-based services (related to sub-solution S4.1.3 and solution S9 S5); and

RCO 7: Bridge and workstation layout standardization (related to sub-solution S1.1).

21 A number of necessary actions and tasks have been identified in order to progress the development and implementation of the five e-navigation solutions. These are listed below under each respective solution and consolidated in table 7.

Table 1:

Required regulatory framework and technical requirements for implementation (tasks) for solution 1 (Improved, harmonized and user-friendly bridge design)

Sub-Solution	Description	Task Action	Task Identifier (Table 7)
S1.1	Ergonomically improved and harmonized bridge and workstation layout.	Guidelines on Human Centred Design (HCD) for e-navigation systems. Guidelines on Usability testing, Evaluation and Assessment (UTEA) for e-navigation systems. Resolutions A.694(17) , A.997(25) and MSC.252(83) and MSC/Circ.982 , SN.1/Circ.265 , SN.1/Circ.274 and SN.1/Circ.288 are of relevance.	T1 T2
S1.2	Extended use of standardized and unified symbology for relevant bridge equipment.	Develop symbology for relevant equipment using as a reference resolution MSC.192(79)	T2
S1.3	Standardized manuals for operations and familiarization to be provided in electronic format for relevant equipment	Develop the concept of electronic manuals and harmonize the layout to provide Seafarer seafarers with an easy way of familiarization for relevant equipment	T3
S1.4	Standard default settings, save/recall settings, and	Performance or technical standards mandating the features on relevant equipment. Develop a testbed	T4

Sub-Solution	Description	Task Action	Task Identifier (Table 7)
	S-mode functionalities on relevant equipment.	demonstrating the whole concept of standardized modes of operation including store and recall for various situations as well as S-mode functionality on relevant equipment.	
S1.5	All bridge equipment to follow IMO BAM (Bridge Alert Management) performance standard.	Ensure that all equipment is checked during type approval and that it meets the requirements of resolution MSC.302(87) on Bridge Alert Management, as may be updated.	T5
S1.6	Information accuracy/reliability indication functionality for relevant equipment.	Develop a testbed demonstrating technically how accuracy and reliability of navigation equipment may be displayed.	T6
S1.6.1	Graphical or numerical presentation of levels of reliability together with the provided information.	From the above develop a harmonized display system indicating reliability levels.	T6
S1.7	Integrated bridge display system for improved access to shipboard information.	INS systems which integrate navigation equipment data already exist but are not mandatory carriage to — (resolution MSC.252(83)). E-navigation relies on integration and without mandatory carriage of INS it would be difficult to achieve the solutions. The carriage of an INS or maybe something simpler performing integration should be investigated.	T7
S1.8	GMDSS equipment integration – one common interface.	Take into account resolution A.811(19) when integrating GMDSS into one common interface.	(Already in hand)

Table 2:

Required regulatory framework and technical requirements for implementation (tasks) for solution 2 (Means for standardized and automated reporting)

Sub-Solution	Description	Task Action	Task Identifier (Table 7)	Status
S2.1	Single-entry of reportable information in single-window solution.	Develop testbeds demonstrating the use of single window for reporting along with S2.4.	T8 T15	In progress
S2.2	Automated collection of internal ship data for reporting.	Much data is already collected in the by onboard navigation equipment – investigate the option of facilitating the use of this data transfer for automated reporting of ship navigational information to authorities.	T9	In progress
S2.3	Automated or semi-automated digital distribution/communication of required reportable information, including both "static" and "dynamic" information.	Review the original AIS long-range port facility as well as the new long-range frequencies made available at WRC 2012 described in the latest revision of ITU-R M.1371-5 , the revised IEC 61993-2 , or the developments within VHF Data Exchange System (VDES) and see if the information could be used at no or low cost for automated or semi-automated reporting. The long-range port was not used during the development of LRIT due to the cost to shipowners of sending this information. Develop Guidelines for the efficient distribution of relevant navigation-related information from communications equipment to navigation displays (see NCSR 5/6, para. 8)	T9 T15	In progress

Sub-Solution	Description	Task Action	Task Identifier (Table 7)	Status
S2.4	All national reporting requirements to apply standardized digital reporting formats based on recognized internationally harmonized standards, such as IMO FAL Forms or SN.1/Circ.289 .	Liaise with administrations and agree on standardized formats for ship reporting so as to enable "single window" worldwide. In this respect national and regional harmonization is the first step.	T8	In progress

Table 3:

Required regulatory framework and technical requirements for implementation (tasks) for solution 3 (Improved reliability, resilience and integrity of bridge equipment and navigation information)

Sub-Solution	Description	Task Action	Task Identifier (Table 7)	Status
S3.1	Standardized self-check/built-in integrity test (BIIT) with interface for relevant equipment (e.g. bridge equipment).	Equipment should be developed with standardized BIIT built-in . The general requirements in resolution A.694(17) as tested by IEC 60945 should be investigated reviewed to determine to see if additional definitions and testing is required.	T10	In progress
S3.2	Standard endurance, quality and integrity verification testing for relevant bridge equipment, including software.	Software quality assurance especially lifetime assurance methods need to be developed into draft guidelines. The type approval process needs to be developed further to ensure that the equipment used in e-navigation is robust in all aspects.	T11 T11	completed
S3.3	Perform information integrity tests based on integration of navigational equipment – application of INS integrity monitoring concept.	This task is very similar to that described for S1.6 and S1.6.1.	T6	In progress

Sub-Solution	Description	Task Action	Task Identifier (Table 7)	Status
S3.4	Improved reliability and resilience of onboard PNT information and other critical navigation data by integration with, and backup of, external and internal systems.	<p>MSC 98 approved new MSC circular MSC.1/Circ.1575 on <i>Guidelines for shipborne position, navigation and timing data processing</i></p> <p>IMO is already drafting performance standards for a multi-system navigational receiver designed to use all available systems for an improved and more reliable PNT solution. There may be traditional methods and other terrestrial systems which should also be investigated as the external input.</p> <p>Backup arrangements for critical foundation data, particularly in the event of interruption to cloud-based solutions should be investigated.</p> <p>Administrations need to indicate their support for terrestrial systems.</p>	T12	Part-completed

Table 4:

Required regulatory framework and technical requirements for implementation (tasks) for solution 4 (Integration and presentation of available information in graphical displays received via communication equipment)

Sub-Solution	Description	Task Action	Task Identifier (Table 7)
S4.1	Integration and presentation of available information on graphical displays (including MSI, AIS, nautical charts, radar, etc.) received via communication equipment.	<p>The INS has a display that could be used for displaying this information. Work done by IALA et al. shows that additional information on existing displays such as ECDIS and radar might obliterate critical information on these displays.</p> <p>Investigate and demonstrate via a testbed the feasibility of the integration and portrayal of this information and develop associated draft guidelines on how it should be done in a harmonized way the harmonization of display.</p> <p>Resolution MSC.252(83) and SN.1/Circ.265 are related.</p>	<p>T13</p> <p>In progress</p>
S4.1.1	Implement a Common Maritime Data Structure (CMDS) for Maritime Service Portfolios (MSP) and include parameters for priority, source, and ownership of information.	CMDS is at the heart of e-navigation. It has been already agreed to use the IHO S-100 data model. Develop both the shore-based data models and also the shipboard data models including firewalls, as necessary, and harmonize via the IMO-IHO Harmonization Group on Data Modelling (HGDM).	T14
S4.1.2	Standardized interfaces for data exchange should be developed to support transfer of information from communications equipment to navigational systems (INS).	Most equipment already complies with one of the IEC 61162 series interface standards, although IMO only refer to them by footnote. The testing standards for shipboard equipment developed by IEC refer to this standard. The interfaces should meet the S-100 principle although it may not be necessary to use this standard between simple equipment.	T14
S4.1.3	Provide mapping of specific services (information available) to specific regions (e.g.	Ensure that the correct and up-to-date information for the area of operation are provided by the	T13

Sub-Solution	Description	Task Action	Task Identifier (Table 7)
	maritime service portfolios) with status and access requirements.	shore side and that the Seafarer receives the information for the area of operation. MSI could be viewed on relevant or defined displays, such as on ECDIS, radar or INS task displays.	
S4.1.4	Provision of a system for automatic source and channel management on board for the selection of most appropriate communication means (equipment) according to criteria such as bandwidth, content, integrity, costs.	Least cost routeing systems are available and could be demonstrated. The communication means should be transparent to the user. Available communications systems need to be identified, including how they can be used, based on range, bandwidth, etc. and what systems are currently being developed and will be in use when e-navigation-is-live is fully implemented. The task should look into short-range systems such as VHF, 4G and 5G. Develop Guidelines for the efficient distribution of relevant navigation-related information from communications equipment to navigation displays (see NCSR 5/6, para. 8)	T15
S4.1.5	Routeing and filtering of information on board (weather, intended route, etc.).	Investigate the Review of the performance standards for INS with a view to determine how these facilities can be addressed in a revised INS performance standard implemented Develop Guidelines for the efficient distribution of relevant navigation-related information from communications equipment to navigation displays (see NCSR 5/6, para. 8)	T7
S4.1.6	Provide A quality assurance process to be followed to ensure that all data is reliable and based on a consistent common reference system (CCRS) or converted to such before integration and display.	Ensure data quality and CCRS meets with new Quality Assurance, set out in MSC.1/Circ.1512 .	T11

Sub-Solution	Description	Task Action	Task Identifier (Table 7)
S4.1.7	Implement harmonized presentation concept of information exchanged via communications equipment including using standard symbology and text, taking into account human element and ergonomics design principles to ensure useful presentation and prevent information overload.	Harmonize displays.	T6 T13 In progress
S4.1.8	Develop a holistic presentation library as required to support accurate presentation across displays.	Harmonize displays.	T6
S4.1.9	Provide alert functionality of INS concepts to information received by communications equipment and integrated into INS.	Ensure that all bridge equipment meets the Bridge Alert Management performance standards.	T7
S4.1.10	Harmonization of conventions and regulations for navigation and communication equipment.	The task to go through all the IMO performance standards may be very large. It would be advisable to draft an "e-navigation enabling Performance Standard" which would identify the changes to interfaces, control symbology and other details which would be used as an add-on for approval for use in e-navigation.	T16

Table 5:

Required regulatory framework and technical requirements for implementation (tasks) for solution 9.5 (Improved communication of VTS service portfolio (not limited to VTS stations))

Solution	Description	Task Actions	Task Identifier (Table 7)
S5	Improved communication of VTS service portfolio (not limited to VTS stations)	<p>Communications is a key factor in the e-navigation concept. This task needs to identify the possible communications methods that might be used and testbeds which need to be built to demonstrate which systems are best in different areas of operation. (e.g. deep sea, coastal and port).</p> <p>Much of this work is appropriate to S4.1.4.</p>	<p>T15</p> <p>T17</p>

Maritime Services Portfolios (MSP)

22 As part of the improved provision of services to vessels through e-navigation, maritime services MSP have been identified as the means of providing electronic information in a harmonized way, which is part of solution 9.5. The proposed list of MSPs Maritime Services is presented in table 6 below. The following definition is currently being reviewed under the e-navigation output on the harmonization of the format and structure of maritime services within a maritime service portfolio:

Maritime Service Portfolio is a set of operational Maritime Services and associated technical services provided in digital format.

Further information about MSPs Maritime Services to be used in a MSP is set out in annex 2. The further development of the MSP is subject of task T17.

23 The following six areas have been identified for the delivery of MSP:

- .1 port areas and approaches;
- .2 coastal waters and confined or restricted areas;
- .3 open sea and open areas;
- .4 areas with offshore and/or infrastructure developments;
- .5 Polar areas; and
- .6 other remote areas.

Table 6:

List of proposed Maritime Services for use in MSP

Service No	Identified Services	Domain Coordinating Body	Identified Responsible Service Provider
1	VTs Information Service (INS)	IALA	VTs Authority
2	Navigational Assistance Service (NAS)	IALA	VTs Authority National Competent Authority/Coastal or Port Authority
3	Traffic Organization Service (TOS)	IALA	VTs Authority National Competent Authority/Coastal or Port Authority
4	Local Port Service (LPS)	IHMA	Local Port/Harbour Authority
5	Maritime Safety Information Service (MSI)	IHO	National Competent Authority
6	Pilotage service	IMPA	Pilotage Authority/Pilot Organization
7	Tugs service	TBD	Tug Authority National Competent Authority; Local Port/Harbour Authority
8	Vessel Shore Reporting	TBD	National Competent Authority; Shipowner/Operator/Master and appointed service providers
9	Telemedical Assistance Service (TMAS)	TBD	National health Organization/dedicated health Organization
10	Maritime Assistance Service (MAS)	TBD	Coastal/Port Authority/Organization
11	Nautical Chart Service	IHO	National Hydrographic Authority/ Organization
12	Nautical Publications Service	IHO	National Hydrographic Authority/ Organization
13	Ice Navigation Service	WMO	National Competent Authority/Organization

Service No	Identified Services	Domain Coordinating Body	Identified Responsible Service Provider
14	Meteorological Information Service	WMO	National Meteorological Authority, WMO/Public Institutions
15	Real-time hydrographic and environmental information Service	IHO	National Hydrographic and Meteorological Authorities
16	Search and Rescue Service	TBD	SAR Authorities

Development of related guidelines

24 The combination of the five e-navigation solutions supported by the FSA, and the three guidelines, *Guidelines on Human Centred Design (HCD) for e-navigation*, *Guidelines on Usability Testing, Evaluation and Assessment (U-TEA) for e-navigation systems* and *Guidelines for Software Quality Assurance (SQA) in e-navigation* *Guideline on Software Quality Assurance and Human-Centred Design for e-navigation*⁴, propose an e-navigation implementation that facilitates a holistic approach to the interaction between shipboard and shore-based users.

25 The development of an e-navigation reference model for the five solutions, including possible proposed legal framework, governance structures and funding models for relevant infrastructures, could involve establishing a globally cooperating network of regional testbeds.

26 ~~During the development of e-navigation~~ As part of the development of e-navigation, the use of testbeds is crucial as they are pivotal to the progressive implementation of e-navigation solutions. ~~It would be advisable that,~~ Whenever feasible and appropriate there should be international cooperation in the establishment of testbeds as a vital component to ensure that e-navigation solutions can successfully operate on a global scale and to leverage the benefits of pooled resources and expertise.

27 Further testbeds may be used and evaluated, ~~and it has been identified that guidelines on the reporting need to be drafted so that the results can be presented in a harmonized way. These guidelines have been added to the task list as task T18.~~ in line with MSC/Circ.1494 on *Guidelines on harmonization of testbed reporting* which were developed under task **T18** which is completed.

Identification of tasks, deliverables and schedule

28 Table 7 outlines the identified tasks with a short definition including deliverables and transition arrangements, if considered necessary, and an indication of the prioritized implementation schedule.

⁴ MSC.1/Circ.1512 on *Guideline on Software Quality Assurance and Human-Centred Design for e-navigation*.

Table 7

Tasks, expected deliverables, transition arrangements and implementation schedule

Task No	Task	Expected Deliverable	Transition Arrangements	Prioritized Implementation Schedule	Status/Remark
T1	Development of draft Guidelines on Human Centred Design (HCD) for e-navigation systems.	Guidelines on Human Centred Design (HCD) for e-navigational systems.	None	2014/2015	completed MSC.1/Circ.1512 ⁵
T2	Development of draft Guidelines on Usability Testing, Evaluation and Assessment (UTEA) of e-navigation systems.	Guidelines on Usability Testing, Evaluation and Assessment (UTEA) of e-navigation systems.	None	2014/2015	completed MSC.1/Circ.1512 ⁵
T3	Develop the concept of electronic manuals and harmonize the layout to provide seafarers with an easy way of familiarization for relevant equipment.	Guidelines on electronic equipment manuals.	Provide existing manuals as .pdf	2019	Under consideration
T4	Formulate the concept of standardized modes of operation, including store and recall for various situations, as well as S-mode functionality on relevant equipment.	Guidelines on S-mode.	None	2017 2019	In progress
T5	Investigate whether an extension of existing Bridge Alert Management Performance Standards (PS) is necessary. Adapt all other alert relevant PSs to the to Bridge Alert Management PS.	(a) Guidelines on implementation of Bridge Alert Management.	None	2016	Under consideration
		(b) Revised Performance Standards on BAM.	None	2019	

⁵ NCSR 1 agreed to the consolidate the draft Guidelines on Human Centred Design (HCD) for e-navigation systems, the draft Guidelines on Usability Testing, Evaluation and Assessment (UTEA) for e-navigation systems, and the draft Guidelines on Software Quality Assurance (SQA) in e-navigation into a single guideline (MSC.1/Circ.1512).

Task No	Task	Expected Deliverable	Transition Arrangements	Prioritized Implementation Schedule	Status/Remark
T6	Develop Guidelines on the display of accuracy and reliability of navigation equipment. Develop a methodology of how accuracy and reliability of navigation equipment may be displayed. This includes a harmonized display system.	Guidelines on the display of accuracy and reliability of navigation equipment.	None	2017	In progress
T7	Investigate if an INS, as defined by resolution MSC.252(83) , is the right integrator and display of navigation information for e-navigation and if so, what amendments are needed, including, inter alia, communication ports and a PNT module. Refer to resolution MSC.191(79) and SN/Circ.243/Rev.1 .	(a) Report on the suitability of INS. (b) New or additional modules for the Performance Standards for INS.	None None	2016 2019	Completed
T8	Member States to agree on standardized format guideline for ship reporting so as to enable "single window" worldwide (SOLAS regulation V/28, resolution A.851(20) and SN.1/Circ.289)	Updated Guidelines on single window reporting.	National/Regional Arrangements	2019	Under consideration
T9	Investigate the best way to automate the collection of internal ship data for reporting including static and dynamic information.	Technical report on the automated collection of internal ship data for reporting.	None	2016	In progress

Task No	Task	Expected Deliverable	Transition Arrangements	Prioritized Implementation Schedule	Status/Remark
T10	Investigate the general requirements in resolution A.694(17) and IEC 60945 to determine how Built In Integrity Testing (BIIT) can be incorporated.	(a) Revised resolution on the general requirements including Built In Integrity Testing.	None	2017	Under consideration
		(b) Revised IEC Standard on General Requirements including Built In Integrity Testing.	None	2019	
T11	Development of Guidelines for Software Quality Assurance (SQA) in e-navigation. This task should include an investigation into the type approval process to ensure that software lifetime assurance (software updates) can be carried out without major re-approval and consequential additional costs. Refer to SN.1/Circ/266/Rev.1 and MSC.1/Circ.1389 .	Guidelines for Software Quality Assurance (SQA) in e-navigation.			completed MSC.1/Circ.1512 ⁵
T12	Develop guidelines on how to improve reliability and resilience of onboard PNT systems by integration with external systems. Liaise with Administrations to ensure that relevant shore-based systems will be available.	Guidelines on how to improve reliability and resilience of onboard PNT systems by integration with external systems.			completed MSC.1/Circ.1575 ⁶
T13	Develop guidelines showing how navigation information received by communications equipment can be displayed in a harmonized way and what equipment functionality is necessary.	Guidelines on the harmonized display of navigation information received from communications equipment.	None Interim To be finalized after completion of T4 and T17	2021	Interim Guidelines completed

⁶ MSC 98 approved MSC.1/Circ.1575 on *Guidelines for shipborne position, navigation and timing (PNT) data processing*.

Task No	Task	Expected Deliverable	Transition Arrangements	Prioritized Implementation Schedule	Status/Remark
T14	Develop a Common Maritime Data Structure and include parameters for priority, source, and ownership of information based on the IHO S-100 data model. Harmonization will be required for both, use on shore and use on the ship, and the two must be coordinated (Two Domains).	(a) Guidelines on a Common Maritime Data Structure.	None	2017	(a) HGDM to consider
	Support the further development of the standardized interfaces for data exchange used on board (IEC 61162 series) to support transfer of information from communication equipment to navigational systems (INS) including appropriate firewalls (IEC 61162-450 and 460).	(b) support the further development of the IEC standards for data exchange used on board, including firewalls.	Use latest IEC standards	2019	(b) Completed

Task No	Task	Expected Deliverable	Transition Arrangements	Prioritized Implementation Schedule	Status/Remark
T15	<p>Identify and draft guidelines on seamless integration of all currently available communications infrastructure and how they can be used (e.g. range, bandwidth, etc.) and what systems are being developed (e.g. maritime connectivity platform) and could be used for e-navigation.</p> <p>The task should look at short-range systems such as VHF, 4G and 5G as well as HF and satellite systems taking into account the 6 areas defined for the MSP.</p> <p>Develop Guidelines for the efficient distribution of relevant navigation-related information from communications equipment to navigation displays (see NCSR 5/6, par.8)</p>	<p>Guidelines on seamless integration of all currently available communications infrastructure and how they can be used and what future systems are being developed along with the revised GMDSS.</p> <p>Guidelines for the efficient distribution of relevant navigation-related information from communications equipment to navigation displays (see NCSR 5/6, para. 8)</p>	Use existing onboard communications infrastructure	2019	Under consideration
T16	Investigate how the Harmonization of conventions and regulations for navigation and communication equipment would be best carried out. Consideration should be given to an all-encompassing e-navigation performance standard containing all the changes necessary rather than revising over 30 existing performance standards.	Report on the Harmonization of conventions and regulations for navigation and communication equipment would be best carried out.	None	2017	Under consideration
T17	Further develop the MSP to refine services and responsibilities ahead of implementing transition arrangements.	Resolution on Maritime Services within a Maritime Service Portfolios.	National/Regional Arrangements	2019	In progress

Task No	Task	Expected Deliverable	Transition Arrangements	Prioritized Implementation Schedule	Status/Remark
T18	Development of Draft Guidelines for the Harmonization of testbeds reporting.	Guidelines for the Harmonization of testbeds reporting.	None		completed ⁷

29 Table 8 shows the timelines for each task and an indication of the schedule to clarify common understanding necessary for the implementation.

⁷ MSC.1/Circ.1494 on *Guidelines on harmonization of testbed reporting* approved at MSC 94 (November 2014).

Table 8:
Indication of the schedule to clarify common understanding necessary for the implementation

No	Task	Remark	Prioritization	2017 NCSR 4	2018 NCSR 5	2019 NCSR 6	2020 NCSR 7	2021 NCSR 8
1	Development of draft Guidelines on Human Centred Design (HCD) for e-navigation systems	completed						
2	Development of draft Guidelines on Usability Testing, Evaluation and Assessment (UTEA) of e-navigation systems.	completed						
7a	Investigate if an INS, as defined in res. MSC.252(83) , is the right integrator and display of navigation information for e-navigation and identify the modifications it will need, including a communications port and a PNT module. Refer to resolution MSC.191(79) and SN/Circ.243. (a) Report on the suitability of INS.	completed						
7b	Investigate if an INS, as defined in res. MSC.252(83) , is the right integrator and display of navigation information for e-navigation and identify the modifications it will need, including a communications port and a PNT module. Refer to resolution MSC.191(79) and SN/Circ.243. (b) New or additional modules for the Performance Standards for INS	completed						
11	Development of draft Guidelines for Software Quality Assurance (SQA) in e-navigation. This task should include an investigation into the type approval process to ensure that software lifetime assurance (software updates) can be carried out without major re-approval and consequential additional costs. Refer to SN/Circ/266/Rev.1 and MSC.1/Circ.1389	completed						
12	Develop guidelines on how to improve reliability and resilience of onboard PNT systems by integration with external systems. Liaise with Administrations to ensure that relevant shore-based systems will be available	completed						
18	Development of Draft Guidelines for the Harmonization of testbeds reporting	completed						

No	Task	Remark	Prioritization	2017 NCSR 4	2018 NCSR 5	2019 NCSR 6	2020 NCSR 7	2021 NCSR 8
13	Develop Guidelines on the harmonized display of navigation information received from communications equipment showing how navigation information received by communications equipment can be displayed in a harmonized way and what equipment functionality is necessary	Interim Guidelines To be finalized after completion of T4 and T17	HIGH					
4	Formulate the concept of standardized modes of operation, including store and recall for various situations, as well as S-mode functionality on relevant equipment	Guidelines under development (2019)						
17	Further develop the MSPs to refine services and responsibilities ahead of implementing transition arrangements. Resolution on Maritime Service Portfolios.	Guidelines under development (2019)						
8	Member States to agree on standardized format guideline for ship reporting so as to enable "single window" worldwide (SOLAS regulation V/28, resolution A.851(20) and SN.1/Circ.289) Updated Guidelines on single window reporting	requires new output	MEDIUM					
14	Develop a Common Maritime Data Structure and include parameters for priority, source, and ownership of information based on the IHO S-100 data model. Harmonization will be required for both use on shore and use on the ship and the two must be coordinated (Two Domains). Develop further the standardized interfaces for data exchange used on board (IEC 61162 series) to support transfer of information from communication equipment to navigational systems (INS) including appropriate firewalls (IEC 61162- 450 and 460). (a) Guidelines on a Common Maritime Data Structure.	requires new output						
15	Identify and draft guidelines on seamless integration of all currently available communications infrastructure and how they can be used (e.g. range, bandwidth, etc.) and what systems are being developed, along with the revised GMDSS (e.g. maritime connectivity platform) and could be used for e-navigation. The task should look at short range systems such as VHF, 4G and 5G as well as HF and satellite systems taking into account the 6 areas defined for the MSPs. Guidelines for the efficient distribution of relevant navigation-related information from communications equipment to navigation displays (see NCSR 5/6, par.8)	requires new output						

No	Task	Remark	Prioritization	2017 NCSR 4	2018 NCSR 5	2019 NCSR 6	2020 NCSR 7	2021 NCSR 8
3	Develop the concept of electronic manuals and harmonize the layout to provide mariner with an easy way of familiarization for relevant equipment	requires new output	LOW					
5a	Investigate whether and extension of existing Bridge Alert Management Performance Standards (PS) is necessary. Adapt all other alert relevant PS to the to Bridge Alert Management PS . (a) Guidelines on implementation of Bridge Alert Management.	requires new output						
5b	Investigate whether and extension of existing Bridge Alert Management Performance Standards (PS) is necessary. Adapt all other alert relevant PS to the to Bridge Alert Management PS . (b) Revised Performance Standards on BAM.	requires new output						
6	Develop a methodology of how accuracy and reliability of navigation equipment may be displayed. This includes a harmonized display system Guidelines on the display of accuracy and reliability of navigation equipment	requires new output						
9	Investigate the best way to automate the collection of internal ship data for reporting including static and dynamic information	requires new output						
10a	Investigate the general requirements resolution A.694(17) and IEC 60945 to see how Built In Integrity Testing (BIIT) can be incorporated (a) Revised resolution on the general requirements including Built In Integrity Testing.	requires new output						
10b	Investigate the general requirements resolution A.694(17) and IEC 60945 to see how Built In Integrity Testing (BIIT) can be incorporated (b) Revised IEC Standard on General Requirements including Built In Integrity Testing	requires new output						
16	Investigate how the Harmonization of conventions and regulations for navigation and communication equipment would be best carried out. Consideration should be given to an all-encompassing e-navigation performance standard containing all the changes necessary rather than revising over 30 existing performance standards.	requires new output						

Relevant key enablers for e-navigation

30 During the development of the SIP, a number of actions have been identified as key enablers for e-navigation. Some of them are listed below.

Table 9:
Examples of key enablers of e-navigation

Key Enabler	INITIAL ACTION	status
Globally Standardized Data Exchange	Data providers to adapt to IMO recognized data standards such as IHO's S-100 data model	IMO/IHO Harmonization Group on Data Modelling (HGDM), activated at MSC 98
A harmonized data communication standard	International Organizations with industry; IALA is developing a standard for VHF data Exchange System (VDES) in collaboration with ITU	Ongoing
Maritime Service Portfolios	Further develop the proposed maritime services MSP as shown in table 6 and annex 2	See Task T17
Providers and onboard systems for resilient PNT	IMO is developing Performance Standards for multi-system navigation receiver PS	completed Res. MSC.401(95)
Connect all relevant equipment and functionality	IEC is developing a family of standards including a firewall with the support of the industry	Ongoing
Software Quality Assurance	Guidelines to be developed	completed MSC.1/Circ.1512
Ensure that relevant e-navigation functions will be accepted as complying with the relevant IMO performance standards for shipborne navigational and radiocommunications equipment	NCSR Sub-Committee to undertake as need arises	See Task T16
Connect all relevant equipment and functionality for VTS	Member States to address individually. IALA and IEC may assist in developing standards	Ongoing
Coastal States to provide the required infrastructure	IALA, IHO and CIRM may assist in developing required infrastructure, including relevant standards	Ongoing
Establish Human Centred Design principles	Continue to refine INS and IBS performance standards and guidelines respectively	Ongoing Part-completed MSC.1/Circ.1512

Description of the ship and shore architecture for the solutions

31 Figure 1 shows the principle of an information/data flow in the e-navigation architecture. The figure shows the complete overarching e-navigation architecture, and defines two additional important features:

- .1 the Common Maritime Data Structure (CMDs) that spans the whole of the horizontal axis; and
- .2 the World Wide Radio Navigation System (WWRNS).

32 The architecture also:

- .1 brings into focus the "operational service" level and the "Functional links used by Technical services" and the "Physical links used by Technical services";
- .2 highlights the fundamental distinction between information and data domains, explaining the relationship between the user requested information items and introducing the concepts of Operational and Technical Services, as well as Functional and Physical Links into a hierarchical perspective;
- .3 identifies the concept of "Maritime Service Portfolios"; and
- .4 unfolds the relationship of shore-to-shore data exchange.

33 The detailed shore and ship side architecture will be further developed in the light of the completion of some of the relevant tasks.

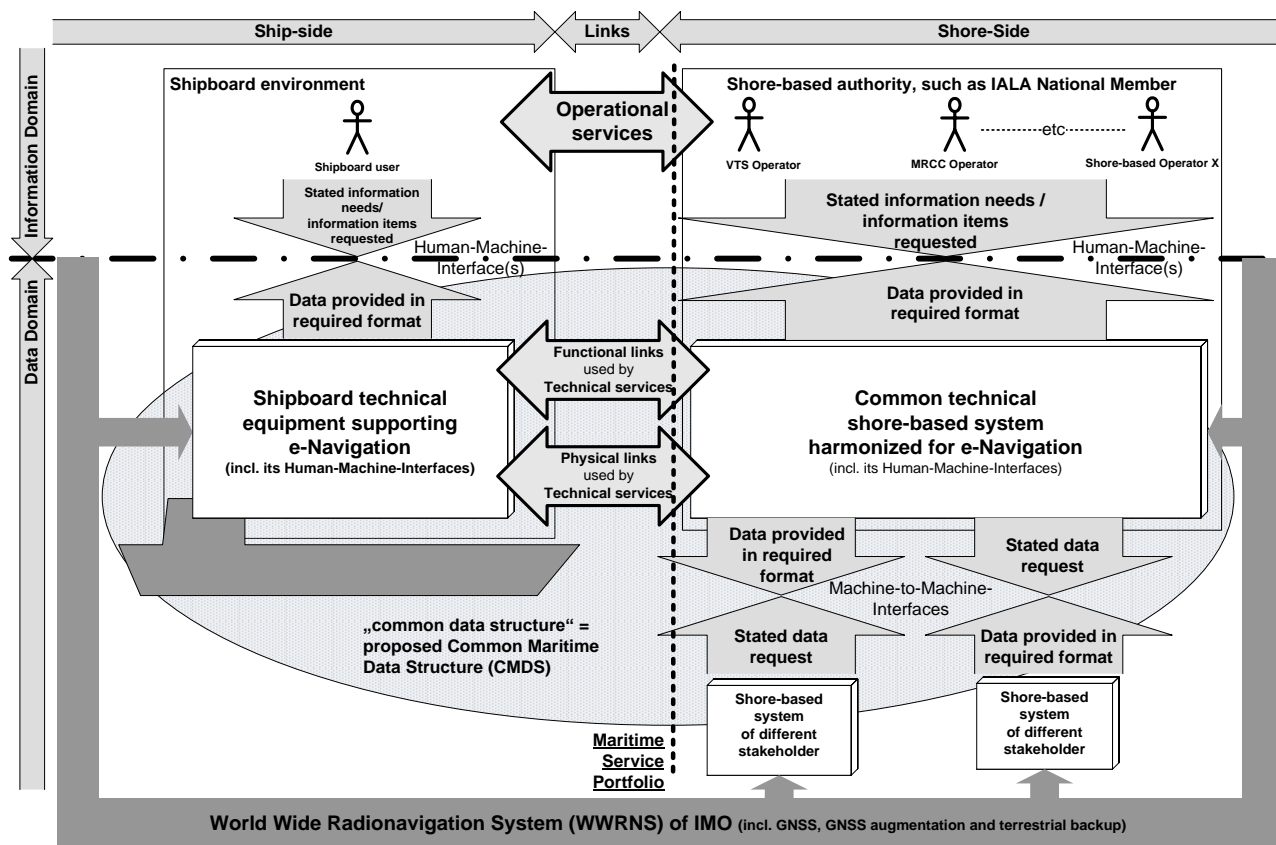


Figure 1 – Overarching e-navigation architecture

Identification of communication systems for e-navigation

34 Communications are a key for e-navigation. Any communications systems used must be able to deliver appropriate MSP in the 6 areas defined, as per ~~S9~~ S5, as well as delivering reliable ship reporting as identified in S2.

35 Existing available communications can be broadly divided into those:

- .1 used for distress and safety-related communications such as for the promulgation of maritime safety information (MSI), as is currently mandated under SOLAS; and
- .2 commercially available systems, such as various satellite solutions (e.g. Inmarsat, Iridium and VSAT) as well as terrestrial telephone and data networks, such as GSM / 3G /4G.

36 Future communication systems could include VHF data (VDES) and NAVDAT, and be developed for internet-based solutions, such as a maritime connectivity platform, facilitating system-wide information management solutions.

37 Existing and future communication links could be integrated via a maritime intranet, although each technical service will be limited by the capabilities of the available communication links. This infrastructure will primarily be based on IP communications links but will enable the utilization of free communication links for safety and mandatory reporting where appropriate, enabling a seamless integration and transition between available communications technologies.

38 The gap analysis, when considering effective and robust shipboard communications, identified that communications system should be developed in the future based on IP technology.

39 Relevant requirements for commercial communication links for e-navigation should have certain availability and latency criteria for the defined service area, and should provide a two-way data communication channel, enabling acknowledgement of information delivery.

40 This could enable automatic quality assurance of:

- .1 service efficiency;
- .2 availability and coverage of the communication service; and
- .3 the shipborne communication installation and capability.

41 It is assumed that the communication for various MSP increases for a ship as it approaches the coast and, therefore, it is likely that more bandwidth/speed may be needed in these areas.

42 Task **T15** addresses these issues and is critical to the implementation of e-navigation. The ability to send, receive and ensure the required quality the MSP depends on the availability of the right solution.

43 The possible further development of the existing LRIT shore-based infrastructure has the potential to provide a data link between authorities ashore using secure communications links, for use for certain MSP (as an example MSP16 (search and rescue)). This does not impact on the mandatory LRIT ship reporting system nor does it add to the ship to shore cost for an LRIT message.

44 The concept of the "Maritime Cloud" or named in this document as the "Maritime Connectivity Platform" should be further investigated, including its development and funding, operational and legal issues, including liability, quality and accessibility of information, global functional operation.

Proposals on enhancing public awareness of the e-navigation concept to key stakeholder and user groups

45 E-navigation is relevant and important to a broad range of stakeholders. The aim of the proposals on enhancing awareness of e-navigation is to improve the overall knowledge of the e-navigation concept among different stakeholders, and to enlist their cooperation and assistance in the implementation of e-navigation.

46 In this respect, five stakeholder groups have been identified as important and influential recipients, including key messages for each e-navigation solution. The key messages should be actively used to inform different stakeholders of the potential outcome and benefits of e-navigation, as well as the process of implementing e-navigation.

47 The development of an e-navigation website is also proposed in order to provide a coordinated and dynamic approach for distributing and sharing information related to the further development of e-navigation.

48 Regional/technical cooperation activities could be held in various parts of the world to promote and provide information on the status of the implementation of e-navigation initiatives. It would also provide a meeting arena for knowledge exchange on the process.

49 An e-navigation communication plan is provided in the SIP approved by MSC 94.

Regulatory impact

50 The provision and further development of e-navigation should consider relevant international conventions, regulations and guidelines, national legislation and standards. The development and implementation of e-navigation should build upon the work of IMO⁸.

51 E-navigation is intended to be based on the use of the existing equipment, however any changes in carriage requirement for some of the elements needed to make the system work may have an impact on ship certification.

52 Certain elements in the e-navigation strategy plan have not yet been fully investigated as they depend on the outcome of some of the tasks.

⁸ Including, but not limited to, the requirements of the FAL, SOLAS, MARPOL and STCW conventions.

Funding

53 Solution 2 (Means for standardized and automated reporting) and Solution 9 5 (improved communication of VTS service portfolio) both refer to improved shore-based facilities which may need funding for e-navigation to be successfully implemented for some stakeholders.

54 The funding may comprise two components: regional and international contributions. The former being normally provided by participating government agencies or national or regional grants, and the latter by donors operating under the support of institutions such as the World Bank or national agencies providing international development assistance. The funding can be grants, loans or important technical advisory services.

55 In addition, there are bilateral agreements between regions and countries which may contribute to successful funding of e-navigation solutions.

56 The identification of potential sources of funding for development and implementation, particularly in developing regions and countries and any actions to secure that funding, including resource management, could, as an example, usefully look at previous successfully funded international maritime projects.

57 According to World Bank statistics, in the case of the Marine Electronic Highway (MEH) in the Straits of Malacca and Singapore, the budget was \$17 million which was split as 51% regional (Littoral States and private) and 49% international (GEF/World Bank as grants for IMO and Indonesia).

ANNEX 1

BACKGROUND INFORMATION RELATED TO THE IDENTIFIED RISK CONTROL OPTIONS (RCOS)

1 Relevant background information related to the Risk Control Options (RCOs) identified during the Formal Safety Assessment (FSA) is provided in the following paragraphs.

RCO 1: Integration of navigation information and equipment including improved software quality assurance

2 There is a potential for various navigational information to be available in an increasingly centralized way enabling presentation on relevant task-orientated workstations. This ~~may~~ reduces the workload of the navigating officer, master or pilot and otherwise ease the task of navigation.

3 Sophisticated bridge navigational systems are increasingly integrated with each other and with other kinds of systems on the ship. This, as well as the implicit ability of these systems to influence each other, increases complexity. As such it is of increasing importance that these systems are usable and available at all times in a reliable and resilient ~~fashion~~.

RCO 2: Bridge alert management

4 On a bridge with no centralized alert management system, problems in properly identifying alerts may arise. Additionally, alerts from various sources may not be prioritized by importance with regards to safe navigation. Potentially unnecessary distractions of the bridge team by redundant and superfluous audible and visual alarm announcements may occur, increasing the cognitive load ~~on the bridge team on the operator~~.

5 The relevant performance standards ~~in relation to~~ for central alert management are specified in resolution [MSC.252\(83\)](#) on *Adoption of the revised performance standards for Integrated Navigation Systems (INS)* and resolution [MSC.302\(87\)](#) on *Adoption of performance standards for Bridge Alert Management*.

RCO3: Standardized mode(s) for navigation equipment

6 In order to aid the ~~navigator~~ navigating officer, ~~the~~ navigation equipment manufacturers and suppliers are continuously developing their products to include a rapidly increasing number of sophisticated functionalities. As the different suppliers follow different generation and presentation philosophies, and in part different terminology, this introduces the risk of ~~navigator~~ the bridge team not being able to access or use all the available functions, not being able to produce a familiar setup of the equipment, and consequently not being able to obtain information required for navigational decision-making.

7 Safe navigation relies on the ability of key personnel of the bridge team to easily operate navigational equipment as well as to comprehend the information that is presented to them. Without proper familiarization, which can sometimes take a significant period of time due to the current differences between operating systems, this is not always the case when someone is new to a particular setup. Lack of familiarity with bridge equipment can result in slow or inappropriate responses due to not finding correct information, system, control function or alarm and is therefore adversely affecting the safe navigation of the ship.

8 Standard modes or default display configurations are envisaged for relevant navigational equipment. Such standard mode(s) should be selectable at the task station and would reset presentation and settings of information to provide a standardized and common display familiar to all users. The standard mode should be accessible by a simple operator action. The standard or default settings would act as a starting point for a user to build the optional settings appropriate for a particular task. Those optional settings could be then saved by the user and be recalled later by a single operator action.

9 Standardized information presentation, symbols and coding should be used according to resolution [MSC.191\(79\)](#) on *Performance standards for the presentation of navigation-related information on shipborne navigational displays*. There should be a standard or default user interface mode (accessible by a simple operator action) and associated display configuration for relevant navigational equipment.

RCO 4: Automated and standardized ship-shore reporting

10 A potential for reducing workload due to filling out and delivering reportable information has been identified. Forms are usually manually filled out and sent individually to each authority requesting the information. Hence there is a significant potential for reduction of paper work and ~~administration exists~~ administrative tasks.

11 Standardized ship-shore electronic reporting has been the subject of recent work done by the Facilitation Committee and by the European Commission.

RCO 5: Improved reliability and resilience of onboard PNT systems

12 The primary aim of position fixing is to ensure a ship is correctly following its passage plan. Systems such as Global Navigational Satellite Systems (GNSS) provide position, and timing information. Other information can be derived from multiple position fixes and timing such as, velocity or course and speed over the ground. Changes in velocity ~~and course~~ over time can also yield other information such as rate of turn. Together this set of information is commonly referred to as Position Navigation and Timing (PNT). Ensuring reliable and resilient PNT data is particularly important for safe navigation at sea.

13 Resilience is the ability of a system to detect and compensate for external and internal sources of disturbances, malfunction and breakdowns in parts of the system. Achieving resilient PNT does not imply any setting up of additional GNSS or terrestrial systems, but may use information from such systems, should they exist. Reliability is the probability that the PNT system, when it is available, performs a specified function without failure under given conditions for a specified time.

14 Provision of resilient PNT information can be achieved through a combination of existing space-based and terrestrial systems, modernized and future radio navigation systems, ship-based sensors and other services.

15 Caution must be exercised against the use of differing systems for PNT in different regions of the world. Such a move would potentially create circumstances resulting in new risks for navigation, as ~~Seafarers~~ seafarers will potentially need to change their practices when travelling between regions. Another issue is that ships could be optimized to navigate only in particular regions with certain types of PNT solutions. This also could impact upon achieving a uniform training regime for seafarers. The implementation of e-navigation should as much as possible employ a consistent approach to the provision of PNT for marine navigation worldwide.

16 In order to increase the reliability and resilience of PNT information on board, an appropriate functional, goal-based performance standard for a PNT data processing unit, might be drafted, which would operate using sensor fusion techniques. This performance standard should not be tied to particular technologies.

~~17 It is evident there are some good candidates. Onboard equipment is available to assist with resilient PNT which that, alongside GNSS and some potential satellite-independent terrestrial systems regional systems, could provide resilient PNT. These are:~~

17 In addition to GNSS/regional satellite systems and potential satellite-independent terrestrial systems, the following could assist in ensuring resilient PNT.

- .1 inertial navigation systems;
- .2 signals of opportunity, such as radio, radar, sonar, echo sounder, etc.;
- .3 electronically-enabled human-observed bearings and distances (i.e. modern electronic coastal navigation using an e-pelorus, radar and ECDIS);
- .4 autonomous celestial navigation; and
- .5 other possibilities that could arise from research, for example in the areas of defence and robotic vehicle navigation.

RCO 6: Improved shore-based services

18 VTS, ports and other shore-based stakeholders gather and hold ~~a lot of~~ various information regarding navigational warnings, incidents, operations, tide, AIS, traffic regulations, chart updates, meteorological conditions, ice conditions, etc., which is often referred to as the Maritime Services **Portfolio**.

19 Implementation of a system for automatic and digital distribution of shore support services would make information more available, updated and relevant for **navigators** navigation officers.

20 Firstly, Maritime Safety Information (MSI) received by the ship should be relevant to the ship's specific voyage. Today, broadcasted MSI are delivered as printed text from a NAVTEX receiver and must be considered for action. As the Officer of Watch (OOW) may potentially receive several MSI messages daily, of which a large portion of the messages may not be of concern to the voyage, there is the risk of missing vital MSI. Important MSI could easily be overlooked. The MSI should be displayed in relation to the information it relates to and is being used on the bridge in the correct place.

21 Secondly, Notices to Mariners, updates to ENC's and corrections to all nautical publications should be received electronically without any delays in the delivery. Distribution via post is time consuming and may introduce risks to the ships sailing in waters, for which the nautical charts are not up to date.

22 As e-navigation evolves, broadband communications needs to become more cost-effective and readily available. Changes that should be made to current regulatory regimes (e.g. performance standards) should be done in a structured way, so that new systems can be included. This will ensure their use is compliant with the various existing navigational equipment and services, while not limiting the possibilities for new approaches that could offer benefits such as reduced costs and improvements in efficiency and effectiveness.

23 The most appropriate platform to present MSI may be either the INS tasks *route monitoring and status and data display* (resolution [MSC.252\(83\)](#)) or the ECDIS unit and optionally on another navigational display. Notices to Mariners, updates and corrections to ENC's and all nautical publications should be able to be received electronically with minimal delay in delivery. Such updates and corrections should, in the future, fully integrated into the INS tasks *route monitoring and status and data display* (resolution [MSC.252\(83\)](#)) or the ECDIS unit and optionally on another navigational display. Thus, such updates and corrections should not be reliant on formats such as pdf or require the ~~navigator~~ navigation officer to manually transfer updates and corrections between source and navigation device.

RCO 7: Bridge and workstation layout standardization

24 Cumbersome equipment layout on the bridge adversely influences the ~~Seafarer's~~ seafarer's ability to optimally perform navigational duties. Although some good bridge layout designs exist with respect to ergonomics, this is an area identified as insufficiently regulated so as to ensure a consistent acceptable level of functionality.

25 Reference should be made to SOLAS regulation V/15 on *Principles relating to bridge design, design and arrangement of navigational systems and equipment and bridge procedures*, [MSC/Circ.982](#) on *Guidelines on Ergonomic Criteria for Bridge Equipment and Layout*, [SN.1/Circ.265](#) on *Guidelines on the Application of SOLAS regulation V/15 to INS, IBS and bridge design*, [SN.1/Circ.288](#) on *Guidelines for bridge equipment and systems, their arrangement and integration (BES)* and [ISO 8468](#) on *Ships Bridge layout and associated equipment*.

~~26 Document NAV 59/6/1 (Australia) related to "Design Usability Principles for e-navigation Solutions and Risk Control Options" is relevant to this RCO, along with the application of Human Centred Design (HCD) guidelines and the Usability (UTEA) guidelines.~~

26 The *Guideline on Software Quality Assurance and Human-Centred Design for e-navigation* ([MSC.1/Circ.1512](#)), already developed under the IMO e-Navigation Strategic Implementation Plan (SIP), is relevant to this RCO.

27 Seafarers may experience difficulties in accessing necessary information because of ergonomic problems, such as inappropriate physical bridge locations of navigational equipment. Ergonomic problems of navigation equipment also exist in the sense that there is a lack of intuitive human-machine interface for communication and navigation means. Bridge layouts, equipment and systems have not been consistently and sufficiently designed from an ergonomic and usability perspective. Lack of familiarity with bridge equipment and/or slow response due to not finding correct information/control/alarm is considered to adversely affect safe navigation.

ANNEX 2

A DETAILED EXPLANATION OF THE PROPOSAL OF THE MARITIME SERVICES TO BE USED IN MARITIME SERVICE PORTFOLIOS

Maritime Service No	Identified Services	Identified Service Provider	Short Description
1 MSP1	VTS Information Service (INS)	VTS Authority	<p>The VTS Information Service (IS) (INS) is defined as "a service to ensure that essential information becomes available in time for onboard navigational decision-making".</p> <p>Relevant information is broadcast at fixed times and intervals or provided when deemed necessary by the VTS or at the request of a vessel.</p> <p>A VTS IS INS involves maintaining a traffic image and allows interaction with traffic and response to developing traffic situations. An Information Service should provide essential and timely information to assist the onboard decision-making process, which may include but is not limited to:</p> <ul style="list-style-type: none"> • the position, identity, intention and destination of vessels; • amendments and changes in promulgated information concerning the VTS area such as boundaries, procedures, radio frequencies, reporting points; • the mandatory reporting of vessel traffic movements; • meteorological and hydrological conditions, Notices to Mariners, status of aids to navigation; • manoeuvrability limitations of vessels in the VTS area that may impose restrictions on the navigation of other vessels, or any other potential hindrances; or • any information concerning the safe navigation of the vessel. <p>The IS INS is designed to improve the safety and efficiency of vessel traffic and to protect the environment. Among others, such services include routing, channel info, security level, berthing, anchorage, time slot, traffic monitoring and assessment, waterway conditions, weather, navigational hazards, any other factors that may influence the vessel's transit, reports on the position, identity and intentions of other traffic.</p>

Maritime Service No	Identified Services	Identified Service Provider	Short Description
2 MSP2	Navigational Assistance Service (NAS)	VTS Authority National Competent VTS Authority/ Coastal or Port Authority	<p>The NAS is defined as "a service to assist onboard navigational decision-making and to monitor its effects".</p> <p>NAS may be provided on request by a vessel in circumstances such as equipment failure or navigational unfamiliarity.</p> <p>Specific examples of developing situations where NAS may be provided by the VTS include:</p> <p>Risk of grounding; vessel deviating from the recommended track or sailing plan; vessel unsure of its position or unable to determine its position; vessel unsure of the route to its destination; assistance to a vessel to an anchoring position; vessel navigational or manoeuvring equipment casualty; inclement conditions (e.g. low visibility, high winds); potential collision between vessels; potential collision with a fixed object or hazard; assistance to a vessel to support the unexpected incapacity of a key member of the bridge team, on the request of the master.</p>
3 MSP3	Traffic Organization Service (TOS)	VTS Authority National Competent VTS Authority/ Coastal or Port Authority	<p>The TOS is defined as "a service to prevent the development of dangerous maritime traffic situations and to provide for the safe and efficient movement of vessel traffic within the VTS area".</p> <p>The purpose of the TOS is to prevent hazardous situations from developing and to ensure safe and efficient navigation through the VTS area.</p> <p>TOS should be provided when the VTS is authorized to provide services, such as when:</p> <ul style="list-style-type: none"> • vessel movements need to be planned or prioritized to prevent congestion or dangerous situations; • special transports or vessels with hazardous or polluting cargo may affect the flow of other traffic and need to be organized; • an operating system of traffic clearances or sailing plans, or both, has been established; • the allocation of space needs to be organized; • mandatory reporting of movements in the VTS area has been established; • special routes should be followed; • speed limits should be observed; • the VTS observes a developing situation and deems it necessary to interact and coordinate vessel traffic; and • nautical activities (e.g. sailing regattas) or marine works in-progress (such as dredging or submarine cable-laying) may interfere with the flow of vessel movement.

Maritime Service No	Identified Services	Identified Service Provider	Short Description
4 MSP4	Local Port Service (LPS)	Local Port/Harbour Operator	<p>LPS is applicable to those ports where it has been assessed that a VTS, as described above, is excessive or inappropriate.</p> <p>The main difference arising from the provision of LPS is that it does not interact with traffic, nor is it required to have the ability and/or the resources to respond to developing traffic situations and there is no requirement for a vessel traffic image to be maintained.</p> <p>Provision of LPS is designed to improve port safety and coordination of port services within the port community by dissemination of port information to vessels and berth or terminal operators. It is mainly concerned with the management of the port, by the supply of information on berth and port conditions. Provision of LPS can also act as a medium for liaison between vessels and allied services, as well as providing a basis for implementing port emergency plans. Examples of LPS may include:</p> <ul style="list-style-type: none"> • berthing information; • availability of port services; • shipping schedules; and • meteorological and hydrological data. <p>A number of web-based LPS services are being developed. An example is AVANTI, an initiative of the International Harbour Masters Association (IHMA).</p>
5 MSP5	Maritime Safety Information Service (MSI)	National Competent Authority	<p>The Global Maritime Distress and Safety System (GMDSS) as described in SOLAS chapter IV defines the seventh functional requirement as:</p> <p>"Every ship, while at sea, shall be capable of transmitting and receiving maritime safety information".</p> <p>The MSI service is an internationally coordinated network of broadcasts of Maritime Safety Information from official information providers, such as:</p> <ul style="list-style-type: none"> • National Hydrographic Offices, for navigational warnings and chart correction data; • National Meteorological Offices, for weather warnings and forecasts; • Rescue Co-ordination Centres (RCCs), for shore-to-ship distress alerts; and • the International Ice Patrol, for Oceanic ice hazards.

Maritime Service No	Identified Services	Identified Service Provider	Short Description
			<p>Specific information on Aids to Navigation and restrictions on safe navigation are part of MSI services provided by national authorities. This can include but is not limited to, the following type of information to be available to Seafarers seafarers:</p> <ul style="list-style-type: none"> • status of Aids to Navigation; • status of GPS and DGPS; • buoy tendering operation; and • restriction on safe navigation such as bridge/hydro cable air gap, new hazards, construction or dredging operations.
6 MSP6	Pilotage Service	Pilotage Authority/ Pilot Organization	<p>The aim of the pilotage service is to safeguard traffic at sea and protect the environment by ensuring that vessels operating in pilotage areas have pilots with adequate qualifications and local knowledge for safe navigation. Each pilotage area needs highly specialized experience and local knowledge on the part of the pilot.</p> <p>Efficient pilotage depends, among other things, effectiveness of communications and information exchanges between the pilot and the master as well other bridge team members with the understanding that each has functions and duties related to each other.</p> <p>The Pilot's Portable Unit (PPU) is a useful tool for safe navigation in clear and restricted visibility. Data accessible by the PPU should be made available in a structured, harmonized and reliable manner, and the interface for accessing such e-navigation information should be standardized.</p> <p>Establishment of effective coordination between the pilot, the master and the bridge personnel, taking due account of the ship's systems and equipment available to the pilot, will aid a safe and expeditious passage (see resolution A.960(23)).</p>
7 MSP7	Tugs Service	National Competent Authority; Local Port/Harbour Authority	<p>Efficient tug operations depend on, among other things, the effectiveness of the communications and information exchanges between relevant stakeholders. The aim of the tugs services is to safeguard traffic at sea and protect the environment by conducting operations such as:</p> <ul style="list-style-type: none"> • transportation (personnel and staff from port to anchorage) operations; • ship assistance (i.e. mooring) operations; • salvage (grounded ships or structures) operations;

Maritime Service No	Identified Services	Identified Service Provider	Short Description
			<ul style="list-style-type: none"> • shore operations; • towage (harbour/ocean) operations; • escort operations; and • oil spill response operations.
8 MSP8	Vessel Shore Reporting	National Competent Authority and appointed service providers	<p>The aim of vessel shore reporting is to safeguard traffic at sea, ensure personnel safety and security, protection of the marine environment and increase the efficiency of maritime operations.</p> <p>Single-Window is one of the most important solutions to reduce the seafarer's workload (amount of time spent on preparing and submitting reports to shore-based authorities). To achieve this, reports should be automatically generated as much as possible from onboard systems. Some other important possibilities for vessel shore reporting system may include:</p> <ul style="list-style-type: none"> • single-entry of reportable information in single-window solution; • automated collection of internal ship data for reporting; • all national reporting requirements to apply standardized digital reporting formats based on IMO FAL forms; and • automated or semi-automated digital distribution/communication of required reportable information.
9 MSP9	Telemedical Assistance Service (TMAS)	National health Organization/ dedicated health Organization	<p>TMAS centres provide medical advice for seafarers 24 h/day, 365 days/year. TMAS are permanently staffed by physicians qualified in conducting remote consultations and who are well versed in the particular nature of treatment on board ship.</p> <p>Within the maritime medicine the prevailing view has for a long time been that a standardization of the TMAS services is both necessary and wanted. This would firstly enhance the quality of the medical practice, and secondly, a standardization of reporting and registering of medical treatments provides the basis for advancement.</p>
10 MSP10	Maritime Assistance Service (MAS)	Coastal/Port Authority/ Organization	<p>The primary mission of MAS is to receive reports from ships in the event of an incident involving a ship and/or where a ship is in need of assistance.</p>

Maritime Service No	Identified Services	Identified Service Provider	Short Description
			<p>The MAS is operational on a 24-hour basis to organize rapid assistance and professional support for ships in connection with combating pollution, fire and explosions on board, collision, grounding, etc., but not requiring rescue of persons (see A.950(23))</p> <p>The MAS is responsible only for receiving and transmitting communications and monitoring the situation. It serves as a point of contact between the master and the coastal State concerned if the ship's situation requires exchanges of information between the ship and the coastal State.</p> <p>Situations where the MAS apply are as follows:</p> <ul style="list-style-type: none"> • ship involved in an incident (loss of cargo, accidental discharge of oil, etc.) that does impair its seakeeping ability but nevertheless has to be reported; • ship in need of assistance according to the master's assessment, but not in distress situation that requires the rescue of personnel on board; and • ship in distress situation and those on board have already been rescued, with the possible exception of those who have remained aboard or have been placed on board to attempt to deal with the ship's situation. <p>The MAS entails the implementation of procedures and instructions enabling the forward of any given information to the competent Organization and requiring the Organizations concerned to go through the MAS in order to make contact with the ship.</p>
11 MSP11	Nautical Chart Service	National Hydrographic Authority/ Organization	<p>The aim of the nautical chart service is to provide nautical chart information such as nature and form of the coast, water depth, tides table, obstructions and other dangers to navigation, location and type of aids to navigation.</p> <p>The Nautical Chart service also ensure the distribution, update and licensing of electronic chart to vessels and other maritime parties.</p>
12 MSP12	Nautical Publications Service	National Hydrographic Authority/ Organization	<p>The term nautical publications refer to the set of nautical information available for a particular sea area or port. It comprises nautical charts, information on ports, navigational aids ashore and at sea as well as contact information of authorities and services for a sea area or port, such as sailing directions, lists of lights, Notices to Mariners, tide tables and all other nautical publications necessary for the intended voyage (SOLAS reg.V/27).</p> <p>The aim of the nautical publication service is to promote navigation awareness and safe navigation of ships. The nature of waterways described by any given nautical publication</p>

Maritime Service No	Identified Services	Identified Service Provider	Short Description
			<p>changes regularly, and a Seafarer navigating by use of an old or uncorrected publication is courting disaster. Nautical publications include:</p> <ul style="list-style-type: none"> • tidal currents, aids to navigation system, buoys and fog signals, radio aids to marine navigation, chart symbols, terms and abbreviations, sailing directions; and • a Chart and Publication Correction Record Card system can be used to ensure that every publication is properly corrected prior use by Seafarers.
13 MSP13	Ice Navigation Service	National Competent Authority Organization	<p>The ice navigation service is critical to safeguard the ship navigation in ice-infested waters, given how quickly the ice maps become outdated in the rapid changing conditions of the ice-covered navigational regions. Such services include:</p> <ul style="list-style-type: none"> • ice condition information and operational recommendations/advice; • ice condition around a vessel; • vessel routeing; • vessel escort and ice breaking; • ice drift load and momentum; and • ice patrol.
14 MSP14	Meteorological Information Service	National Meteorological Authority/ Public Institutions	<p>The meteorological service is essential to safeguard the traffic at sea by providing weather, climate digital forecasts and related information to seafarers who use these types of information to support their decision-making. Such information includes:</p> <ul style="list-style-type: none"> • weather routeing, solar radiation and precipitation; • cold/hot durations and warnings; • air temperature, wind speed and direction; and • cloudiness and barometric pressure.
15 MSP15	Real-time hydrographic and environmental information service	National Hydrographic and Meteorological Authorities	<p>The real-time hydrographic and environmental information service is essential to safeguard navigation at sea and protect the environment. The services provided include:</p> <ul style="list-style-type: none"> • current wind speed and direction; • wave height; • marine habitat and bathymetry; and

Maritime Service No	Identified Services	Identified Service Provider	Short Description
			<ul style="list-style-type: none"> sailing Directions (or pilots): detailed descriptions of areas of the sea, shipping routes, harbours, aids to navigation, regulations, etc.; lists of lights: descriptions of lighthouses and lightbuoys; tide surge prediction tables and tidal stream atlases; ephemerides and nautical almanacs for celestial navigation; and Notices to Mariners: periodical (often weekly) updates and corrections for nautical charts and publications.
16 MSP16	Search and Rescue Service (SAR)	SAR Authorities	<p>The SAR service performs distress monitoring, communication, coordination and search and rescue functions, including provisions of medical advice, initial medical assistance, or medical evacuation, through the use of initial medical assistance. An MRCC provides reliable communication links to the system's network for efficient handling of shore-to-ship distress alert relays and distress traffic.</p> <p>In maintaining a state of full readiness the MRCC may perform the following rescue functions:</p> <ul style="list-style-type: none"> rescuing of survivors of any aircraft (not in an act of war) crashes or forced landings at sea; rescuing of crew and passengers of vessels in distress; and rescuing of survivors of maritime accidents or incidents. <p>The SAR services must also coordinate the evacuation of seriously injured or ill person from a vessel at sea when the person requires medical treatment sooner than the vessel would be able to get him or her to a suitable medical facility.</p> <p>MRCCs may also be pro-actively involved in activities such as:</p> <ul style="list-style-type: none"> information collection, distribution and coordination; monitoring towing operations; monitoring and evaluating levels of risk from Maritime Safety Information (MSI) broadcasts to ensure an immediate response in case of life threatening situations developing; monitoring vessels not under command; and pollution reports and vessels aground.

Maritime Service No	Identified Services	Identified Service Provider	Short Description
			<p>E-navigation can provide additional information such as number of persons on board, type of ship, port of destination, etc. and enable provision of additional information such as available SAR resources on board ships, etc.</p> <p>Information on other vessels in the area can be crucial for an effective rescue.</p> <p>Communication solutions used for e-navigation will be able to exchange information about SAR areas and allocate search patterns and provide facilities for MRCCs to set up a common information sharing log or chatroom for MRCCs, on-scene coordinator and other resources to share and update information during a SAR incident.</p>

ANNEX 3

USER NEEDS AND PRIORITIES

Shipboard user needs and priorities

User Need	Justification	Relation to IMO Strategy	Priority in terms of work required	Issues to Consider
Human Machine Interface Issues				
Improved Ergonomics Seafarers have expressed a desire for bridge layouts, equipment and systems to be better designed from an ergonomic and user-friendly perspective.	Many ship bridges have been designed without much thought given to the effective layout of equipment or workstations. Seafarers have expressed that in an e-navigation era, work stations, navigation displays, communication devices, and other bridge equipment must be designed to improve effective bridge operation. Such layouts should take into account expanded bridge teams, including the pilot.	<ul style="list-style-type: none"> Human-Machine Interface Human-centred presentation needs 	<p>Harmonize and apply existing documentation Take note of: IMO documents:</p> <ul style="list-style-type: none"> Resolution MSC.252(83) (Adoption of the Revised performance standards for Integrated Navigation Systems (INS) – valid for equipment installed on or after 1 January 2011) Resolution MSC.86(70), annex 3 (Performance standards for an Integrated Navigation System (INS) – valid for equipment installed on or after 1 January 2000 but before 1 January 2011) MSC/Circ.982 (Guidelines on Ergonomic Criteria for Bridge Equipment and Layout) Arrangements and Integration) Resolution MSC.191(79) (Performance standards for the presentation of navigation-related information on shipborne navigational displays) Other industry standards. 	It should be noted that much work has been done in this area, however not widely applied. Consideration of more prescriptive bridge layout requirements. Consideration of more prescriptive work station requirements. Better application of centralized and effective dimming of screens. Innovations and new technology solutions; should concentrate on the needs and capabilities of the users.

				<p>Promotion of access to information at one place where appropriate (multi-functional workplaces).</p> <p>Methodology to consider usability of navigational equipment</p>
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User Need	Justification	Relation to IMO Strategy	Priority in terms of work required	Issues to Consider
Standard Interface Seafarers expressed a desire for greater standardization of functionality for navigation displays (human-machine interface).	Navigation system functions, operations and presentation (including ECDIS, Radar, AIS, GPS, GMDSS, etc.) can vary widely between manufacturers and even between models by a single manufacturer. The differences include where certain information is displayed (i.e. Speed and Course), how it is displayed, menu functions and interface devices such as knobs or joysticks. This makes type specific training difficult, and leads to ineffective use of features particularly by those watchkeepers who are new to a vessel.	<ul style="list-style-type: none"> Human-centred presentation needs Human-Machine Interface Analysis 	Research should be conducted regarding the functionality of standard interfaces. Take note of: IMO documents - MSC.191(79) (Pres. Of Nav-Related Info on NavDisplays) - MSC.252(83) (INS) - NAV 55/4, annex 1 (Bridge Equipment, System Arrangements and Integration) Other industry standards.	Design specification for current equipment. Note should be made of concept of S-Mode. Need to update and establish balance between standardization and innovation.
Familiarization Requirements Seafarers need all safety-related equipment to be provided with familiarization material specific to the model and installation.	Seafarers often join ships where non-standard equipment and functions exist. It was thought that if these pieces of equipment or systems could be provided with familiarization material or tutorials safety would improve.	<ul style="list-style-type: none"> Human-Machine Interface Analysis Implementation issues 	Identify where familiarization material specifications need to be developed for existing and developing performance standards. Take note of: IMO document (SN.1/Circ.274) Guidelines for application of the modular concept to performance standards.	Consideration should be given to requiring such familiarization material to be provided by the manufacturer. Consider example using INS Performance Standard (MSC.252(83)).

User Need	Justification	Relation to IMO Strategy	Priority in terms of work required	Issues to Consider
User-selectable presentation of information received via communication equipment	Seafarers expressed a desire to have the possibility to present user-selectable information received via communication equipment on the navigational displays (e.g., vessel in distress, wind speed/ direction, AtoN status, restricted areas). They further requested the possibility to filter some transmitted data for presentation according to user-set parameters (e.g. only information from user-selected sea areas).	<ul style="list-style-type: none"> • Effective communication: • Human-centred presentation needs • Human-Machine Interface • Analysis 	Research should be conducted regarding the type of information, equipment and systems involved and how to present and/or filter such information.	Availability of information in real-time with possible presentation on the navigational displays. Information overload needs to be prevented, therefore, presentation of information should be user-selectable to filter required information. Task-oriented presentation based on INS-tasks MSC.252(83).
Maritime Safety Information (MSI) Seafarers expressed a desire to sort and display MSI, such as NAVTEX, SafetyNET more effectively.	<p>On most ships, NAVTEX information is displayed on a separate screen or printed on a scroll of paper. The Latitude and Longitude of the MSI must then be compared to that of the vessel by the watchkeeper to identify whether the information is relevant and poses a risk. For example, notification of a new and dangerous wreck carries is not prioritized over a drifting buoy, possibly hundreds of miles away from the ship's intended route.</p> <p>This is a very time-consuming and distracting task, and susceptible to human error. Seafarers considered that presenting such safety information on the ship's navigation display would be far more effective and a clear benefit of e-navigation.</p>	<ul style="list-style-type: none"> • Effective communication • Human-centred presentation needs • Human-Machine Interface • Analysis 	<p>Work with relevant stakeholders to address technical requirements for presenting MSI on navigation displays.</p> <p>Take note of Methodology for developing e-navigation user needs using a task-based approach (NAV 55/11/4).</p>	<p>Possible re-formatting of NAVTEX data and continuing with transmitting data on same frequencies.</p> <p>Transition from old to new format. Task-oriented presentation based on INS-tasks MSC.252(83).</p>

User Need	Justification	Relation to IMO Strategy	Priority in terms of work required	Issues to Consider
Alert Management Bridge alerts (emergency alarms, alarms, warnings and cautions) must be coordinated, weighted, and support decision-making without undue distraction.	<p>It is not uncommon for the bridge of a ship to have in excess of 500 alarms pertaining to navigation, propulsion, cargo, and communication systems.</p> <p>These alarms are usually uncoordinated, physically located all over the bridge, and give little indication of severity without interrogation, which distracts the navigator. As systems become increasingly complex, all bridge alarms must be coordinated to avoid undue distraction.</p>	<ul style="list-style-type: none"> • Human-centred presentation needs • Data and System Integrity • Analysis 	<p>Investigate possibility to apply existing IMO regulations to INS alert management and bridge alert management.</p> <p>Take note of:</p> <p>IMO documents</p> <ul style="list-style-type: none"> • Resolution A.1021(26) on Code on Alerts and Indicators, 2009 • Resolution MSC.252(83) (INS) • Resolution MSC.302(87) on Adoption of performance standards for Bridge Alert Management 	
Indication of Reliability	<p>Seafarers have expressed a concern that on systems such as ECDIS, the ship's position is always indicated as an absolute, leaving seafarers to rely on their understanding of technically complex systems to assess the accuracy of such indicated positions. Seafarers have expressed a desire for systems to automatically assess the accuracy and integrity of hydrographic data, position fixing data, radar, and other ship sensors to return a graphical indication of assessment.</p>	<ul style="list-style-type: none"> • Human-centred presentation needs • Human-Machine Interface • Data and System Integrity • Analysis 	<p>Investigate effective ways to indicate levels of reliability using graphical representation. Take note of:</p> <ul style="list-style-type: none"> • Resolution MSC.252(83) (INS) • Other industry standards. 	<p>Consideration of using, e.g. ellipses of uncertainty to indicate expected accuracy. Consideration of using, e.g. colour or shading changes to indicate integrity of information.</p>

User Need	Justification	Relation to IMO Strategy	Priority in terms of work required	Issues to Consider
Operational Issues				
Improved Reliability Before seafarers are confident in e-navigation systems, they must prove far more reliable than many of the present systems.	Seafarers today often struggle with electronic equipment that fails or malfunctions in some respect. This may relate to poor performance from radar; electronic chart software faults; incorrect AIS data, GMDSS alerts or loss of position fixing systems. Even a 99% reliability rating, would result in a problem for one voyage in every 100. This has resulted in many Seafarers distrusting electronic systems, and now having grave doubts about relying on e-navigation. It must be recognized that there is little competence for fixing such systems on board, and obtaining the services of a qualified technician in some ports can be difficult.	<ul style="list-style-type: none"> • Effective and robust communications • Data and System Integrity 	It will be necessary to carry out an assessment to quantify reliability parameters. To include specific assessment of reliability of electronic position fixing systems.	Design specification for current equipment. Type approval process. Competence of installation and repair technicians. Better control and visibility of software and hardware updates.
Standardized and automated reporting Seafarers have expressed a keen desire to reduce the amount of ship/shore reporting and to adopt the principle of single entry for any information into the system. They have further expressed a desire for globally standardized reporting procedures and forms to avoid repetition of reporting and to reduce workload.	A major frustration and distraction for seafarers is the repeated reporting of static and dynamic information pertaining to the vessel, cargo, crew, and voyage to shore authorities. A major benefit of e-navigation would be for ships' crew to enter such information into their system only once and for it to be shared by authorized authorities without further intervention by the ship.	<ul style="list-style-type: none"> • Common Maritime Information/Data Structure • Automated and Standardized Reporting Functions • Effective and Robust Communications 	Investigate methods for global standardization of reporting procedures and technology. Investigate the legal aspects associated with access and sharing of information.	Possible increased use of AIS. Possible increased demands on communication means, i.e. spectrum and bandwidth.

User Need	Justification	Relation to IMO Strategy	Priority in terms of work required	Issues to Consider
Improved Target Detection Seafarers would be grateful if e-navigation could facilitate better detection of targets.	Seafarers are constantly concerned with identifying targets, including leisure and fishing craft, pirates, flotsam and jetsam, ice, etc. Better detection of small targets is considered a priority	<ul style="list-style-type: none"> • Effective and robust communications • Human Centred Presentation Needs • Data and System Integrity • Analysis 	Investigate technologies to assist with better detection of targets and risk of collision.	High resolution X-band NT radar has potential benefit in this area.
Guard Zones Seafarers expressed a desire to have more effective Guard Zones to notify watchkeepers of hazards pertaining to collisions and groundings.	As target detection become more effective, MSI becomes integrated, and passage plans are programmed in ECDIS, Seafarers feel that guard zones in three dimensions can be an effective way to warn watchkeepers of undetected hazards. This should include hazards of grounding taking into account UKC in a dynamic environment; air draft; and risk of collision. Warnings from this Guard Zone feature should be integrated into the bridge alert system.	<ul style="list-style-type: none"> • Human-centred presentation needs • Human-Machine Interface • Data and System Integrity • Analysis 	Research effective means of implementing the use of Guard Zones or other means in order to avoid collisions and groundings.	It should be noted that the use of such Guard Zone facility will need to be intrinsic in the training syllabus. Use of Guard Zones must be taught as a decision support feature. Many ships have aspects of Guard Zones on present equipment but don't use them due to poor training with reference to their function and their value.
Reduction of administrative burden and increase use of electronic documentation	Users expressed the need to reduce the amount of administrative work on board. They also expressed a desire to replace paper information and documentation by electronic means for easy location of information.	<ul style="list-style-type: none"> • Human-centred presentation needs • Data and system integrity 	Investigate the best way to harmonize and present maritime documentation in an electronic format to improve efficiency and reduce administrative burden.	Electronic documents should support: - easy localization of information (e.g. with the help of a search function) - automatic updates (e.g. of Notices to Mariners) - Possible integration of information from multiple sources. - the integration of information in other systems on the bridge (e.g. ECDIS) electronic documents should be printable or be additionally provided as paper version. The need for traceability and ability to audit.

User Need	Justification	Relation to IMO Strategy	Priority in terms of work required	Issues to Consider
<p>Automated Updating of Baseline Data and Documents</p> <p>Seafarers expressed a desire for documents such as charts, and voyage planning publications to be automatically updated, with minimal shipboard intervention.</p>	<p>Seafarers are required to use a plethora of publications associated with voyage planning and monitoring. These include, but are not limited to charts, lights list, list of radio signals, sailing directions, port guides, etc. Currently, most of these are kept on board in a paper format and require a considerable amount of time to keep constantly updated. Seafarers believe that e-navigation can be of benefit if it ensures that all these sources of information are automatically maintained up-to-date, and all of this information is accessible from a centralized location. Seafarers have also expressed a desire for this information to be easy to access, sort and make sense of. This may be achieved by standard formats or — smart systems. Seafarers are very concerned that e-navigation may lead to more information being made available to them, leading to further overburdening. It is essential that the provision of information via e-navigation should be managed and presented effectively.</p>	<ul style="list-style-type: none"> • Common Maritime Information/Data Structure • Effective and robust communications • Human-centred presentation needs • Analysis 	<p>Investigate and harmonize means for automated updating of baseline data and documents, including consideration of legal aspects communication costs.</p>	<p>Consideration should be given to a proper electronic format for the data rather than digital copies of existing paper publications. This would allow the presentation of relevant data in a succinct manner. The need for traceability and ability to audit.</p>

User Need	Justification	Relation to IMO Strategy	Priority in terms of work required	Issues to Consider
Effective and robust communications	A clear need was expressed for there to be an effective and robust means of communications for ship and shore users. Shore-based users require an effective means of communicating with vessels to facilitate safety, security and environmental protection and to provide operational information. To be effective, communication with and between vessels should make best use of audio/visual aids and standard phrases to minimize linguistic challenges and distractions to operators. Research has indicated that a high percentage of seafarers regards language incompatibility and non-standard phrases a major problem. They also highlighted equipment failure and busy communication channels a concern that needs to be addressed.	Automated and standardized reporting functions. Effective and robust communications. Common Marine/Data Structure Data and System Integrity Human-centred presentation needs	Research into how voice and digital communication can be made more effective. Plan for greater use of IMO SMCP. Identify reliability standards for communication technology. Identify communication capacity issues to ensure adequate bandwidth for essential communication needs.	Route exchange Use of AIS application specific messages. Use of Wireless technology (Wi-Fi and Wi-MAX).

Shore-based user needs

User Need	Justification	Relation to IMO Strategy	Priority in terms of work required	Issues to Consider
Collection of information	<p>Complete marine domain awareness is essential for the early identification of risks and effective response.</p> <p>The collection of information is necessary to build an enhanced domain awareness, to support safety, security, environment protection and efficiency. This allows for faster and more informed decisions.</p> <p>There are rules that require coastal States to maintain domain awareness.</p> <p>There is currently a gap between the information collected and information required.</p> <p>A change in the type of service offered by a VTS (i.e. Information Service, Navigational Assistance Service or a Traffic Organization Service) may change the functional requirements of the domain awareness system.</p>	<p>Common maritime information/ data structure.</p> <p>Automated and standardized reporting functions.</p> <p>Effective and robust communications.</p> <p>Data and system integrity.</p> <p>Analysis.</p>	<p>Identify the data that will be required.</p> <p>Identify the data sources that will be required.</p> <p>Identify the key data providers, the standards that apply, types of data they provide and any limitations.</p> <p>Identify the relationship between key data providers and users.</p> <p>Identify relevant legislation.</p> <p>Identify harmonization needs for standards, formats and protocols.</p> <p>Develop a system to allow the global exchange of ship and other maritime reporting data.</p>	<p>Such information may include both static and dynamic information including hydrographic, environmental, vessel data, AtoN information and known hazards.</p> <p>Take into account AIS and GMDSS standards</p> <p>Take into account the functionality of existing web-based systems.</p> <p>Take into account the development of Service Level Agreements with data providers.</p> <p>Take into account existing ship reporting systems.</p> <p>There are a multitude of communication methods that should be considered.</p> <p>Consideration will need to be given to legal and liability issues, specifically with regard to the handling of data.</p> <p>Take into account the lessons learnt from development of ECDIS.</p>

User Need	Justification	Relation to IMO Strategy	Priority in terms of work required	Issues to Consider
Management of information	<p>Shore authorities need tools for managing increased levels of information pertaining to the maritime domain awareness.</p> <p>A harmonized and holistic approach to information management will enable shore authorities to manage resources more efficiently.</p> <p>The harmonized and enhanced presentation of domain awareness will improve situational awareness for allied¹ and other support services.</p> <p>Enhanced information management is required for improving logistics management and in support of safety, security and environment protection.</p> <p>Currently, there are major challenges to managing and sharing a diverse range of information from dissimilar systems.</p> <p>Current systems suffer without a harmonized approach to quality and structure.</p>	<p>Common maritime information/data structure.</p> <p>Automated and standardized reporting functions.</p> <p>Effective and robust communications.</p> <p>Human-centred presentation needs.</p> <p>Data and system integrity.</p> <p>Analysis.</p>	<p>Identify the sources and ownership of information to be managed.</p> <p>Identify communication methods/variety of communication methods.</p> <p>Identify quality parameters for different types of information, including accuracy, reliability, latency, etc.</p> <p>Identify specific requirements for alerting for the loss of integrity or system failure.</p> <p>Identify the legal issues pertaining to capturing, storing and sharing data.</p> <p>Seek to harmonize policies for the security and use of data.</p>	<p>A gap analysis should be used to identify the capability of present information management systems to deal with an increasing amount of information in a timely manner.</p> <p>Take into account best practice for information management and examples from other industries, such as aviation.</p> <p>Take into account the benefits of open architecture systems.</p>

¹ Allied services are services actively involved in the safe and efficient passage of the vessel through the VTS area (IMO resolution A.857(20)).

User Need	Justification	Relation to IMO Strategy	Priority in terms of work required	Issues to Consider
Provision of information to vessels	<p>Shore authorities have an obligation to provide maritime information to vessels.</p> <p>There is a need to improve the delivery and presentation of such information to enhance onboard decision-making.</p> <p>Effective and harmonized communication should allow for the provision of such information in an operationally effective manner.</p>	<p>Common maritime information/ data structure.</p> <p>Automated and standardized reporting functions.</p> <p>Effective and robust communications.</p> <p>Human centred presentation needs.</p> <p>Data and system integrity.</p> <p>Analysis.</p>	<p>Identify the information necessary to be provided to vessels, taking into account the responsibility assigned to the shore-based provider.</p> <p>Identify the means of communicating the information to vessels.</p>	<p>Consider the efficient provision of relevant information pertaining to logistics and commercial activities.</p> <p>Consider how to provide information to the seafarer efficiently and effectively. This pertains to traffic information, MSI, security-related information, updates to nautical publications, met-ocean information, etc.</p> <p>Take into account the need for scalability.</p> <p>Consider a facility for shore authorities to assess the real time status of shore systems and to disseminate this information as appropriate.</p> <p>Take into account the use of AIS binary messages.</p>
Quality assurance	<p>The shore authority needs to have confidence that the navigation systems being used on board are operating correctly.</p> <p>Shore authorities need to be confident that the information which they receive from and send to the ship is correct.</p> <p>Shore authorities have a need to be capable of establishing effective communication with bridge teams and other shore users.</p>	<p>Common maritime information/ data structure.</p> <p>Automated and standardized reporting functions.</p> <p>Effective and robust communications.</p> <p>Data and system integrity.</p> <p>Analysis.</p>	<p>It will be necessary to carry out an assessment to quantify reliability parameters, taking into account existing IEC standards/IMO Performance Standards for on board equipment.</p> <p>Investigate the technical and procedural capabilities for monitoring quality</p> <p>Consider how information can have a quality rating.</p>	<p>Consider how shore authorities are assured of the navigation system status on board ships in real time. And for system faults ashore to be brought to the attention of seafarers as appropriate.</p> <p>Consider the effectiveness of communications in terms of technology and language.</p> <p>Consider legal and liability issues.</p>

User Need	Justification	Relation to IMO Strategy	Priority in terms of work required	Issues to Consider
Shore-to-shore information exchange	<p>Shore authorities need an enhanced ability to share maritime information amongst authorized shore users to ensure consistency and reduce the reporting burden by ship personnel.</p> <p>More effective shore-to-shore information exchange will aid safety, security, the identification of risk, environmental protection and improve logistics management.</p>	<p>Common maritime information/ data structure.</p> <p>Automated and standardized reporting functions.</p> <p>Effective and robust communications.</p> <p>Human-centred presentation need.</p> <p>Data and system integrity.</p> <p>Analysis.</p>	<p>Identify and/or develop necessary protocols, formats and data structures</p> <p>Investigate methods for global data sharing</p> <p>Identify relevant legal and regulatory implications</p>	<p>Consider the need for data security and ownership issues.</p> <p>Consider work done in other relevant industries.</p> <p>Consider the use of standard data exchange protocols.</p>
Effective and robust communications	<p>A clear need was expressed for there to be an effective and robust means of communications for ship and shore users. Shore-based users require an effective means of communicating with vessels to facilitate safety, security and environmental protection and to provide operational information. To be effective, communication with and between vessels should make best use of audio/visual aids and standard phrases to minimize linguistic challenges and distractions to operators.</p> <p>Research has indicated that a high percentage of seafarers regards language incompatibility and non-standard phrases a major problem. They also highlighted equipment failure and busy communication channels as concerns that needs to be addressed.</p>	<p>Automated and standardized reporting functions.</p> <p>Effective and robust communications.</p>	<p>Research into how voice and digital communication can be made more effective.</p> <p>Plan for greater use of IMO SMCP.</p> <p>Identify reliability standards for communication technology.</p> <p>Identify communication capacity issues to ensure adequate bandwidth for essential communication needs.</p>	

SAR authority user needs for e-navigation

User Need	Justification	Relation to IMO Strategy	Priority in terms of work required	Issues to Consider
SAR should have access to relevant information contained within the e-nav domain	SAR need a full range of information pertaining to ships and their domain to support the saving of lives.	Common Data Structure Automated reporting Robust Communications Data Integrity		
Effective Communication and information sharing.	SAR must be able to use the e-nav infrastructure to communicate and share information effectively with all parties involved in an incident.	Common Data Structure Automated reporting Robust Communications Data Integrity		
Priority for distress communications	Within the e-nav domain, distress communications should take priority over all other communications.	Common Data Structure, Automated reporting, robust communications data integrity		
SAR Authorities need access to the details of all relevant onboard communication equipment and capabilities.	To maximize incident response, SAR need to be able to determine the best means for communications.			

ANNEX 4

LIST OF STANDARDS THAT COULD BE EVALUATED FOR E-NAVIGATION

Some of the IMO performance standards already have interfaces and displays which might be suitable for use in an e-navigation context. However, some existing equipment standards do not currently have all the appropriate interfaces or use the appropriate up to date display standards, but manufacturers may be providing them as an extra feature. For example, it is not currently an IMO requirement to be able to display AIS information on an ECDIS but some manufacturers' equipment has this facility.

The following tables list the communications and navigation equipment currently required by SOLAS chapters III, IV and V. These equipment are mandatory depending on the configuration of the ship (tonnage, etc.) and GMDSS Sea Area (A1, A2, A3 or A4). The INS has been added because although it is not currently a carriage requirement as it might be an essential element of e-navigation.

The fifth column of the tables indicates if the equipment might be used for e-navigation (i.e. has appropriate interfaces, etc.).

E = may be used without modification to the existing standards

F = future upgrade may be needed for interfacing

M = standards may need to be modified for e-navigation

P = presentation rules may apply

Note: Some equipment standards are subject to clarification from circulars from MSC, NAV and COMSAR.

Note: Until the Organizations review of the GMDSS is complete, the communications devices in the table below are based on the current GMDSS.

Note: Where the equipment is radio-based, the appropriate ITU recommendations are not cited as none have been identified yet that may need changing.

Table 1 – Communications equipment from SOLAS chapter IV
(including those required by SOLAS chapter III life-saving appliances)

Item designation	SOLAS 74 where "type approval" is required	Regulations of SOLAS 74 and the relevant resolutions and circulars of the IMO, as applicable	International Testing standards	Suitability for e-navigation
VHF radio capable of transmitting and receiving DSC and radiotelephony	Reg. IV/14, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14.	Reg. IV/7, — Reg. X/3, — IMO Res. A.385(X), — IMO Res. A.524(13), — IMO Res. A.694(17), — IMO Res. A.801(19), — IMO Res. A.803(19), — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14, — IMO MSC/Circ.862, — IMO COMSAR Circ.32, —	IEC 61097-3 (1994), IEC 61097-7 (1996), IEC 61162 series, — IMO MSC/Circ.862.	E P
VHF DSC watchkeeping receiver	Reg. IV/14, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14.	Reg. IV/7, — Reg. X/3, — IMO Res. A.694(17), — IMO Res. A.801(19), — IMO Res. A.803(19), — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14, — IMO COMSAR Circ.32, —	IEC 60945 (2002), — IEC 61097-3 (1994), — IEC 61097-8 (1998).	E
Navtex receiver	Reg. IV/14, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14.	Reg. IV/7, — Reg. X/3, — IMO Res. A.694(17), — IMO Res. A.801(19), — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14, — IMO Res. MSC.148(77), — IMO COMSAR Circ.32, —	IEC 60945 (2002), — IEC 61097-6 (2005-12).	M P
EGC receiver	Reg. IV/14, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14.	Reg. IV/7, — Reg. X/3, — IMO Res. A.570(14), — IMO Res. A.664(16), — IMO Res. A.694(17), — IMO Res. A.801(19), — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14, — IMO COMSAR Circ.32.	IEC 60945 (2002), — IEC 61097-4 (1994).	M P

Item designation	SOLAS 74 where "type approval" is required	Regulations of SOLAS 74 and the relevant resolutions and circulars of the IMO, as applicable	International Testing standards	Suitability for e-navigation
HF marine safety information (MSI) equipment (HF NBDP receiver)	Reg. IV/14, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14	Reg. IV/7, — Reg. X/3, — IMO Res. A.694(17), — IMO Res. A.699(17), — IMO Res. A.700(17), — IMO Res. A.801(19), — IMO Res. A.806(19), — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14, — IMO COMSAR Circ.32, —	ETSI ETS 300067 Ed.1 (1990-11), — ETSI ETS 300067/A1 Ed.1 (1993-10), — EN 60945 (2002), — EN 61162 Series.	M P
MF radio capable of transmitting and receiving DSC and radiotelephony	Reg. IV/14, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14.	Reg. IV/9, — Reg. IV/10, — Reg. X/3, — IMO Res. A.694(17), — IMO Res. A.801(19), — IMO Res. A.804(19), — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14, — IMO COMSAR Circ.32, —	IEC 60945 (2002), — IEC 61097-3 (1994), — IEC 61097-9 (1997), — IEC 61162 series, — IMO MSC/Circ.862.	M P
Inmarsat-C SES	Reg. IV/14, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14.	Reg. IV/10, — Reg. X/3, — IMO Res. A.570(14), — IMO Res. A.664 (16), (applicable only if the Inmarsat C SES comprises EGC functions), — IMO Res. A.694(17), — IMO Res. A.801(19), — IMO Res. A.807(19), — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14, — IMO MSC/Circ.862, — IMO COMSAR Circ.32.	IEC 60945 (2002), — IEC 61097-4 (2007), — EN 61162 series, — IMO MSC/Circ.862.	E P
MF/HF radio capable of transmitting and receiving DSC, NBDP and radiotelephony	Reg. IV/14, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14.	Reg. IV/10, — Reg. X/3, — IMO Res. A.694(17), — IMO Res. A.801(19), — IMO Res. A.806(19), — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14, — IMO MSC/Circ.862, — IMO COMSAR Circ.32, —	IEC 60945 (2002), — IEC 61097-3 (1994), — IEC 61097-9 (1997), — IEC 61162 series, — IMO MSC/Circ.862.	M P

Item designation	SOLAS 74 where "type approval" is required	Regulations of SOLAS 74 and the relevant resolutions and circulars of the IMO, as applicable	International Testing standards	Suitability for e-navigation
Inmarsat-F SES	Reg. IV/14, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14.	Reg. IV/10, — IMO Res. A.570 (14), — IMO Res. A.801(19), — IMO Res. A.808 (19), — IMO Res. A.694 (17), — IMO Res. MSC.36(63)-(1994 HSC Code) 14, — IMO Res. MSC.97(73)-(2000 HSC Code) 14, — IMO MSC/Circ.862, — IMO COMSAR Circ.32.	IEC 60945 (2002), — IEC 61097-13 (2003), — IMO MSC/Circ.862.	E

Table 2 – Navigation equipment
(Including those required by SOLAS CH III)

Item designation	SOLAS 74 where "type approval" is required	Regulations of SOLAS 74 and the relevant resolutions and circulars of the IMO, as applicable	Testing standards	Suitability for e-navigation
Integrated Navigation System (INS)	Reg. V/18 Not currently a carriage requirement	Reg. V/19 IMO Res.A.694(17) IMO Res. MSC.252(83)	IEC 60945(2002) IEC 61924 ed 2(tba)	M, P
Magnetic compass	Reg. V/18.	Reg. V/19, — IMO Res. A.382(X), — IMO Res. A.694(17).	ISO 449 (1997), — ISO 694 (2000), — ISO 1069 (1973), — ISO 2269 (1992), — IEC 60945 (2002).	E
Transmitting heading device THD (magnetic method)	Reg. V/18, — Reg. V/19, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.694(17), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.116(73).	IEC 60945 (2002), — IEC 61162 series. — ISO 22090-2 (2004), including Corrigendum 2005.	E F
Gyro compass	Reg. V/18.		ISO 8728 (1997), — IEC 60945 (2002), — IEC 61162 series, — IEC 62288 Ed.1.0(2008).	E F

Item designation	SOLAS 74 where "type approval" is required	Regulations of SOLAS 74 and the relevant resolutions and circulars of the IMO, as applicable	Testing standards	Suitability for e-navigation
Echo Sounding Equipment	Reg. V/18, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.424(XI), — IMO Res. A.694(17), Reg. V/19, — IMO Res. A.224(VII), — IMO Res. A.694(17), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.74(69) annex 4, — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.191(79).— IMO Res. MSC.191(79).	ISO 9875 (2000), — IEC 60945 (2002), — IEC 61162 series, — IEC 62288 Ed.1.0(2008).	E P F
Speed and Distance Measuring Equipment	Reg. V/18, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.694(17), — IMO Res. A.824(19), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.96(72), — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.191(79).	IEC 60945 (2002), — IEC 61023 (2007), — IEC 61162 series, — IEC 62288 Ed.1.0(2008)	E P F
Rate of Turn Indicator	Reg. V/18, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.526(13), — IMO Res. A.694(17), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.191(79).	IEC 60945 (2002), — IEC 61162 series, — ISO 20672 (2007), — IEC 62288 Ed.1.0(2008).	E P F
GPS equipment	Reg. V/18, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.694(17), — IMO Res. MSC.36(63)-(1994 HSC Code), — IMO Res. MSC.97(73)-(2000 HSC Code), — IMO Res. MSC.112(73), — IMO Res. MSC.191(79).	IEC 60945 (2002), — IEC 61108-1 (2003), — IEC 61162 series, — IEC 62288 Ed.1.0(2008).	E F P
Glonass equipment	Reg. V/18, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.694(17), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.113(73), — IMO Res. MSC.191(79).	IEC 60945 (2002), — IEC 61108-2 (1998), — IEC 61162 series, — IEC 62288 Ed.1.0(2008).	E F P
Galileo	Reg V/18 IMO res xxx	?????		E F P

Item designation	SOLAS 74 where "type approval" is required	Regulations of SOLAS 74 and the relevant resolutions and circulars of the IMO, as applicable	Testing standards	Suitability for e-navigation
Rudder angle indicator	Reg. V/18, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.526(13), — IMO Res. A.694(17), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.191(79).	IEC 60945 (2002), — ISO 20673 (2007), — IEC 62288 Ed.1.0(2008).	M F P
Propeller revolution indicator	Reg. V/18,	Reg. V/19, — IMO Res. A.694(17), — IMO Res. MSC.191(79),	IEC 60945 (2002), — ISO 22554 (2007), — IEC 62288 Ed.1.0(2008).	M F P
Pitch indicator	Reg. V/18,	Reg. V/19, — IMO Res. A.694(17), — IMO Res. MSC.191(79).	IEC 60945 (2002), — ISO 22555 (2007), — IEC 62288 Ed.1.0(2008).	M F P
Voyage data recorder (VDR)	Reg. V/18, — Reg. V/20, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/20, — IMO Res. A.694 (17), — IMO Res. A.861 (20), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.214(81), — IMO Res. MSC.191(79).	IEC 60945 (2002), — IEC 61162 Series, — IEC 61996-1 (2007-11), — IEC 62288 Ed.1.0(2008).	M F
Electronic chart display and information system (ECDIS) with backup, and raster chart display system (RCDS)	Reg. V/18, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.694(17), — IMO Res. MSC.36(63)-(1994 HSC Code) 13 — IMO Res. MSC.64(67), — IMO Res. MSC.86(70), — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.191(79), — IMO Res. MSC.232(82). [ECDIS back-up and RCDS are only applicable when this functionality is included in the ECDIS. The module B certificate shall indicate whether these options were tested.]	IEC 60945 (2002), — IEC 61162 Series, — IEC 61174 (2008), — IEC 62288 Ed.1.0(2008).	E F P
Gyro compass for high-speed craft	Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	IMO Res. A.694(17), — IMO Res. A.821(19), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.191(79).	ISO 16328 (2001), — IEC 60945 (2002), — EN 61162 Series, — IEC 62288 Ed.1.0(2008).	E F

Item designation	SOLAS 74 where "type approval" is required	Regulations of SOLAS 74 and the relevant resolutions and circulars of the IMO, as applicable	Testing standards	Suitability for e-navigation
Universal automatic identification system equipment (AIS)	Reg. V/18, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.694 (17), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.74(69), — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.191(79), — ITU-R M. 1371-3(2007). <i>Note:</i> ITU-R M. 1371-3(2007) annex 3 shall only be applicable in accordance with requirements of IMO Res. MSC.74(69).	IEC 60945 (2002), — IEC 61162 Series, — IEC 61993-2 (2001), — IEC 62288 Ed.1.0(2008).	E P F
Track control system (working at ship's speed from minimum manoeuvring speed up to 30 knots)	Reg. V/18.	Reg. V/19, — IMO Res. A.694(17), — IMO Res. MSC.74(69).	IEC 60945 (2002), — IEC 61162 Series, — IEC 62065 (2002).	E F P
Radar equipment CAT 1	Reg. V/18.	Reg. V/19. — IMO Res. A.278(VIII), — IMO Res. A.694(17), — IMO Res. A.823(19), — IMO Res. MSC.191(79), — IMO Res. MSC.192(79), — ITU-R M. 628-3(11/93), — ITU-R M. 1177-3(06/03).	IEC 60945 (2002), — IEC 61162 Series, — IEC 62288 Ed.1.0(2008), — IEC 62388 Ed.1.0(2007).	E F P
Radar equipment CAT 2	Reg. V/18.	Reg. V/19, — IMO Res. A.278(VIII), — IMO Res. A.694(17), — IMO Res. MSC.191(79), — IMO Res. MSC.192(79), — ITU-R M. 628-3(11/93), — ITU-R M. 1177-3(06/03).	IEC 60945 (2002), — IEC 61162 Series, — IEC 62288 Ed.1.0(2008), — IEC 62388 Ed.1.0(2007).	E F P
Radar equipment CAT 3	Reg. V/18.	Reg. V/19, — IMO Res. A.278(VIII), — IMO Res. A.694(17), — IMO Res. MSC.191(79), — IMO Res. MSC.192(79), — ITU-R M. 628-3(11/93), — ITU-R M. 1177-3(06/03).	IEC 60945 (2002), — IEC 61162 Series, — IEC 62288 Ed.1.0(2008), — IEC 62388 Ed.1.0(2007).	E F P

Item designation	SOLAS 74 where "type approval" is required	Regulations of SOLAS 74 and the relevant resolutions and circulars of the IMO, as applicable	Testing standards	Suitability for e-navigation
Radar equipment for high-speed craft applications (CAT 1H, CAT 2H and CAT 3H)	Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	IMO Res. A.278(VIII), — IMO Res. A.694(17), — IMO Res. A.820(19), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.191(79), — IMO Res. MSC.192(79), — ITU-R M. 628-3(11/93), — ITU-R M. 1177-3(06/03).	IEC 60945 (2002), — IEC 61162 Series, — IEC 62288 Ed.1.0(2008), — IEC 62388 Ed.1.0(2007).	E F P
Radar equipment approved with a chart option (CAT 1HC, CAT 2HC and CAT 3HC)	Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	IMO Res. A.278(VIII), — IMO Res. A.694(17), — IMO Res. A.820(19), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.191(79), — IMO Res. MSC.192(79), — ITU-R M. 628-3(11/93), — ITU-R M. 1177-3(06/03).	IEC 60945 (2002), — IEC 61162 Series, — IEC 62288 Ed.1.0(2008), — IEC 62388 Ed.1.0(2007).	E F P
Transmitting heading device THD (GNSS method)	Reg. V/18, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.694(17), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.116(73), — IMO Res. MSC.191(79).	ISO 22090-3 (2004), — IEC 60945 (2002), — IEC 61162 series, — IEC 62288 Ed.1.0(2008).	E F
Differential beacon receiver for DGPS and D Glonass equipment	Reg. V/18, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.694 (17), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.114(73).	IEC 60945 (2002), — IEC 61108-4 (2004), — IEC 61162 series.	E
Chart facilities for shipborne radar	Reg. V/18, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.694(17), — IMO Res. A.817(19), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.64(67), — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.191(79), — IMO Res. MSC.192(79).	IEC 60936-3 (2002), — IEC 60945 (2002), — IEC 61162 series, — IEC 62288 Ed.1.0(2008), — IEC 62388 Ed.1.0(2007).	?

Item designation	SOLAS 74 where "type approval" is required	Regulations of SOLAS 74 and the relevant resolutions and circulars of the IMO, as applicable	Testing standards	Suitability for e-navigation
Transmitting heading device THD (gyroscopic method)	Reg. V/18, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.694 (17), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.116(73).	ISO 22090-1 (2002) including Corr.1 (2005), — IEC 60945 (2002), — IEC 61162 series.	E F
DGPS equipment	Reg. V/18, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.694 (17), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.114(73), — IMO Res. MSC.191(79).	IEC 60945 (2002), — IEC 61108-1 (2003), — IEC 61108-4 (2004), — IEC 61162 series, — IEC 62288 Ed.1.0(2008).	E F P
D Glonass equipment	Reg. V/18, — Reg. X/3, — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13.	Reg. V/19, — IMO Res. A.694 (17), — IMO Res. MSC.36(63)-(1994 HSC Code) 13, — IMO Res. MSC.97(73)-(2000 HSC Code) 13, — IMO Res. MSC.114(73), — IMO Res. MSC.191(79).	IEC 60945 (2002), — IEC 61108-2 (1998), — IEC 61108-4 (2004), — IEC 61162 series, — IEC 62288 Ed.1.0(2008).	E F P

ANNEX 5

LIST OF REFERENCED DOCUMENTS IN THE SIP

Number	Title	Date of approval /adoption	Remark
A.694(17)	General requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids	06/11/1991	
A.811(19)	Performance standards for shipborne integrated radiocommunication system (IRCS) when used in the GMDSS	18/12/1995	
A.851(20)	General principles for ship reporting systems and ship reporting requirements, including guidelines for reporting incidents involving dangerous goods, harmful substances and/or marine pollutants	02/12/1997	
A.950(23)	Maritime Assistance Services (MAS)	05/12/2003	
A.960(23)	Recommendations on training and certification and operational procedures for maritime pilots other than deep-sea pilots	05/03/2004	
A.997(25)	Survey guidelines under the harmonized system of survey and certification, 2007	16/01/2008	
IEC 60945	Maritime navigation and radiocommunication equipment and systems – general requirements – methods of testing and required test results	01/04/2008	
IEC 61162	Maritime navigation and radiocommunication equipment and systems – Digital interfaces	2016	
IEC 61993-2	Maritime navigation and radiocommunication equipment and systems – Automatic identification systems (AIS) – Part 2: Class A shipborne equipment of the automatic identification system (AIS) - Operational and performance requirements, methods of test and required test results	2012	
ISO8468	Ships and marine technology – Ship's bridge layout and associated equipment – Requirements and guidelines	2007	
ITU-R M.1371-5	Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile frequency band	02/2014	
MSC.1/Circ.1389	Guidance on procedures for updating shipborne navigation and communication equipment	07/12/2010	

Number	Title	Date of approval /adoption	Remark
MSC.1/Circ.1512	Guidelines on software quality assurance and human-centred design for e-navigation	13/07/2015	
MSC.1/Circ.1575	Guidelines for shipborne position, navigation and timing (PNT) data processing		
MSC.191(79)	Performance standards for the presentation of navigational related information on shipborne navigational displays	06/12/2004	
MSC.192(79)	Adoption of the Revised performance standards for radar equipment	06/12/2004	
MSC.252(83)	Revised performance standards for integrated navigation systems (INS)	08/10/2007	
MSC.302(87)	Performance standards for Bridge Alert Management (BAM)	17/05/2010	
MSC.401(95)	Performance standards for multi-system shipborne radionavigation receivers	08/06/2015	
MSC/Circ.982	Guidelines on ergonomic criteria for bridge equipment and layout	20/12/2000	
SN.1/Circ.265	Guidelines on the Application of SOLAS Regulation V/15 to INS, IBS and Bridge Design	19/10/2007	
SN.1/Circ.274	Guidelines for application of the modular concept to performance standards	10/12/2008	
SN.1/Circ.288	Guidelines for bridge equipment and systems – their arrangement and integration (BES)	02/06/2010	
SN.1/Circ.289	Guidance on the use of AIS application-specific messages	02/06/2010	
SN.1/Circ./266/Rev.1	Maintenance of ECDIS software	07/12/2010	
SN/Circ.243/Rev.1	Guidelines for the Presentation of Navigation-related Symbols	23/05/2014	