|  |
| --- |
| IALA Guideline |

1105

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

Edition 1.0

December 2013

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

|  |  |  |
| --- | --- | --- |
| Date | Page / Section Revised | Requirement for Revision |
| March 2021 | Entire document | The content of some paragraphs in the main body are condensed.  New referred documents are added.  Status of documents and standards cited are updated and listed in one form. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

1. INTRODUCTION 4

2. BACKGROUND 4

3. SCOPE 4

3.1. Core Objectives 5

3.2. Basic Premise and Caveats 5

4. GENERAL REFERENCES 6

5. OPERATIONAL REQUIREMENTS 7

5.1. Voyage Requirements 7

5.2. Situational Needs 7

5.3. Shipborne perspective 8

5.4. Shore-based perspective 8

5.5. Categories of information 8

6. BASIC GUIDANCE ON PORTRAYAL 9

6.1. Six basic ways 9

6.1.1. Alpha-numeric 9

6.1.2. Graph 9

6.1.3. Point, line or polygon 9

6.1.4. Symbol 9

6.1.5. Geo-spatial 10

6.1.6. Imagery 10

6.2. Guiding Principles 10

6.3. Examples of portrayal 10

7. CURRENT PRESENTATION/DISPLAY STANDARDS 11

7.1. ECDIS 11

7.2. Radar 11

7.3. AIS 12

7.4. INS 13

8. EXAMPLES OF ITEMS THAT MAY CONTRIBUTE TO A GOOD PORTRAYAL 15

9. DEFINITIONS & ACRONYMS 15

9.1. Definitions 15

9.2. Acronyms 18

ANNEX A PORTRAYAL EXAMPLES 20

# 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]](#footnote-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]](#footnote-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.

# 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.

In December 2008, MSC 85 adopted a 'Strategy for the Development and Implementation of e-Navigation' (MSC 85/26/Add.1 Annex 20). 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). MSC94 approved the E-navigation Strategy Implementation Plan (SIP), in November 2014, MSC99 approved the *E-navigation Strategy Implementation Plan – Update 1*, in May 2018（MSC.1/Circ.1595）

In 2006, IALA established an e-Navigation Committee. After the IALA e-Navigation Seminar in July 2007, the IALA Committee established six working groups which are newly adjusted to three working groups: Digital information system (WG1), Emerging digital technology (WG2), and Digital communication system (WG3), to advance the work of IALA’s e-Navigation work programme.

# 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.

## Core Objectives

The 85th Session of IMO MSC agreed on a number of **core objectives** related to the e-Navigation concept.[[3]](#footnote-3) 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 familiarisation 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.

## 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.

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.

Considering the similarity between ship-side and shore-based E-navigation strategies in terms of technical and equipment portrayal standards, the IMO prescriptive documents play an important role in setting the portrayal standards for shore-based E-navigation. In particular, IMO Resolution MSC.466(101) “The Performance Standards For The Presentation Of Navigation-Related Information On Shipborne Navigational Displays” updated the performance standards for navigation-related information display in onboard navigation display on 14 June 2019 This Resolution, which addresses standards for the description of metadata (Part 4.0) and equipment (Part 5.0), has significant implications for the harmonization of standards for shoreside e-Navigation data and information portrayal.

# 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',[[4]](#footnote-4) 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*.

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.

**IMO Resolution MSC.1/Circ.1593** *Interim guidelines for the harmonized display of navigation information received via communication equipment, 25May2018.*

**IMO SN1/Circ.243/Rev.2**, *Guidelines for the presentation of Navigation-related symbols, terms and abbreviations, 14 JUNE 2019.*

The purpose of this IALA Guideline is 'to provide guidance on the appropriate use of navigation-related symbols to achieve a harmonized and consistent presentation.'

There are two Annexes:

* 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.*

This IALA Guideline was 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 Guideline contains 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.

**IEC 60945**, *Maritime navigation and radiocommunication equipment and systems- General Requirements, Methods of testing and required test results, Edition 4, 2002. (Corrigendum 1 in April,2008).*

This standard specifies the general requirements, methods of testing, and required test results, for shipborne radio navigation equipment and electronic navigation aids in support of IMO Resolution A.694. More specifically, it specifies minimum performance requirements for equipment that are required carriage under SOLAS1974, Chapter V. Key sections that pertain to the presentation, display or portrayal of navigation- related information include:

* Ergonomics and Human Machine Interface (HMI)
* Screen display and indicators
* Alarms and Indicators
* 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 2.0, July 2014.

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 also addresses ergonomic criteria published in circular MSC/Circ.982.

**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.

# 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.

## 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.

## Situational Needs

“Current situation” includes the various phases of navigation during a voyage and can be related to the prevailing conditions. Examples of different navigation phases include open-ocean, coastal, and approach. Prevailing conditions can include but are not limited to, traffic density, alerts, time of day ship movement, and meteorological and hydrological conditions.

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. Information based on a planning system may also be part of this process.

Special attention should be given to Maritime Safety Information and emergency warning systems regarding EPIRB, MOB devices, etc..

Also, communication capabilities such as VHF, AIS, Mobile AtoN, etc. should be considered according to the situational needs.

## Shipborne perspective

The International Chamber of Shipping's '*Bridge Procedures Guide*'[[5]](#footnote-5) 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*.'

## Shore-based perspective

The IALA VTS Manual[[6]](#footnote-6) is a comprehensive guide to Vessel Traffic Services (VTS) providers and users.

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[[7]](#footnote-7) the general principles for the presentation of all symbology on a VTS display are:

* 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.

## 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:[[8]](#footnote-8)

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

# BASIC GUIDANCE ON PORTRAYAL

## Six basic ways

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

1. Alpha-numeric
2. Graphical
3. Point, line or polygon
4. Symbol
5. Geo-spatial
6. Imagery

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

### 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 MSC-MEPC.2/Circ.12/Rev.2 and MSCMEPC.2/Circ.13 concerning Human Element Analysing Process (HEAP).

### Graphs

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).

### 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.

### 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.

**IMO Resolution MSC.191 (79)**, Performance Standards for the presentation of navigation-related information on shipborne navigational display, 6 December 2004.

**IMO MSC.1/Circ.1593,** *Interim guidelines for the harmonized display of navigation information received via communication equipment, 25May2018.*

**IMO ResolutionMSC.466(101)**, *Amendments to the Performance Standards for the presentation of navigation-related information on shipborne navigational display,14 June 2019 (****Resolution*** *MSC.191(79)*) (shipborne navigational displays on the bridge of a ship for radar equipment, electronic chart display and information system (ECDIS) and integrated navigation systems (INS) installed on or after 1 January 2024, all other navigational displays on the bridge of a ship installed on or after 1 July 2025).

**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 2.0, July 2014.

### 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.

### 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.

## 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 able to be categorized for the various users as required.
* The '*portrayal of e-Navigation information onboard ships or ashore does not necessarily have to be identical*.'[[9]](#footnote-9) 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.
* The portrayal should allow a user to control the system, input data and take action efficiently.
* Where possible, the portrayal should indicate invalid and erroneous user input.
* The portrayal should be able to display and log significant events.
* The portrayal should support the playback of recorded data.

## Examples of portrayal

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

It should be noted that the examples of portrayal referred to may be subject to change due to developments.

# 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,[[10]](#footnote-10) and IALA e-Navigation related documents. 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.

## 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 and the presentation requirements set out in resolution MSC.191(79)

**IMO Resolution MSC.466(101)**, *Amendments to the Performance Standards for the presentation of navigation-related information on shipborne navigational display*,14 June 2019 (**Resolution** MSC.191(79))

**IHO S-52**, *Specifications for Chart Content and Display aspects of ECDIS Edition 6.1.1, October2014*

IHO S-52 contains several parts, and all pertain to the presentation/display of chart and navigation-related information.  
IHO S-100 *IHO Universal Hydrographic Data Model Edition 4.0.0*, December 2018.

IHO S-100 part 9 and part 9aspecifies the portrayal model for defining and organizing symbols and portrayal rules necessary to portray S-100 product Features.

IHO S-101 *IHO S-101 ENC Product Specification Edition 1.0.0, December 2018*

**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 4, August 2015.*

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.

## Radar

**IMO ResolutionMSC.192(79)**, *Revised Recommendation on* *Performance Standards for Radar Equipment, 6 December 2004.*

This Performance Standard applies to all ship-borne radar installations as mandated by the 1974 SOLAS Convention for this purpose, radar should provide the integration and display of radar video, target tracking information, positional data derived from own ship’s Electronic Position Fixing System (EPFS) and geo-referenced data.

**IEC 62388**, *Maritime navigation and radiocommunication equipment and systems –Shipborne radar – Performance requirements, methods of testing and required test results, Edition 2.0 Corrigendum 1 12th February 2014*

**IMO resolution A.823(19)**, *Performance Standards for automatic radar plotting aids, 23 November 1995*

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

**IALA Recommendation V-128** *Operational and Technical Performance Requirements of VTS System, Edition 4.1, May 2015.*

The purpose of this Recommendation is to assist the VTS provider in the definition, establishment and upgrades of a VTS system.

## AIS

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

**IMO Resolution A.1106(29**), *Revised Guidelines for the Onboard Operational Use of Shipborne Automatic Identification Systems (AIS),2 December 2015****.***

**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.

**IMO SN/Circ.236**, *Guidance of the Application of AIS Binary Messages, 28 May 2004.[[11]](#footnote-11)*

AIS can also be used as a means to communicate Binary Messages for certain types of specific applications. Binary Messages may provide a variety of capabilities for pre-defined information packages.

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. Over 19 AIS message types are described capable of conveying a wide range of hydrographic, meteorological, VTS, area notice, and route information. The display, generation and transmission of the information transmitted by AIS Application-Specific Messages requires external hardware and dedicated software in addition to the AIS equipment (e.g. ECDIS, ECS or VTS display).

**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*.

**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 providing guidance for the Presentation and Display of AIS ASM information.

## INS

**IMO Resolution MSC.86(70**)**, Annex 3**,

**IMO Resolution MSC.252(83),** *Performance Standards for an Integrated Navigation System (INS), 8 October 2007*

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).

The portrayal should present information to the user intuitively.

The portrayal should facilitate achieving an appropriate situational awareness and support effective decision‐making.

The portrayal should be designed for efficiency of operation and avoidance of information overload.

Physical conditions and ergonomics are very important as are workload, shift arrangements and reserve capacity.

Human‐centered design (HCD) and an ergonomic approach should be followed.

MSC.1/Circ.1512 defines HCD) as an approach to system design and development that aims to make interactive systems more usable by focussing on the use of the system; applying human factors, ergonomics and usability knowledge and techniques.

Furthermore:

* HCD helps to ensure that human factors-related knowledge and techniques in system design and development processes are addressed, thus ensuring that user needs and safety are met. The primary goals of usability and safety through efficiency, effectiveness, risk reduction and satisfaction should always be maintained.
* Key elements of HCD are the involvement of multi-disciplinary teams including users and an iterative approach to design. HCD is driven by knowledge about use, derived from evaluation and testing with users, the results of which drive a formal feedback loop in each of the design stages to ensure usability and safety. E-navigation systems should aim to ensure that navigational and associated tasks are effectively supported, with usability being the measure that is tested to ensure that this is achieved.

More detailed information can be found in MSC.1/Circ.1512.

There is further guidance emerging from NCSR6.

**IMO Resolution MSC.466(101)**, *Amendments to the Performance Standards for the presentation of navigation-related information on shipborne navigational displa*y,14 June 2019 (**IMO Resolution** MSC.191(79)).

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

This IALA Guideline was 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 Guideline contains 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.

**IEC 61924-2** *Maritime navigation and radiocommunication equipment and systems - Integrated navigation systems (INS) - Part 2: Modular structure for INS - Operational and performance requirements, methods of testing and required test results,2021 Edition 2.0*

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 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.

# EXAMPLES OF ITEMS THAT MAY CONTRIBUTE TO A GOOD PORTRAYAL

The overarching purpose of a good portrayal is to improve safety and efficiency. To reach this goal, the following non-exhaustive list of items may be considered when determining user requirements:

* A defined area of interest.
* Information that is provided when and where needed.
* Standardization of portrayal configuration, which supports consistent application of operational procedures.
* Role definition capabilities to support different portrayal profiles, such as Operators, Supervisors, and/or other users as required.
* Ergonomic HMI considerations with the goal of reducing and mitigating operator fatigue, distraction, and other factors that may negatively impact overall safety and efficiency;
* Minimizing non-essential administrative tasks in order to support the ability of the operator to focus upon critical tasks;
* Where possible, automatic validation of data integrity should occur prior to presentation;
* Minimal steps needed to navigate the VTS equipment in order to retrieve the necessary information to assist in real-time decision making;
* In a portrayal, a distinction should be made between operational alarms (related to navigation safety) and system alarms (related to technical deficiencies with the operating system). These alarms should be configured and displayed in an appropriate manner to ensure that they are relevant to users;
* A log of warning and alarms should be maintained and readily accessible to the user;
* A portrayal should not restrict the innovation of equipment manufacturers and unnecessarily interfere with the individual operational and risk based requirements of individual VTS Authorities.
* A portrayal may also contain considerations regarding system failures and recovery, and if possible/appropriately describe Business Continuity Measures .
* A portrayal should consider local regulations considering storage and access of data
* A portrayal should consider measures to be taken against unauthorised access to the system
* A portrayal should have some flexibility to consider advanced technologies that may be adopted in the future for Aids to Navigation Requirements and Management (ARM), ships, VTS, etc..

# DEFINITIONS & ACRONYMS

## Definitions

In conjunction with this Guideline, there is benefit in using agreed 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,[[12]](#footnote-12) Merriam Webster Dictionary,[[13]](#footnote-13) IALA Dictionary, IHO Dictionary,[[14]](#footnote-14) 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.*

**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).

## Acronyms

AIS Universal Shipborne Automatic Identification System

ARPA Automatic Radar Plotting Aid

ASM Application Specific Message

AtoN Marine Aids to Navigation

Circ. Circular (IMO document)

COMSAR Sub-Committee on Communications and Search and Rescue(IMO)

ECDIS Electronic Chart Display and Information System

ECS Electronic Chart System

EPFS Electronic Position Fixing System

e-NAV e-Navigation

ENC Electronic Navigation Chart

GI Geospatial Information (IHO)

GPS Global Positioning System

HCD Human Centred Design

HEAP Human Element Analysing Process

HMI Human Machine Interface

IEC International Electrotechnical Commission

IHO International Hydrographic Organization

IMO International Maritime Organization

INS Integrated Navigation System

ISO International Organization for Standardisation

MSC Maritime Safety Committee (IMO)

NAV Sub-Committee on Safety-of-Navigation (IMO)

SENC System Electronic Navigation Chart

SN Safety of Navigation (IMO)

S-52 Standard and the portrayal of colours and symbols in ECDIS (IHO)

S-57 Transfer Standard for Digital Hydrographic Data (IHO)

S-100 Universal Hydrographic Data Model (IHO)

SOLAS International Convention for the Safety of Life at Sea

VTS Vessel Traffic Services

VTSO Vessel Traffic Services Operator

WG Working Group

1. PORTRAYAL EXAMPLES

Types of VTS tasks (examples) that should be portrayed.

* Do a command
* Radar acquire target
* Indentify a radar track
* Modify data
* Create or modify a vessel trip
* Manage the portrayal
* Chart pan, zoom in, zoom out, etc.
* Perform measurements ; CPA, Distance,…,
* Handling of Alarms (grounding etc) reveived
* Handling from Alarms received by MOB’s etc
* Handling of (system)errors on inputs (radar, ais, ..)
* Filtering of information
* Managing AToN ‘s
* Managing (temporarily) obstructions
* VTS support tasks
* Recent information playback
* Reporting dangerous situations/accidents
* VTS auxiliary tasks
* Shift on and shift off operators
* Maintenance tasks and diagnostics
* Sensor controls
* Housekeeping tasks

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

<https://www.iala-aism.org/technical/information-portrayal/portrayal-examples/>

<https://www.iala-aism.org/technical/information-portrayal/iala-portrayal-guideline/>

**LIST OF REFERENCED DOCUMENTS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ID** | **Document Number** | **Title** | **Date of Approval /Adoption** | **Remark** |
| 1 | IMO Resolution MSC 85/26/Add.1 Annex 20) | Strategy for the Development and Implementation of E-Navigation | January 2009 |  |
| 2 | IMO Resolution MSC.1/Circ.1595 | E-Navigation Strategy Implementation Plan - Update 1 | 25 May 2018 |  |
| 3 | IMO Resolution  MSC.191 (79) | Performance standards for the presentation of navigational related information on shipborne navigational displays | December 2004 | Amended by IMO Resolution MSC.466 (101),June2019 |
| 4 | IMO ResolutionMSC.1/Circ.1593 | Interim Guidelines for the Harmonized Display of Navigation Information Received via Communication Equipment | |  | | --- | | 25 May 2018 | |  |
| 5 | IMO Resolution  MSC.466 (101) | Amendments to the Performance Standards for the presentation of navigation-related information on shipborne navigational display | 14 June 2019 |  |
| 6 | IMO Resolution MSC.Rev.232(82), | Adoption of the revised performance standards for electronic chart display and information systems (ECDIS) | 5 December 2006 | Amends A.817(19)-still in force for equipment installed before  1 January 1999 |
| 7 | IMO ResolutionMSC.192(79) | Adoption of the Revised performance standards for radar equipment | December 2004 |  |
| 8 | IMO Resolution MSC.74(69), Annex 3 | Recommendation on Performance Standards for An Universal  Shipborne Automatic Identification System(AIS) | June 1998. |  |
| 9 | IMO Resolution MSC.252(83) | Revised performance standards for integrated navigation systems (INS) | 8 October 2007 | Amends Annex 3 of MSC.86(70)  1) Installed on or after 1 January 2011  2) Refer to remarks on MSC.86(70) |
| 10 | IMO Resolution MSC/Circ.982 | Guidelines on ergonomic criteria for bridge equipment and layout | 20 December 2000 |  |
| 11 | IMO Resolution MSC.86(70) | New and amended performance standards for navigational equipment | 8 December 1998 | Superseded by MSC.116(73), Annex 2 Superseded by MSC.166(78), Annex 3 amended by MSC.252(83), but still in force for equipment installed before 1 January 2011 |
| 12 | IMO Resolution 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 | Novernmber.1991 |  |
| 13 | IMO Resolution A.823(19) | Performance standards for automatic radar plotting aids (ARPAs) | Novernmber.1995 |  |
| 14 | IMO Resolution A.917(22) | Guidelines for the Onboard Operational Use of Shipborne Automatic Identification Systems (AIS) | 25 January 2002 | Amended by Resolution A.1106(29) December 2015 |
| 15 | IMO Resolution A.1106(29) | Revised Guidelines for the Onboard Operational Use of Shipborne Automatic Identification Systems (AIS). | December 2015 |  |
| 16 | MSC-MEPC.2/  Circ.12/Rev.2 | Revised Guidelines for Formal Safety Assessment(FSA) for use in the IMO Rule-making Process | 4 April 2018 |  |
| 17 | MSC-MEPC.2/  Circ.13 | Guidelines for the Application of the Human Element Analysing Process(HEAP) to the IMO Rule-making Process | 8 July 2013 |  |
| 18 | IMO SN.1/Circ.243/Rev.2 | Amended Guidelines for the Presentation of navigation-related symbols, terms and abbreviations | June,2019 |  |
| 19 | IMO SN/Circ.217 | Interim Guidelines for The Presentation And  Display of AIS Target Information | 11 July 2001 |  |
| 20 | IMO SN/Circ.236 | Guidance of the Application of AIS Binary Messages | 28 May 2004 |  |
| 21 | IMO SN.1/Circ.289 | Guidance on the Use of AIS Application-Specific Messages | 2 June 2010. |  |
| 22 | IMO SN.1/Circ.290 | Guidance for the Presentation and Display Of AIS Application-Specific Messages Information | 2 June 2010. |  |
| 23 | IEC 62288, Edition 2.0, | 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. | July,2014 |  |
| 24 | IEC 60945, Edition 4.0 | Maritime navigation and radiocommunication equipment and systems – general requirements – methods of testing and required test results | August,2002 | Corrigendum 1 in April,2008 |
| 25 | IEC 61174, Edition 4.0 | 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. | August,2015 |  |
| 26 | IEC 62388, Edition 2.0, | Maritime navigation and radiocommunication equipment and systems –Shipborne radar – Performance requirements, methods of testing and required test results. | 26th June 2013.-Corrigendum 1 12th February 2014 |  |
| 27 | IEC 61924-2, Edition 2.0, | Maritime navigation and radiocommunication equipment and systems - Integrated navigation systems (INS) - Part 2: Modular structure for INS - Operational and performance requirements, methods of testing and required test results | 12thFebruary 2021 |  |
| 28 | IHO S-52, Edition 6.1.1 | Specifications for chart content and display aspects of ECDIS- | October 2014 -with Clarifications up to July 2015 | Annex A to S-52 -IHO ECDIS Presentation Library (Edition 4.0(.2), October 2014 - with Clarifications up to July 2017) |
| 29 | IHO S-100, Edition 4.0 | IHO Universal Hydrographic Data Model | December 2018 |  |
| 30 | IHO S-101, Edition 1.0.0 | IHO S-101 ENC Product Specification | December 2018 |  |
| 31 | IALA Recommendation V-125, Edition 3.0 | On the use and presentation of symbology at a VTS Centre | June 2012 |  |
| 32 | IALA Guideline G1106, Edition 2.0 | Producing an IALA S-200 Series Product Specification | June 2017 |  |
| 33 | IALA Recommendation V-128, Edition 4.1 | On Operational and Technical Performance Requirements for VTS Equipment. | 29 May 2015 |  |
| 34 | IALA Guideline 1095, Edition 1.0 | On Harmonised implementation of Application-Specific Messages (ASMs) | 31 May 2013 |  |
| 35 | IALA Recommendation V-127 Edition 2 | Operational Procedures for Vessel Traffic Services | June 2011 |  |
| 36 | IALA Recommendation V-125 Edition 3 | The use and presentation of symbology at a VTS Centre | June 2012 |  |
| 37 | IALA Recommendation V-119 Edition 2 | The Implementation of Vessel Traffic Services | December 2009 |  |
| 38 | IALA Guideline 1111 Edition 1.0 | Preparation of Operational and Technical Performance Requirements for VTS Systems  (Chapter10: VTS Human/Machine Interface and Chapter 11: Decision Support) | May 2015 |  |
| 39 | IALA Guideline G1106 Edition 2.0 | Producing an IALA S-200 Series Product Specification | June 2017 |  |
| 40 | “Report of the IALA Workshop on the Portrayal of Data and Information at a VTS” [Bremen, 2013] |  |  |  |
| 41 | Report on the IALA Workshop on Human Factor and Ergonomic in VTS [Gothenburg 2015] |  |  |  |
| 42 | IALA Recommendation 1014 Edition 1.1 | Portrayal of VTS Information and Data | December 2011 |  |

1. MSC 85/26/Add.1 Annex 20 section 1.1. [↑](#footnote-ref-1)
2. The *Recommendation e-NAV-140 on e-Navigation Architecture Shore Perspective (Ed 2)*, may address some aspects to be taken in consideration. [↑](#footnote-ref-2)
3. IMO MSC 85/26/Add.1, ANNEX 20, Strategy for the development and implementation of e-Navigation. [↑](#footnote-ref-3)
4. Terms Of Reference for IALA e-Navigation Committee, Information Portrayal Working Group(WG6). [↑](#footnote-ref-4)
5. Bridge Procedures Guide, 4th Edition 2007, International Chamber of Shipping (www.marisec.org, www.shipping facts.com). [↑](#footnote-ref-5)
6. IALA VTS Manual, 7th Edition, 2021. [↑](#footnote-ref-6)
7. IALA Recommendation V-125, Edition 3, 2012. [↑](#footnote-ref-7)
8. ' e-Navigation: A vision and its Practical Implementation', Dr. Andy Norris, (IALA eNAV11/11/4). [↑](#footnote-ref-8)
9. 'e-Navigation Portrayal and User Needs', International Chamber of Shipping (eNAV12/69) [↑](#footnote-ref-9)
10. IMO NAV 54-WP.2, Annex 1 (Existing Components of e-Navigation). [↑](#footnote-ref-10)
11. 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)'. [↑](#footnote-ref-11)
12. http://oxforddictionaries.com [↑](#footnote-ref-12)
13. http://www.merriam-webster.com [↑](#footnote-ref-13)
14. http://hd.iho.int/en/index.php/Main\_Page [↑](#footnote-ref-14)