IALA COUNCIL
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Agenda item 9 – IALA TECHNICAL ACTIVITIES

9.4   e-NAV

9.4.1   Documents submitted for approval

9.4.1-1 Draft Guideline on

shore-side portrayal ensuring harmonisation with e-Navigation related information

Note by the Secretariat

1   SUMMARY

This Guideline sets out to provide suitable guidance regarding how the presentation and display of e-Navigation related information should be harmonized for both shipborne and shore-based systems/services, and to what extent.

Since e-Navigation is an evolutionary process, this Guideline is intended to be descriptive – not prescriptive. Until more practical experience is gained, it is premature to prescribe specific means to present/display e-Navigation related information. As such, the intent is to publish a general, goal-based guideline whereby over-arching objectives are defined, but freedom to innovate is left to both developers and users. This document is not providing guidance for e-Navigational portrayal on the ships as this is defined by other competent bodies but rather takes the relevant existing and being developed ship portrayal standards and guidelines into consideration to guide shore side system development.

2   ACTION REQUESTED

The Council is requested to Approve the draft Guideline

International Association of Marine Aids to Navigation and Lighthouse Authorities

IALA

Association Internationale de Signalisation Maritime

AISM

IALA Guideline No.

on

Shore-side portrayal ensuring harmonisation with e-Navigation related information

Edition 1
(September 2013)

Document Revisions

Revisions to the IALA Document are to be noted in the table prior to the issue of a revised document.

Date	Page / Section Revised	Requirement for Revision

Table of Contents

Harmonized Portrayal of e-Navigation-related Information

3 INTRODUCTION

IMO has defined e-Navigation as:

*the harmonized collection, integration, exchange, **presentation** and analysis of marine information onboard 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.*[1]

The term 'presentation' pertains to the manner in which information is displayed. In the case of e-Navigation, this is primarily through electronic means. In a broader sense, the term 'portrayal' has been defined as the "*presentation of information to humans*" (ISO 19117). This may include visual, sound and touch (haptics). However, for the purposes of this Guideline, the term 'portrayal' primarily refers to visual means of displaying e-Navigation related information.

The objective of this document is to provide guidance on how to achieve a "*harmonized presentation*" of information ashore with the presentation on board in the e-Navigation context.[2] The goal is to achieve improved common understanding of situations by shore side users and ship navigators by having similar portrayal of common information. This will support the goal of e-Navigation for enhancing navigation safety and efficiency.

4 BACKGROUND

In July 2006, the 81st Session of the IMO Maritime Safety Committee (MSC) first decided to include e-Navigation in the work programmes of the Safety-of-Navigation (NAV) and Communications and Search and Rescue (COMSAR) Sub-Committees. The "Development of an e-Navigation strategy" became a high-priority item with a target completion date of 2008.

In December 2008, MSC 85 adopted a "Strategy for the Development and Implementation of e-Navigation" (MSC 85/26/Add.1 Annex 20). This comprehensive document document defined e-Navigation and described the scope as being: *"intended to meet present and future user needs through harmonization of marine navigation systems and supporting shore services."* In addition to describing the need, case for, vision, and benefits of e-Navigation, the core objectives of the e-Navigation concept were described. Included with this document was a description of the responsibilities that come with IMO ownership and control (Annex 1), and a summary of potential shipborne and shore-based users (Annex 2).

In 2006, IALA established an e-Navigation Committee. After the IALA e-Navigation Seminar in July 2007, the IALA Committee established six working groups to advance the work of IALA's e-Navigation work programme. The IALA e-Nav Information Portrayal WG was established in September 2010 with the overall objective to:

"*Recommend suitable "guidance" regarding how the presentation and display of e-Navigation related information should be harmonized for both shipborne and shore-based systems/services, and to what extent.*" [3]

This Guideline is the result of this effort.

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1 MSC 85/26/Add.1 Annex 20 section 1.1

2 The *Recommendation e-NAV-140 on e-Navigation Architecture Shore Perspective (Ed 2)*, may address some aspects to be taken in consideration.

3 Terms of Reference for IALA e-Navigation Committee, Information Portrayal Working Group (WG 6), September 2010

5   SCOPE

Since e-Navigation is an evolutionary process, this Guideline is intended to be descriptive – not prescriptive. Until more practical experience is gained, it is premature to prescribe specific means to present/display e-Navigation related information. As such, the intent is to publish a general, goal-based guideline whereby over-arching objectives are defined, but freedom to innovate is left to both developers and users. This document is not providing guidance for e-Navigational portrayal on the ships as this is defined by other competent bodies but rather takes the relevant existing and being developed ship portrayal standards and guidelines into consideration to guide shore side system development.

5.1   Core Objectives

The 85th Session of IMO MSC agreed on a number of **core objectives** related to the e-Navigation concept.[4] In the following listing, those that are associated with the presentation and display (i.e., portrayal) of e-Navigation information are highlighted.

- facilitate safe and secure navigation of vessels with regards to hydrographic, meteorological and navigational information and risks;

- facilitate vessel traffic observation and management from shore/coastal facilities, where appropriate;

- facilitate communications, including data exchange, between ship to ship, ship to shore, shore to ship, shore to shore and other users;

- provide opportunities for improving the efficiency of transport and logistics;

- support the effective operation of contingency response, and search and rescue services;

- demonstrate defined levels of accuracy, integrity and continuity appropriate to a safety-critical system;

- integrate and present information on board and ashore through a human-machine interface which maximizes navigational safety benefits and minimizes any risks of confusion or misinterpretation on the part of the user;

- integrate and present information onboard and ashore to manage the workload of the users, while also motivating and engaging the user and supporting decision-making;

- incorporate training and familiarization requirements for the users throughout the development and implementation process;

- facilitate global coverage, consistent standards and arrangements, and mutual compatibility and interoperability of equipment, systems, symbology and operational procedures, so as to avoid potential conflicts between users; and

- support scalability, to facilitate use by all potential maritime users.

5.2   Basic Premise and Caveats

The basic, over-riding premise of this Guideline is that:
Shipborne and shore-based equipment/systems/services should portray e-Navigation-related information to all users (both onboard and ashore) in a consistent manner.

However, there are several caveats:

1   How information is portrayed onboard or ashore depends on the particular tasks, function, and needs of the user.

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4 IMO MSC 85/26/Add.1, ANNEX 20, Strategy for the development and implementation of e-Navigation

2   The current situation or task-at-hand can influence the amount of information necessary to make informed decisions.

3   The portrayal of information onboard ships or ashore does not necessarily have to be identical.

6   DEFINITIONS

In conjunction with this Guideline, there is benefit in using agreed-upon terminology in order to have a clear understanding of what various terms mean. This is particularly important when making a distinction between such terms as data and information, as well as display, presentation and portrayal.

The following terms are defined based on what is contained in widely recognized dictionaries or technical references. This includes the Oxford English Dictionary [5], Merriam Webster Dictionary[6], IALA Dictionary, IHO Dictionary[7], and relevant ISO standards.

For ease of reference, the following terms are listed in alphabetical order. Further guidance is also provided by way of an example or context of use of these terms associated with the portrayal of e-Navigation related information. Since there are differences in the way some terms are defined, grey highlights indicate the definition(s) that are used in conjunction with this Guideline.

Consistent

> *Oxford English Dict. - unchanging in effect over a period of time.*

> *Merriam-Webster Dict. – showing steady conformity to character; constant*

> Example/context: The use of **consistent** symbology across all displays helps to reduce misunderstanding and confusion.

Data

> *Oxford English Dict. – computing the quantities, characters, or symbols on which operations are performed by a computer, being stored and transmitted in the form of electrical signals and recorded on magnetic, optical, or mechanical recording media.*

> *Merriam-Webster Dict. – factual information output by a sensing device that must be processed to be meaningful; information in numerical form that can be digitally transmitted or processed.*

> Example/context: **data** is a raw collection of unprocessed facts

Display

> *Oxford English Dict. - (of a computer or other device) show (information) on a screen. - an electronic device [used] for the visual presentation of data*

> *Merriam-Webster Dict. – show; an electronic device that presents information in visual form*

> Example/context: An ECDIS **display** is capable of portraying both chart and navigation-related information

Feature
> *ISO 19117 **-** abstraction of real world phenomena*

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5 http://oxforddictionaries.com
6 http://www.merriam-webster.com
7 http://hd.iho.int/en/index.php/Main_Page

Feature attribute

> *ISO 19117* **-** *characteristic of a feature*

Geographic information

> *ISO 19117* **-** *information concerning phenomena implicitly or explicitly associated with a location relative to the Earth*

Icon

> *Oxford English Dict. – a representative symbol of something; a graphic representation on a [computer] screen*

> *Merriam-Webster Dict. – a graphic symbol whose form suggests it meaning; a graphic symbol on a computer screen.*

> *ISO 80416 – a graphic symbol with a particular meaning used to transmit information independently of language presented on a screen or display.*

> Example/context: The own-ship **icon** (i.e., symbol) on ECDIS represents the location of the vessel in real-time.

Information

> *Oxford English Dict. – Computing data [that is] processed, stored, or transmitted by a computer.*

> *Merriam-Webster Dict. – the communication or reception of knowledge or intelligence*

> Example/context: Data becomes **information** when it is processed and presented in a manner which can be better understood by humans

Intuitive

> *Oxford English Dict. – instinctive; based on what one feels is true, even without conscious reasoning*

> *Merriam-Webster Dict. – known or perceived by intuition; readily learned or understood*

> Example/context: Showing water as blue and land as orange/brown is an **intuitive** electronic chart colour scheme.

Obvious

> *Oxford English Dict. – easily perceived or understood; clear, self-evident or apparent*

> *Merriam-Webster Dict. – easily discovered, seen or understood; apparent*

> Example/context: The use of blue for water and orange/brown colours for land is both intuitive and **obvious** as to meaning.

Portrayal

> *Oxford English Dict. – a description or depiction of something in a particular way (example: realistic portrayal of a real-world object)*

> *Merriam-Webster Dict. – act or process of portraying or depicting; representation synonyms: definition, delineation, depiction, picture, portrait, rendering*

> *ISO 19117 – **presentation of information to humans***

> *IMO SN.1.Circ.290 - the process of representing or depicting (i.e., showing an example of what is or could be)*

> Example/context: e-Navigation information can be **portrayed** in a variety of ways

Presentation

Oxford English Dict. – *the manner in which something is displayed; the method by which radio, navigation or radar information is given to the operator*

Merriam-Webster Dict. – a symbol or image that represents something

Example/context: The IHO S-52 Colours and Symbols **Presentation** Library is a prescriptive standard for ECDIS.

Symbol

Oxford English Dict. – *a thing that represents or stands for something else; a mark or character used as a conventional representation of an object, function, or process*

Merriam-Webster Dict. – an arbitrary or conventional sign to represent operations, quantities, elements, relations or qualities

ISO 80416 – A graphical symbol is a visually perceptible figure used to transmit information independently of language.

Example/context: There should be a clear difference in the type of **symbol** used to represent something that physically exists in the real-world (e.g., physical) versus a 'virtual' representation.

Unambiguous

Oxford English Dict. – not open to more than one interpretation

Merriam-Webster Dict. – clear, precise; apparent; unmistakable, straight-forward

Example/context: the use of both 'standard' and 'simplified' symbols could lead to **ambiguity.**

Uniform

Oxford English Dict. – *not changing in form or character; remaining the same in all cases and at all times; of a similar form or character to another or others*

Merriam-Webster Dict. – *having always the same form, manner, or degree; not varying or variable; consistent; constant*

Example/context: Portraying information in a uniform manner reduces confusion as to meaning or intent.

Uniqueness

Oxford English Dict. – *being the only one of its kind; unlike anything else*

Merriam-Webster Dict. – distinctively characteristic

Example/context: Portraying e-Navigation in a **unique** manner should be avoided, particularly if it causes confusion as to meaning or intent.

User selected presentation

IMO MSC 191(79) **-** An auxiliary presentation configured by the user for a specific task-at-hand. The presentation may include radar and/or chart information, in combination with other navigation or ship related data.

Data vs. Information → Portrayal

In addition to specific, individual definitions, it is important to make a clear distinction between what is "data" and what is "information". In the strictest sense, data can be simply a raw collection of facts, which can exist in any form without particular meaning, sequence or usability.

In terms of e-Navigation equipment, systems and services, "data" is usually in alpha-numeric form that is digitally transmitted via electronic means. Some examples include navigation sensor data (e.g., GPS and radar) or AIS Application Specific Messages.

However, when this data is transformed into a human-readable format (i.e., portrayal) it then becomes "information" capable of being understood by shipborne and shore-based users. This information can be portrayed in a variety of ways, including alpha-numeric text, point, line or polygon, symbols or icons, and geo-spatial (map or chart).

7   GENERAL REFERENCES

IMO and IEC have adopted several standards (i.e., references) that provide general guidance related to presentation, display or portrayal of navigation-related information. Based on the premise that "*shipborne and shore-based equipment/systems/services should portray e-Navigation-related information to all users (both onboard and ashore) in a consistent manner",[8]* much of this guidance is relevant to the presentation, display or portrayal of e-Navigation related information at shore-based facilities as well (e.g., at a VTS Centre or Port Authority).

The following sections provide a brief summary of the key contents of each standard.

IMO Resolution MSC.191 (79), *Performance Standards for the presentation of navigation-related information on shipborne navigational display,* 6 December 2004. (valid for equipment installed on or after 1 July 2004)

The purpose of this standard is to "harmonize the requirements for the presentation of navigation-related information on the bridge of a ship to ensure that all navigational displays adopt a consistent human machine interface philosophy and implementation." Further, it supplements and, in case of conflict, takes priority over presentation requirements of the individual performance standards. This standard also includes the consistent use of navigational terms, abbreviations, colours and symbols, as well as other presentation characteristics. This standard also addresses the presentation of information related to specific navigational tasks by recognising user-selected presentations in addition to presentations required by the relevant individual performance standards.

Brief summary of contents:
- General Requirements
- Arrangement of information (e.g., use separate areas for operational display and menu/control functions)
- Readability (for alphanumeric text and icons)
- Colours and intensity
- Symbols
- Colour coding
- Integrity marking
- Alarms and indications (appropriate use of red, yellow, green colours)
- Presentation modes
- Presentation of Operational Information
- Own ship
- Charted information
- Radar information
- Target information (radar and AIS)
- Graphical presentation
- Operational alarms

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8 Terms Of Reference for IALA e-Navigation Committee, Information Portrayal Working Group(WG6)

- Operational Displays

- Multi-function display

- Radar (including display of chart and maps on radar)

- ECDIS (including display of radar and additional information)

- User selected (task orientated) presentation

- Physical Requirements

- Display size (size of symbols and characters)

- Screen size (physical size), its resolution and viewing angle

- Use of Colours (background, symbols etc.)

IMO SN/Circ.243, *Guidelines for the presentation of Navigation-related symbols, terms and abbreviations,* 15 December 2004 and
IMO SN/Circ.243/Add 1, 10 December 2008

The purpose of these guidelines is *"to provide guidance on the appropriate use of navigation-related symbols to achieve a harmonized and consistent presentation."*

Two annexes are included:

- Annex 1 - Guidelines for the Presentation of Navigation-related Symbols
- Annex 2 - Guidelines for the Presentation of Navigation-related Terms and Abbreviations

IMO MSC/Circ.982, *Guidelines on Ergonomic Criteria for Bridge Equipment and Layout*, 20 December 2000

These Guidelines were developed to facilitate a successful ergonomic design of the bridge and the equipment on the bridge in order to improve the reliability and efficiency of navigation. The Guidelines contain ergonomic requirements as well as a functionally-oriented bridge layout to support watch-keeping personnel in their tasks by a user-centred design of the bridge equipment and layout. While these guidelines were primarily intended for shipborne equipment, much of the guidance applies to shore-based workstations as well.

In particular, the guidelines provide a functional description of various types of workstations on the bridge, including:

- Navigating and manoeuvring

- Monitoring

- Manual steering (Helmsman's workstation)

- Docking (bridge wing)

- Planning and documentation

- Safety

- Communication

IEC 60945, *Maritime navigation and radiocommunication equipment and systems- General Requirements, methods of testing and required test results, Edition 4, 2001*

This standard specifies the general requirements, methods of testing, and required test results, for shipborne radionavigation equipment and electronic navigation aids in support of IMO Res. A.694. More specifically, it specifies minimum performance requirements for equipment that are

required carriage under SOLAS V. Key sections that pertain to the presentation, display or portrayal of navigation- related information include:

Section

6.1 Ergonomics and Human Machine Interface (HMI)

6.1.6 Screen display and indicators

6.2.2 Alarms and Indicators

6.2.3 Illumination

IEC 62288, Maritime navigation and radiocommunication equipment and systems - Presentation of navigation-related information on shipborne navigational displays - General requirements, methods of testing and required test results, Edition 1.0, July 2008.

This standard specifies the general requirements, methods of testing, and required test results, for the presentation of navigation-related information on shipborne navigational displays in support of IMO resolution MSC.191(79). This standard is organized so that each group of requirements is immediately followed by a clause identifying the method(s) of test.

This IEC standard also addresses the guidelines for the presentation of navigation-related symbols, terms and abbreviations contained in Safety of Navigation circular SN/Circ.243 together with some requirements published in resolution MSC.192(79) on radar; resolution MSC.232(82) on ECDIS; and ergonomic criteria published in circular MSC/Circ.982.

Three Annexes specifically pertain to presentation/display topics:

- Annex A - The symbols from SN/Circ.243 are reproduced and expanded upon.

- Annex B - The terms and abbreviations from SN/Circ.243 are reproduced and expanded upon.

- Annex C - Additional guidance on display and dialogue design from MSC/Circ.982 is provided.

While this IEC standard is primarily intended for shipborne equipment, much of the guidance and display requirements apply to shore-based displays as well. While it may not be necessary to comply with all aspects of this standard, there is benefit in being aware and harmonizing with navigation-related information as currently displayed onboard vessels.

IALA Recommendation V-125 on the use and presentation of symbology at a VTS Centre (Edition 3, 2012)

The presentation of information is critical to meet SOLAS regulations, relevant IMO resolutions and IALA recommendations. Although there are many compelling reasons for the international standardization of methods of display of electronic charts and data from electronic sensors, including radar and AIS, on board vessels, there may be differing or additional requirements for the display of information at VTS Centres that are port, coastal states or area specific.

The compilation of an accurate traffic image in the VTS Centre, thus allowing the evaluation of situations more accurately and decisions to be made more readily, is substantially dependent on the manner in which the information is presented.

8   OPERATIONAL REQUIREMENTS

The primary factor that influences the portrayal of e-Navigation information is the operational situation. In turn, what information is required depends on the voyage requirements, situation needs, operational perspective (shipborne or shore-based), and levels of information.

8.1   Voyage Requirements

The type or amount of e-Navigation-related information that will be portrayed by shipborne or shore-based users falls into two main categories: strategic and tactical overviews.

- Strategic overview is associated with maintaining overall situational awareness within the surrounding areas. This can include both monitoring and active engagement.

- Tactical overview involves more direct action and decision-support within the immediate or designated area.

8.2   Situational Needs

- Current situation includes the various phases of navigation during a voyage or can be related to the prevailing conditions. Examples of different navigation phases include open-ocean, coastal, and approach. Prevailing conditions include, daytime vs. night time transits, calm vs. stormy weather conditions, good vs. poor visibility, light vs. heavy vessel traffic, etc.

- Regardless of the current situation, the Task-at-Hand can be the determining factor in deciding what information is crucial in making informed decisions. This includes time-critical information necessary for grounding avoidance, collision avoidance, or maintaining overall situational awareness.

8.3   Shipborne perspective

The International Chamber of Shipping "*Bridge Procedures Guide"* [9] provides a useful description of the personnel, activities, equipment, and procedures that "*reflect best navigational practice on merchant ships operating today, in all sectors and trades.*" As explained in the Foreword to the publication, the new (4th) edition has been revised to address the increasing use of modern electronic navigation and charting systems. In particular, it is pointed out that "*increased sophistication brings its own dangers and the need to precautionary measures against undue reliance on technology.*"

8.4   Shore-based perspective

The IALA VTS Manual [10] (5th Edition, 2012) is a comprehensive guide to Vessel Traffic Services (VTS). As described in the Introduction, "*the contents are aimed at a wide readership to encompass all who are in any way involved in the provision, operation, and effectiveness of VTS, including those with management responsibility at national level, and those who deliver services to the mariner.*" For both shipborne and shore-based users, the manual provides useful information on the type of VTS service and functions, VTS-related equipment, and roles and responsibilities of VTS personnel.

As referenced in IALA Recommendation V-125 [11] (see above) the general principles for the presentation of all symbology on a VTS display are:

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[9] Bridge Procedures Guide, 4th Edition 2007, International Chamber of Shipping (www.marisec.org, www.shipping facts.com)
[10] IALA VTS Manual, 5th Edition, 2012.
[11] IALA Recommendation V-125, Edition 3, 2012

- recognizing that VTSO would typically come from a maritime background, the portrayal of VTS information should reflect as far as possible the equivalent portrayal on board ships;

- the international on-board symbology and chart standards should be used as far as possible;

- symbology already identified for existing on-board use should not normally be assigned a different meaning for VTS purposes, however these symbols may be adapted to suit VTS requirements

- any adaptations to symbology must not modify the agreed standard for data transfer;

- the clarity of the presentation and operator workload should be carefully considered.

8.5   Categories of information

Three different categories of navigational information, both at the present time and likely in the future could be considered. While this categorization is focused on ship based information and not related to shore based portrayal, the knowledge of these potential categories may be seen useful when harmonizing portrayals on shore with those on ship[12]:

1. Required by IMO
    Information on systems required on board ships mainly through SOLAS IV and SOLAS V.

2. Required by Flag or Port States in national waters
    Additional information may be required by individual Flag or Port States due to individual conditions in those areas or regions.

3. Innovative or Future Applications
    New innovations and systems in development, for example during Test Bed execution; may provide additional information not mandated but useful for the development of e-Navigation applications.

9   BASIC GUIDANCE ON PORTRAYAL

9.1   Six basic ways

There are six (6) basic ways to visually portray any type of e-Navigation information.

- alpha-numeric
- graph
- point, line or polygon
- symbol
- geo-spatial
- imagery

The following sections provide basic guidance with an example for each.

9.1.1   Alpha-numeric

Unless there is a need to display pre-formatted text or numbers, use the best readable font taking into account Human Centred Design (HCD) as referred to in IMO MSC/CIRC.1022 and MEPC/CIRC.391 concerning Human Element Analysing Process (HEAP).

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12 "e-Navigation: A vision and its Practical Implementation", Dr. Andy Norris, (IALA eNAV11/11/4)

9.1.2   Graph

In some situations, a time-series graph may be preferred instead of a table format. In particular, it is a useful way to show both predicted and real-time information (e.g. water levels); as well as a useful means to indicate trends (e.g., rising or falling water levels).

9.1.3   Point, line, or polygon

This type of information is often displayed as an overlay on chart or map-related background. An Area Notice that is transmitted via AIS Application Specific Message is one example.

9.1.4   Symbol

Similar to the guidance stated in IMO SN.1/Circ.290, the following guiding principles apply to the display of symbols or icons:

- Use consistent symbology across all displays

- Uniqueness – only one possible meaning

- Non-ambiguous – ability to determine differences (i.e. distinct)

- Intuitively obvious – an easily recognized symbol, icon, or pattern

- Have a basic symbol for different categories. Further attributes should be enhancements (not changes) to the basic symbol.

9.1.5   Geo-spatial

Many types of geo-spatial information are best provided in the form of a map or chart. The electronic chart display of an ENC in ECDIS is one example. Another example would be a radar display with chart facilities.

9.1.6   Imagery

This is a broad category that includes various types of images. A still photograph of a fixed or floating Aid to Navigation (AtoN) is one example. Other examples include radar or satellite imagery of sea ice weather conditions. A video recording/replay of a past or simulated voyage is a type of dynamic imagery. There is also increasing interest in the use of 3-D imagery.

9.2   Guiding Principles

In order to achieve 'harmonization' in the portrayal of e-Navigation information for both shipborne and shore-based e-Navigation users, there are several guiding principles to consider:

- The portrayal of information depends on the particular tasks, function, and needs of the various users on ship and ashore.

- Critical and non-critical Information should be categorized for the various users.

- The *"portrayal of e-Navigation information onboard ships or ashore does not necessarily have to be identical."*[13] However, there is benefit to all users if information is displayed in a consistent and unambiguous manner. This includes the use of standard symbology, icons, and colour schemes as to be defined in IHO GI Registry (S-100 Registry).

- Displaying too much supplemental information can obscure critical information or lead to confusion. As such users should be able to determine the volume or types of non-critical information on the display for their operating tasks and navigational decision making processes.

9.3   Examples of portrayal

Examples of portrayal are provided in Annex A to this guideline.

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[13] "e-Navigation Portrayal and User Needs", International Chamber of Shipping (eNAV12/69)

It should be noted that the examples of portrayal as referred to in Annex A may be subject to changes due to developments.

10 CURRENT PRESENTATION/DISPLAY STANDARDS

At the present time, there is no 'formal' list of what equipment/systems/services are currently considered (or will become) components of e-Navigation -- either shipborne or shore-based. As such, the following list is based on what is mentioned in various SOLAS V/19 & 20, IMO MSC, IMO NAV[14], and IALA e-Navigation related documents. These equipments/systems/services are also mentioned in the IMO e-Navigation 'Gap Analysis' process[15].

- The existing standards should be considered 'minimum standards' in terms of what is required.

- It should be noted that the existing standards should not be reviewed in isolation but collectively with all relevant standards to gain the full picture (e.g. IEC and ISO standards).

- Besides the below existing standards, other aspects (e.g. Data Quality assurance, availability and reliability of systems and signals) and as a result of development or increasing user needs (HCD), may be considered.

For each of the following standards, sections that have particular relevance to presentation, display, or portrayal requirements for shore-based applications are highlighted in a grey colour.

10.1 ECDIS

IMO MSC.232(82), *Revised performance standards for electronic chart display and information systems (ECDIS)***, 5 December 2006**

This performance standard applies to ECDIS equipment carried on all ships including dedicated stand-alone workstations or multi-function workstations as part of an INS. Requirements for structure and format of the chart data, encryption of chart data as well as the presentation of chart data are based on relevant IHO standards (e.g., IHO S-57 for ENC data and IHO S-52 for presentation/display of chart-related information, IHO S-100). In addition to the general requirements set out in IMO Res. A.694(17)[16] and the presentation requirements set out in resolution MSC.191(79), ECDIS equipment must meet the requirements of this performance standard, as well as follow the relevant guidelines on ergonomic principles.[17]

Section

- Scope of ECDIS

- Application of these standards

- Definitions

- Provision and updating of chart information

- Display of SENC (System Electronic Navigation Chart) information

- Scale

- Display of other navigational information

- Display mode and generation of the neighbouring area

- Colours and symbols

- Display requirements

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14 IMO NAV 54-WP.2, Annex 1 (Existing Components of e-Navigation)
15 IMO NAV 58-6 (Report from the Correspondence Group on e-Navigation to NAV 58)
16 IEC 60945, Edition 4.
17 IMO MSC/Circ. 982 (Guidelines on Ergonomic Criteria for Bridge Equipment and Layout)

- Route planning, monitoring and voyage recording

- Calculations and accuracy

- Performance tests, malfunction alarms and indications

- Back-up arrangements

- Connections with other equipment

- Power supply

IHO S-52, *Specifications for chart content and display aspects of ECDIS Edition 6,* **March 2010**[18]

As specified in Section 9.1 of the IMO Performance Standard for ECDIS, IHO recommended colours and symbols (i.e., IHO S-52) are used to represent chart-related information on ECDIS. This is intended to ensure: *consistency in base and supplementary levels of display for ENC data; standards of symbols, colours and their standardized assignment to features; scale limitations of data presentation; and, appropriate compatibility with paper chart symbols as standardized in the Chart Specifications of the IHO.*

Further, use of IHO S-52 is intended to ensure that:

- the display is clear and unambiguous

- there is no uncertainty over the meaning of colours and symbols on the display, (by) establishing an accepted pattern for ECDIS presentation that becomes familiar to mariners and so can be recognized instantly without confusion.

IHO S-52 contains several parts, and all pertain to the presentation/display of chart and navigation-related information:

- Main Document – This describes the **Specifications for Chart Content and Display Aspects of ECDIS** in relatively general terms (i.e., methods and requirements).

- Annex A – The **Presentation Library is** a separate document (see further explanation below), and specifies the colours, symbols, symbolization instructions, etc. together with guidance on how an ENC should be displayed on ECDIS. This annex has several components:

- Part I contains chart objects, and an addendum which is a paper-based description of the symbol library as graphics.

- Part II contains (recommended) Mariner's Navigational Objects (e.g. own ship symbol, tracks, waypoints, time tags, etc.)

- The *ECDIS Chart 1* is also included with the Presentation Library as a graphic file, and is also available as a collection of the varying objects contained in a special cell in S-57 format containing generic feature objects.

- Annex B - Specifies procedures for initial colour calibration of displays and the verification of that calibration.

- Annex C - Specifies a procedure for maintaining the calibration of displays.

IHO S-52 Annex A*, IHO ECDIS Presentation Library Ed.3.4,* **January 2008**

This specification provides the details and procedures for implementing the display specifications contained in S-52. It includes a full description of the symbol library for use in ECDIS. It is published separately from the Main Document, and is available on CD-Rom.

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18 IHO is preparing a new standard "S-101" which will have to be reference once in force

Both the Main Document and Annex A are maintained by means of Maintenance Documents (MDs) which are produced from time to time, and are available on the IHO website (www.iho.int). The MDs contain required amendments to S-52 and/or the *PresLib*, and are classified as "immediate" or "deferred" depending on their importance for the safety of navigation.

IEC 61174, *Maritime navigation and radiocommunication equipment and systems – Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results*, **Edition 3, October 2010**

This standard specifies the performance requirements, methods of testing and required test results of equipment conforming to performance standards adopted by the IMO in resolution MSC.232(82). This standard is also associated with IMO resolution A.694(17) and IEC 60945. This standard includes extracts from IHO S-52 when they are applicable to ECDIS.

As stated in Section 1 (Scope), *The requirements of this standard are not intended to prevent the use of new techniques in equipment and systems, provided the facilities offered are not inferior to those stated.*

This standard provides considerable detail about what is required to conform to ECDIS-related standards. The following sections are directly related to presentation, display or portrayal of chart and navigation-related information on ECDIS equipment.[19]

19 The full IEC 61174 is of relevance for shore based systems as well.

10.2   Radar

IMO/MSC.192(79), *Performance Standards for Radar Equipment***, 6 December 2004**

This Performance Standard applies to all shipborne radar installations, used in any configuration, as mandated by the 1974 SOLAS Convention, regardless of the:

- type of ship

- frequency band in use

- type of display

As described in Section 1 (Scope of Equipment):

Radar equipment should assist in safe navigation and in avoiding collision by providing an indication, in relation to own ship, of the position of other surface craft, obstructions and hazards, navigation objects and shorelines.

For this purpose, radar should provide the integration and display of radar video, target tracking information, positional data derived from own ship's position (EPFS) and geo-referenced data.

The integration and display of AIS information should be provided to complement radar. The capability of displaying selected parts of Electronic Navigation Charts and other vector chart information may be provided to aid navigation and for position monitoring.

The radar, combined with other sensor or reported information (e.g. AIS), should improve the safety of navigation by assisting in the efficient navigation of ships and protection of the environment by satisfying the following functional requirements:

-in coastal navigation and harbour approaches, by giving a clear indication of land and other fixed hazards;

-as a means to provide an enhanced traffic image and improved situation awareness;

- in a ship-to-ship mode for aiding collision avoidance of both detected and reported hazards;

- in the detection of small floating and fixed hazards, for collision avoidance and the safety of own ship; and

- in the detection of floating and fixed aids to navigation.

IEC 62388, *Maritime navigation and radiocommunication equipment and systems – Shipborne radar – Performance requirements, methods of testing and required test results***, 13 December 2007**

This standard specifies the minimum operational and performance requirements, methods of testing and required test results conforming to performance standards specified in IMO in Resolution MSC.192(79). This covers the testing of all SOLAS shipborne radar equipment. Individual equipment may be tested for a specific category of vessel. It also provides a summary of the categories and basic differential capabilities for each category.

IMO resolution A.823(19), *Performance Standards for automatic radar plotting aids***, 23 November 1995** (valid for equipment installed on or before 1 July 2008)

This performance standard deals with the use of Automatic Radar Plotting Aids (ARPA) to improve the standard of collision-avoidance at sea:

> *- reduce[ing] the workload of observers by enabling them automatically to obtain information about plotted targets, so that they can perform as well with several separate targets as they can by manually plotting a single target; and*

> *- provide[ing] continuous, accurate and rapid situation evaluation.*

The two sections that contain specific guidance related to presentation or display of ARPA are:

- Section 3.4 – [ARPA] Display

- Section 3.5 – Operational Warnings

- Appendix 1 – Definitions of Terms to be used in Connection with ARPA Performance Standards

IALA Recommendation V-128 on Operational and Technical Performance Requirements for VTS Equipment, Edition 3, June 2007

Note: This Recommendation is kept under review and the next edition is expected to be published in late 2014.

The purpose of this Recommendation is to assist the VTS Authority in the definition, establishment and upgrades of a VTS system. The document addresses the relationship between the Operational Requirements and VTS system performance requirements. More specifically:

- Core Operational requirements;

- Radar;

- Automatic Identification System (AIS);

- Environmental Monitoring;

- Electro-Optical equipment;

- Radio Direction Finders;

- Long Range sensors;

- Radio Communications;

- Data Processing;

- Human / Machine Interface (HMI);

- Decision Support;

- External Information Exchange;

- Verification and Validation.

10.3   AIS

MSC.74(69), Annex 3, *Performance Standards for a Universal Shipborne Automatic Identification System(AIS)***, 19 May 1998**

These performance standards specify the requirements for AIS. It should improve the safety of navigation by assisting in the efficient navigation of ships, protection of the environment, and operation of Vessel Traffic Services (VTS), by satisfying the following functional requirements:

- in a ship-to-ship mode for collision avoidance;

- as a means for littoral States to obtain information about a ship and its cargo; and

- as a VTS tool, i.e. ship-to-shore (traffic management).

In practice, AIS should be able to provide ships and competent authorities, with information from the ship, automatically and with the required accuracy and frequency, to facilitate accurate tracking.

IMO resolution A.917(22), *Guidelines for the Onboard Operational Use of Shipborne Automatic Identification Systems (AIS)*, 25 January 2002 (Amended by Res. A.956(23), 23 2003)

These Guidelines were developed to promote the safe and effective use of shipborne Automatic Identification Systems (AIS). In particular, they are intended to inform the mariner about the operational use, limits and potential uses of AIS. However, these guidelines apply both to shipborne and shore-based users. The Guidelines are intended to assist the user to become familiar with the operation of the equipment, including the correct interpretation of the displayed data.

IMO SN/Circ.217, *Display of AIS Target Information*, 11 July 2001

This guideline deals with the graphical presentation and display of AIS target data in stand-alone or integrated navigational aids or systems. Operational requirements are described in terms of:

- Presentation of information

- Processing of information

- Human interface

This standard was issued as an interim performance guideline, and may be replaced by new guidance once more operational experience is gained.

IMO SN/Circ.236, *Guidance of the Application of AIS Binary Messages[20]*, 28 May 2004

AIS can also be used as a means to communicate Binary Messages for certain types of specific applications. Binary Messages may be either 'Addressed' or 'Broadcast'. These messages are different from Addressed Safety Related Messages and Broadcast Safety Related Messages both of which allow the exchange of format-free ASCII-text. Binary Messages may provide a variety of capabilities for pre-defined information packages.

For example, they may permit:

- ships to report information to other ships and shore stations,

- shore stations to report navigation information, conditions and warnings, and simplified ship reporting.

This standard includes seven (7) types of messages that were to be used during a four-year trial period. This standard was superseded by IMO SN.1/Circ.289.

IMO SN.1/Circ.289, *Guidance on the Use of AIS Application-Specific Messages*, 2 June 2010

Formerly called AIS Binary Messages, AIS Application-Specific Messages (ASMs) are transmitted and received by shipborne mobile AIS devices and AIS base stations. Shore-based stations can receive AIS Application-Specific Messages and distribute them to shore-based users. Over 19 AIS message types are described capable of conveying a wide range of hydrographic, meteorological, VTS, area notice, and route information.

It should be noted that the display capability of AIS ASMs is not part of the mandatory functions of the Minimum Keyboard and Display (MKD). The display of the information transmitted by AIS

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[20] As a result of the development of AIS during the last decade the use of the wording "Binary Messages" is more commonly referred to as "Application Specific Messages (ASM)"

Application-Specific Messages requires external hardware and dedicated software in addition to the AIS equipment (e.g., ECDIS, ECS or VTS display).

The generation and transmission of AIS Application-Specific Messages also requires dedicated software and suitable equipment for entering the information.

IMO SN.1/Circ.290, *Guidance for the Presentation and Display of AIS Application-Specific Message information,* **2 June 2010**

This standard provides general guidance on the presentation and display of AIS ASMs that are contained in IMO SN.1/Circ.289. It lists various types of shipborne equipment (and their associated standards) that could be used to display AIS ASMs. In addition to describing some guiding principles, this standard provides a number of portrayal examples for AIS ASMs.

IALA Recommendation V-128 on Operational and Technical Performance Requirements for VTS Equipment, Edition 3, June 2007

See above (8.2) for detail reference

IALA Guideline 1095 on Harmonised implementation of Application-Specific Messages (ASMs), Edition 1, May 2013

This guideline provides guidance on the implementation and use of ASMs.

In addition to the messages in ITU and IMO documents, competent authorities have developed their own regional messages for use in addressing specific requirements they have identified. In some cases, different authorities have developed separate messages to address similar requirements. This has led to a lack of harmonization, where shipboard equipment may be required to be able to decode/encode several different ASMs in order to receive/send the same information (e.g., met/hydro information).

This guideline addresses actions that are intended to aid harmonization, including the establishment and use of the IALA AIS ASM collection. The intended use of the collection is to promote harmonization through:

- a catalogue of messages for entities to consider for use to meet identified requirements; and
- providing manufacturers with a reference for messages they may implement in their equipment.

While portrayal is outside the scope of this Guideline, IMO has also issued SN.1/Circ. 290,

Guidance for the Presentation and Display of AIS ASM Information. When considering the use of ASMs this Guideline should be consulted.

10.4   INS

IMO Resolution MSC.86(70), Annex 3, (Valid for equipment installed on or before 1 Jan 2011)

IMO Resolution MSC.252(83), *Performance Standards for an Integrated Navigation System* **(INS), 8 October 2007** (Valid for equipment installed on after 1 Jan 2011)

An Integrated navigation systems (INS) is to enhance the safety of navigation by providing integrated and augmented functions to avoid geographic, traffic and environmental hazards. By combining and integrating functions and information the INS provides "added value" for the operator to plan, monitor and/or control safety of navigation and progress of the ship. The INS supports the current operational mode and situational awareness. The INS aims to ensure that by taking human factors into consideration, the workload is kept within the capacity of the operator in order to enhance safe and expeditious navigation as well as complement the mariner's capabilities, while at the same time compensate for their limitations. INS functions that have particular relevance to VTS and other shore-based operations include:

- route monitoring
- collision avoidance

- alert management

- special manoeuvres

Functional requirements for INS displays include:

- All essential information should be displayed clearly and continuously.

- Additional navigational information may be displayed, but should not mask, obscure or degrade essential information required for the display by its primary task, as specified in these performance standards.

- The INS should be capable of displaying data available from the sensors.

- The information should be displayed together with the indication of its source (sensor data, result of calculation or manual input), unit of measurement and status, including mode.

- Display and update of essential information available in the equipment as well as safety-related automatic functions should not be inhibited due to operation of the equipment.

- Default display configurations and operational modes including user-defined display modes (i.e., pre-defined or user defined).

- Mode and status awareness

- Information display

Guidance is also given related to Human Machine Interface (HMI).

IEC 61294 -2, *Integrated Navigation Systems (INS) – Operational and performance requirements, methods of testing and required test results*, 2009

This standard specifies the minimum requirements for the design, manufacture, integration, methods of testing and required test results for an integrated navigation system (INS) to comply with the International Maritime Organization (IMO) requirements of Resolution MSC 252(83). Specific guidance related to presentation and display considerations is provided in:

- Section 6.4 - Functional requirements for displays of INS

- Section 6.5 - Human Machine Interface (HMI)

- Section 7 (Module C) - Alert Management

- Annex D – Display Default Configurations

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ANNEX A Portrayal Examples on the IALA e-Navigation Portal

Examples of new applications or systems that may be e-Navigation related were compiled in conjunction with the preparation of this guideline and can be found in the following website:

http://www.e-Navigation.net
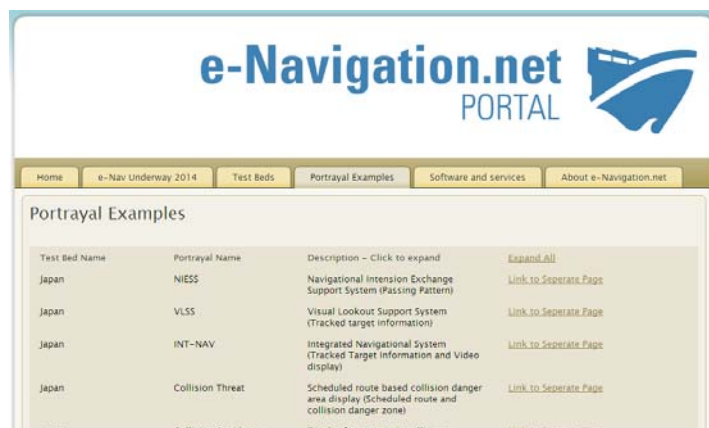
The website is IALA's e-Navigation portal. The operation and maintenance of this website is performed by the Danish Maritime Authority (DMA).

Submitting additional examples

Additional examples can be submitted to the website. Details for submission and the template to be used can be found on the portal itself.