International Association of Marine Aids to Navigation and Lighthouse Authorities

IALA

AISM Association Internationale de Signalisation Maritime

[Draft] IALA Guideline No.

On

Harmonized Portrayal of e-Navigation-related Information

Edition 1

(September 2013)

10, rue des Gaudines
78100 Saint Germain en Laye, France
Telephone: +33 1 34 51 70 01 Fax: +33 1 34 51 82 05
e-mail: contact@iala-aism.org Internet: www.iala-aism.org

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

DRAFT

Table of Contents

DOCUMENT REVISIONS **2**
TITLE OF DOCUMENT **2**
1 INTRODUCTION **4**
2 BACKGROUND **4**
2.1 Goal 4
3 SCOPE **4**
3.1 Core Objectives 5
3.2 Basic Premise and Caveats 5
4 DEFINITIONS **6**
5 GENERAL REFERENCES **9**
6 OPERATIONAL REQUIREMENTS **11**
6.1 Information Requirements 11
6.2 Information Needs 12
6.3 Shipborne-perspective 12
6.4 Shore-based 12
6.5 Levels of Information 12
7 BASIC GUIDANCE ON PORTRAYAL **13**
7.1 Six basic ways 13
7.2 Guiding Principles 14
8 CURRENT OPERATIONAL REQUIREMENTS **15**
8.1 ECDIS 15
8.2 Radar 19
8.3 AIS 20
8.4 INS 22
ANNEX A Examples of New Applications or Systems **23**

DRAFT

Harmonized Portrayal of e-navigation-related Information

1 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 something 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 can include visual, sound and through a sense of touch (haptics). However, for the purposes of this Guideline, the term 'portrayal' primarily refers to visual means of displaying e-navigation related information.

2 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, IALA Committee established six working groups to advance the work of the IALA e-navigation work programme. The IALA e-Nav Information Portrayal WG was established 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*." [2]

This Guideline is the result of this effort.

3 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

[1] MSC 85/26/Add.1 Annex 20 section 1.1
[2] Terms of Reference for IALA e-navigation Committee, Information Portrayal Working Group (WG 6)

general, goal-based guideline whereby over-arching objectives are defined, but freedom to innovate is left to both developers and users.

3.1 Core Objectives

The 85th Session of IMO MSC agreed on a number of **core objectives** related to the e-navigation concept.[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 having regard 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, among 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.*

While these core objectives appear to be straight-forward, what constitutes e-navigation information and how this information should be portrayed is more subjective. As it pertains to this Guideline, the "**e**" in e-navigation refers to *"...**electronic** means to **enhance** berth to berth navigation and related services*." As such, the intent is to provide practical guidance on how to achieve a "*harmonized presentation*" of e-navigation information both aboard and ashore.

3.2 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.

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

[3] IMO MSC 85/26/Add.1, ANNEX 20, Strategy for the development and implementation of e-navigation

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

4 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[4], Merriam Webster Dictionary[5], IALA Dictionary, IHO Dictionary[6], 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 on 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** are a raw collection of facts which can exist in any form without any evident meaning or sequence of usability.

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*

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

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 presented in a manner which is understandable to 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

DRAFT

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 what **symbol** is 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 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 of usability. In terms of e-navigation equipment, systems and services, "data" is usually in alpha-numeric form that is output by a sensing device and then digitally transmitted via electronic means. Some examples include navigation sensor data (e.g., GPS and radar) conforming to NMEA 0183 (IEC 61162-1/-2) or AIS binary message formats (IMO SN.1/Circ. 289). However, when this data is converted 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).

DRAFT

5 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",*[7] 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.

<u>Brief summary of contents</u>:

- 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
- Operational Displays
  - Multi-function display
  - Radar (including display of chart and maps on radar)

[7] Terms Of Reference for IALA e-navigation Committee, Information Portrayal Working Group(WG6)

- ECDIS (including display of radar and additional information)
- User selected (task orientated) presentation

- Physical Requirements
  - Display size
  - Screen size, resolution and viewing angle
  - Colours

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

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 various types of workstations on the bridge, including:

- Navigating and manoeuvring
- Monitoring *
- Manual steering (Helmsman's workstation)
- Docking (bridge wing)
- Planning and documentation *
- Safety *
- Communications *

* Of particular relevance to shore-based workstations.

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 in 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 of how navigation-related information is currently displayed onboard vessels.

6 OPERATIONAL REQUIREMENTS

The primary factor that influences the portrayal 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.

6.1 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: to strategic overview and tactical.

- Strategic overview is associated with maintaining overall situational awareness within the surrounding areas. This can include both monitoring and active engagement.
- Tactical involves more direct action and decision-support within the immediate or designated area.

6.2 Situation 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. nightime 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 what information is crucial to making informed decisions. This includes time-critical information necessary for grounding avoidance, collision avoidance, or maintaining overall situational awareness.

6.3 Shipborne-perspective

The International Chamber of Shipping "*Bridge Procedures Guide"*[8] 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 Forward 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*."

6.4 Shore-based

The IALA VTS Manual[9] (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.

6.5 Levels of information

There are at least three different levels of e- navigation related information, both at the present time and likely in the future[10]:

1) Required by IMO
2) Required by Flag or Port States in national waters
3) Innovative or Future Applications

Level 1 - Required by IMO
This is equipment or systems that are required to meet mandatory carriage requirements (e.g., under SOLAS IV and V). At the present time, this includes the following:

- ECDIS
- Radar
- AIS
- INS
- GMDSS (or equivalent)

[8] Bridge Procedures Guide, 4th Edition 2007, International Chamber of Shipping (www.marisec.org, www.shipping facts.com)
[9] IALA VTS Manual, 5th Edition, 2012.
[10] "e-navigation: A vision and its Practical Implementation", Dr. Andy Norris, (IALA eNAV11/11/4)

Level 2 – Might be required by flag or port states in national waters
Potentially, there may be certain types of equipment, systems, or operational capabilities that would be required for certain areas. At this time, there are no mandatory requirements. However, in the near future there could be situations where 'e-navigation capable' vessels are recognized as having an additional operational capability that enables them to safely proceed in navigation-challenged areas. Possible examples of these areas include the Torres Strait (Australia), The Sound (strait between Sweden and Denmark), and Arctic regions (Canada, Denmark, Norway, Russia, and USA).

Level 3 - Innovative or Future Applications
In recent years, there have been an increasing number of government-sponsored projects that have been conducted that e-navigation relevance. Some examples include:

- ACCSEAS (Accessibility for Shipping, Efficiency, Advantages and Sustainability)
- BLAST (Bringing Land and Sea Together)
- *EfficienSea* (Efficient, Safe and Sustainable Traffic at Sea)
- *MARNIS* (Maritime Navigation and Information Services)
- *MONALISA* Project (Motorways & electronic Navigation by Intelligence at Sea)
- *MEH* (Marine Electronic Highway)
- St. Lawrence River (Canada) e-Navigation Testbed

There are also a number of commercially-available, innovative mobile devices or applications (e.g., smart phone, tablets, etc.) that are being used to 'improve' navigation practices.

- Non-compulsory purchase and use
- Minimum statutory approval to show compliancy with the essential requirements of e-navigation and compatibility with other applications.
- Allow innovation and fast evolution
- Aimed at providing commercially-attractive packages
- Fuel reduction
- Navigational improvements
- Improved company-level reporting
- Dynamic under-keel clearance

Annex A contains a compilation of examples of innovative applications that could become a component of future e-navigation operations. A more detailed description of each of the applications is available on the IALA website.

7 BASIC GUIDANCE ON PORTRAYAL

7.1 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, common sense guidance with an example for each.

7.1.1 Alpha-numeric

Unless there is a need to display pre-formatted text or numbers, use a 'sans-serif' font. To avoid ambiguity, use lower-case lettering for actual words (e.g., radar) and capital letters only for abbreviations (e.g., AIS for Automated Identification System).

7.1.2 Graph

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

7.1.3 Point, line, or polygon

This type of 'vector data' 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.

7.1.4 Symbol

Similar to the guidance contained 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.*

7.1.5 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.

7.1.6 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 type of dynamic imagery. There is also increasing interest in the use of 3-D imagery.

7.2 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 data content and format of e-navigation related data should be similar (e.g., GPS/DGPS, AIS ASMs, ENCs, etc.). However, how the data is displayed as 'information' depends on the particular tasks, function, and needs of the user.
- There should be a means to achieve a similar portrayal of e-navigation information on key equipment/systems (e.g., ECDIS and radar). One possible means of achieving this

is to have a default e-navigation portrayal mode that could be used to portray navigation-related information in a similar manner to that of shipborne displays.

- The *"portrayal of e-navigation information onboard ships or ashore does not necessarily have to be identical."*[11] 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.
- With new types of e-navigation related information becoming available, there will a tendency to add more information to existing navigation displays (e.g., ECDIS and radar). Displaying too much supplemental information can obscure critical information or lead to confusion.

8 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[12], and IALA e-navigation related documents. These equipment/systems/services are also are mentioned in IMO e-navigation 'Gap Analysis' process[13]. These standards should be considered 'prescriptive' in terms of what is required. For each standard, specific mention is made of those sections that have particular relevance to presentation, display, or portrayal requirements for shore-based applications. To aid this process, relevant sections are highlighted in grey colour.

8.1 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 a dedicated stand-alone workstation or a multi-function workstation 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). In addition to the general requirements set out in IMO Res. A.694(17)[14] 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.[15]

<u>Section</u>

- Scope of ECDIS
- Application of these standards
- Definitions
- Provision and updating of chart information
- Display of SENC information
- Scale
- Display of other navigational information

[11] "e-Navigation Portrayal and User Needs", International Chamber of Shipping (eNAV12/69)
[12] IMO NAV 54-WP.2, Annex 1 (Existing Components of e-navigation)
[13] IMO NAV 58-6 (Report from the Correspondence Group on e-navigation to NAV 58)
[14] IEC 60945, Edition 4.
[15] IMO MSC/Circ. 982 (Guidelines on Ergonomic Criteria for Bridge Equipment and Layout)

- Display mode and generation of the neighbouring area
- Colours and symbols
- Display requirements
- Routing planning, monitoring and voyage recording
- Calculations and accuracy
- Performance tests, malfunctions 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

As specified in Section 9.1 of the IMO Performance Standard for ECDIS, IHO recommended colours and symbols (i.e., IHO S-52) is 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** the in relatively general terms (i.e., methods and requirements).
- Annex A – The **Presentation Library is** separate document (see further explanation below), and provides 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. 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 on ECDIS equipment.

4 MINIMUM OPERATIONAL AND PERFORMANCE REQUIREMENTS

4.3 Display of SENC information

4.5 Scale

4.6 Display of other navigational information

4.7 Display mode and generation of the neighbouring area

4.8 Colours and symbols

4.9 Display requirements

5 REQUIREMENTS CONTAINED IN IHO SPECIAL PUBLICATIONS

5.1 Content and structure of chart data

5.2 Priority of chart display

5.3 Display of chart information

- 5.3.1 Scale and navigation purpose
- 5.3.2 Text
- 5.3.3 Units and legend

5.4 Display functions

- 5.4.1 Object information
- 5.4.2 Navigational information
- 5.4.3 Safety contour
- 5.4.4 Navigational calculations

5.5 Supplementary display functions

- 5.5.1 Additional mariner's information
- 5.5.2 Additional non-HO information
- 5.5.3 Tidal adjustment

5.6 Use of the presentation library

5.7 Display characteristics

DRAFT

5.8 Performance requirements
5.8.1 Redraw
5.8.2 Resolution
5.8.3 Number of colours
5.8.4 Brightness and contrast
5.9 Ergonomic requirements
6.5 Initial data tests
6.5.1 Presentation library
6.5.2 ENC
6.6 Accuracy
6.7 Visual requirements
6.7.1 Symbols
6.7.2 Units and legend
6.7.3 Colour table
6.7.4 Resolution
6.7.5 Display characteristics
6.8 Functional requirements
6.8.1 Standard display
6.8.2 Display base
6.8.3 All other information
6.8.4 Display priorities
6.8.5 Additional display functions
6.8.6 Scale and navigation purpose
6.8.7 Mode and orientation
6.8.8 Safety contour
6.8.9 Safety depth
6.8.10 Object information
6.8.11 Navigation related functions
6.8.12 Position integration
6.8.13 Radar and plotting information
6.8.14 Loading of corrupted data
6.8.15 Automatic updates
6.8.16 Manual updates
6.9 Operational requirements
6.9.1 Ergonomic principles
ANNEX A - SENC INFORMATION TO BE DISPLAYED DURING ROUTE PLANNING AND ROUTE MONITORING
ANNEX B - NAVIGATIONAL ELEMENTS AND PARAMETERS
ANNEX C - AREAS FOR WHICH SPECIAL CONDITIONS EXIST
ANNEX D - ALARMS AND INDICATORS
ANNEX E - NAVIGATIONAL SYMBOLS

DRAFT

E.1 Introduction
E.2 Symbols
E.2.1 Symbol definition format
E.2.2 Route monitoring and route planning symbols
ANNEX F (NORMATIVE) ENC TEST DATA SET
F.1 General requirements
F.2 Data subset A – ENC
F.2.1 Complex area
F.2.2 Small-scale data
F.2.3 Data content
F.2.4 Alarms and indications
F.2.5 Alarms and indications: large-scale data
F.2.6 Mathematical calculations
F.2.7 Graphical representations

8.2 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). The 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

8.3 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 capable of providing to ships and to competent authorities, 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*, 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 AIM message types are described capable to 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 Application-Specific Messages requires external hardware and dedicated software in addition to the AIS equipment (e.g., and ECDIS or ECS 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. Similar to these IALA Guidelines, 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.

8.4 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 [current operational] mode and situation 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 and to complement the mariner's capabilities, while at the same time to compensate for their limitations. INS tasks 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 this 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

Examples of New Applications or Systems that May be e-navigation Related

The following is a summary of some e-navigation portrayal examples that were compiled in conjunction with the preparation of this Guideline. Some appear to be good examples, while others less so. The purpose of this compilation is not to pass judgment. Instead, the intent is to provide examples of what should be considered in the development and implementation of e-navigation.

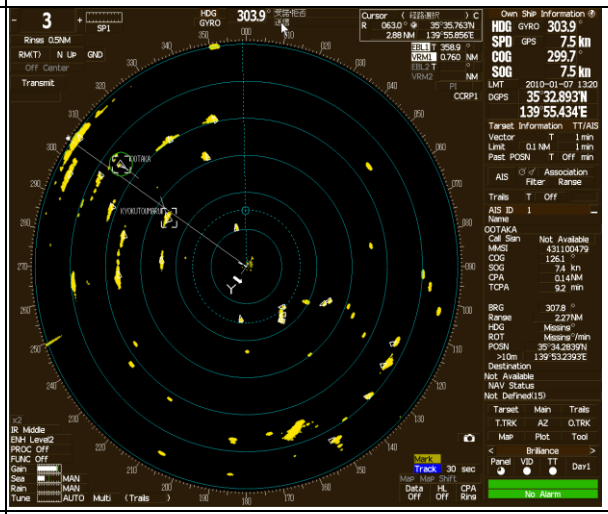
What is provided are single-page summaries, including extracts and a small thumbnail picture. More detail on each summary as well as a higher resolution image (i.e., portrayal example) can be found on the companion web site at: http://www.e-navigation.net

e-Navigation.net Web Site

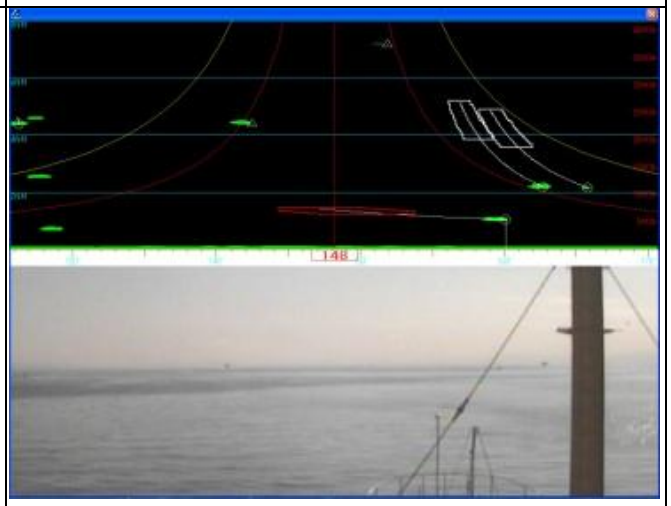
The collection of e-navigation related portrayal examples will continue on the companion web site, thus making this Annex and website a living document. In the near term, the web site will be maintained though the Danish Maritime Authority. Interested parties are encouraged to send in portrayal examples though an interface on the web site. A small, volunteer editorial group16 will provide passwords for submitters, and provide oversight to ensure that submissions are complete.

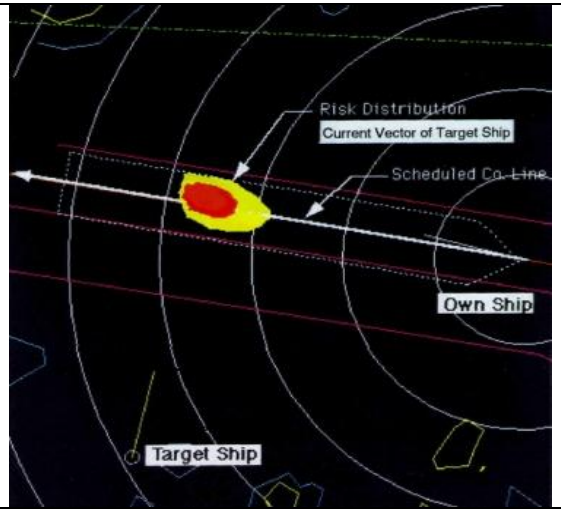
Template for IALA e-Nav Portrayal Website
1. Submitting Organization
2. Point-of-Contact
   Name
   e-mail address
3. Brief Description (PP Pres or 1-2 page info paper)
   - Display type (such as RADAR, ECDIS, ECS or Head-up display)
4. Functional Capabilities (types of data → information content)
5. Intended Purpose (including benefits)
6. Portrayal examples (means or methods of portrayal)
   a) good examples
   b) lessons-learned
   c) some concerns
7. Last edited (date)

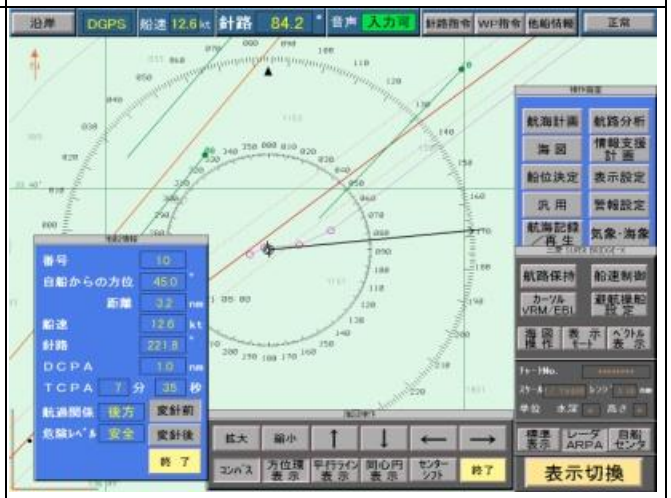
[16] Primarily members of the former IALA e-Navigation Committee Portrayal Working Group

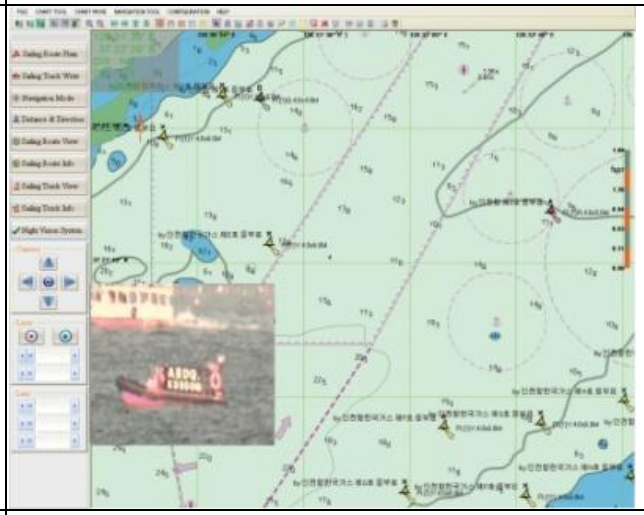
#	Name	Description	Function	Example
1	NIESS **Reference doc** WG6/ Tokyo	Navigational Intension Exchange Support System (Passing Pattern)	A radar add-on using display arrows of intended passing pattern of target ships that is shown on demand.	
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Dr. Junji Fukuto [Japan] National Maritime Research Institute fukuto@nmri.or.jp	Receive AIS message from target ship on intended passing pattern on demand. (e.g., 3 miles ahead) Avoids the need for an additional display.	Concern about displaying too much information on the radar. At present, most radar displays have limited ability for displaying additional data. It clutters the radar.	It may be beneficial to add data layers on Radar, but this needs to be limited, and data should be carefully selected. Showing data on demand is good for keeping the radar display clear.

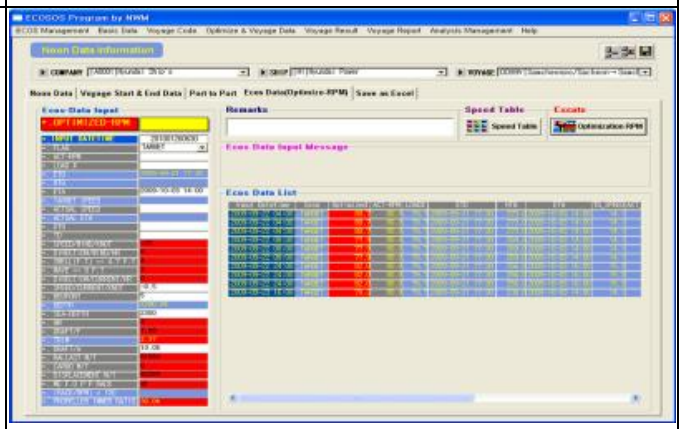
#	Name	Description	Function	Example
2	VLSS	Visual Lookout Support System (Tracked target information)	Heads-up display supporting information	
	Reference doc			
	WG6/ Tokyo			
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Dr. Junji Fukuto National Maritime Research Institute fukuto@nmri.or.jp	Clear visible target information. Enhances visual look-out. Linking real world and digital information.	Display may be confusing if too much information is shown. Possible cluttering of visual outlook.	Level of detail needs to be controlled. Environmental conditions (e.g. light) needs to be considered.

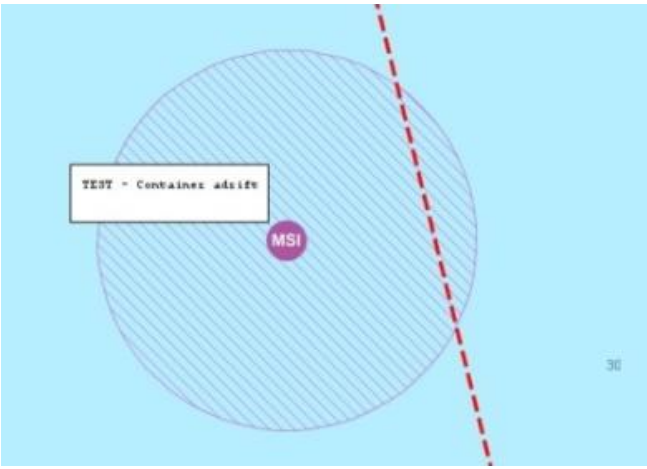
#	Name	Description	Function	Example
3	INT-NAV	Integrated Navigational System (Tracked Target Information and Video display)	Combined Video image and collision threats display	
	Reference doc			
	WG6/ Tokyo			
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Dr. Junji Fukuto National Maritime Research Institute fukuto@nmri.or.jp	Links digital and visual information. Include future trajectory of target ships and collision danger area. Reduced cluttering by split display. Possibility to use enhanced night vision.	Limited use for collision avoidance and planned route. Need to conduct a cognitive analysis on the effect of using two split screens, simultaneously.	Additional 'e-Nav' display may be needed. Stabilization of video image is necessary.

#	Name	Description	Function	Example
4		Scheduled route based collision danger area display (Scheduled route and collision danger zone)	Display of collision threat areas as a radar overlay on scheduled route.	
	Reference doc			
	WG6/ Tokyo			
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
		Visualize collision danger area. From a portrayal point of view similar to the Sperry introduced PAD.	Too much information on the radar. Radar display limits the ability of displaying additional data. It clutters the radar, especially if larger or overlapping danger areas are to be displayed. It is difficult to link danger area to target ship in the portrayal.	It may be beneficial to add data layers on radar, but this needs to be carefully selected.

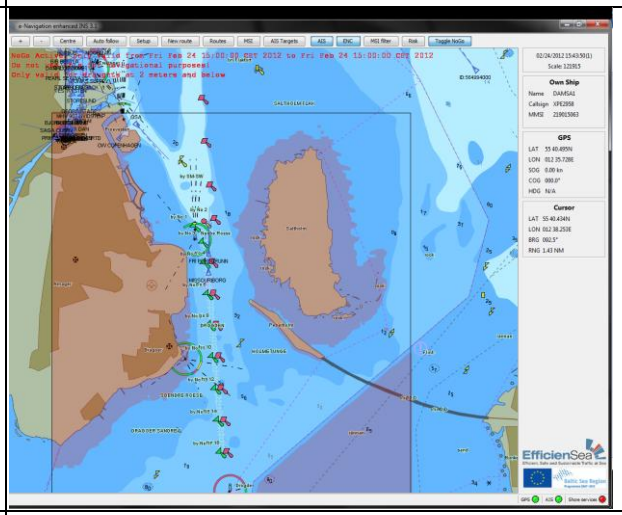
#	Name	Description	Function	Example
5		Display for automatic collision avoidance system (recommended collision avoidance route)	Provide recommended collision avoidance route on ECDIS.	
	Reference doc			
	WG6/ Tokyo			
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
		Provides an alternative option for decision support. Displayed on the primary navigation tool. Easy to understand and includes track control portrayal. Takes in account navigational significant object.	Potential of “overcrowding” the primary navigation display. Potential for distraction of navigator due to focus of display on collision avoidance. Difficult to communicate new route to potential target ships in condensed areas.	Use of different colour for scheduled, recommended and accepted (for tracking) route. Ensure recommended route does not overlay important information (e.g. transparency)

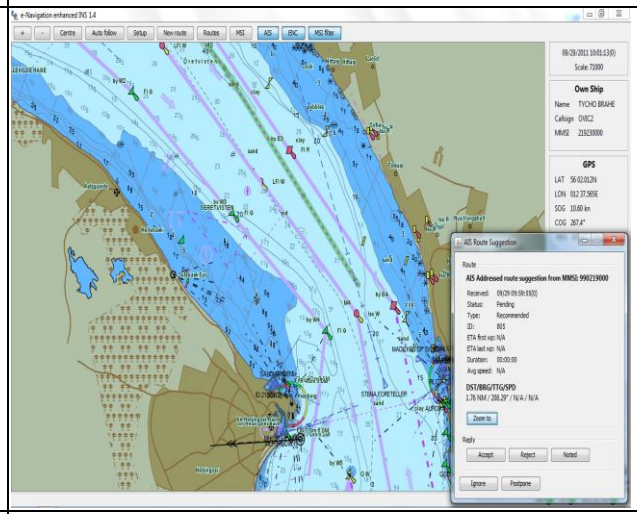
#	Name	Description	Function	Example
6	NAVIEYE	Vessel surveillance equipment **(**Video image of target ship)	Show target vessel on electronic chart with video image during day and night.	
	Reference doc WG6/ Tokyo			
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Dr. Seojeong Lee Korea Maritime University sjlee@hhu.ac.kr	Video image is directly linked to tracked ship by NAVIEYE Show video image of tracked target in day and night	The video image covers ENC data. It is difficult to link the image and tracked target symbol	Ensure video images do not overlay important chart or navigation information. Stabilization of video image is necessary.

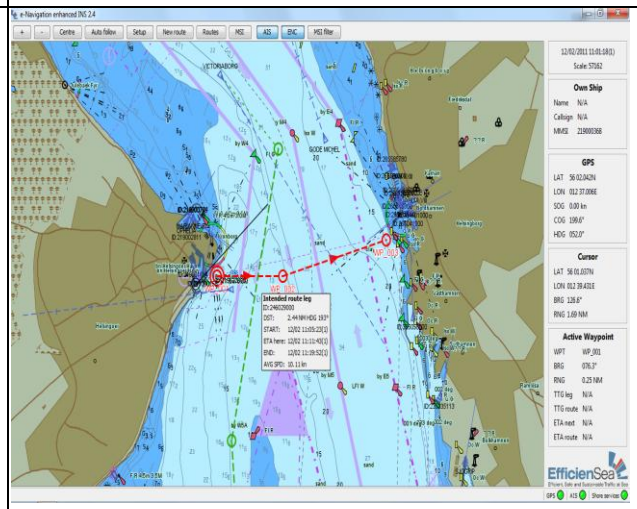
#	Name	Description	Function	Example
7	ECOSOS **Reference doc** WG6/ Tokyo	Energy Consumption Optimized System On Ship Marine engine information display (present state data and guidance data for optimized engine operation)	Suggest optimal navigational speed Display marine engine information Lower CO2 emission by reducing oil consumption	
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Dr. Seojeong Lee Korea Maritime University sjlee@hhu.ac.kr	Well organized for easy understanding of meaning of the data.	Do not use red for optimized value display May be too much information on one display	Use intuitive colour to portrayal information. Do not display too much information on one display Use much larger font. May be a better way to display text information.

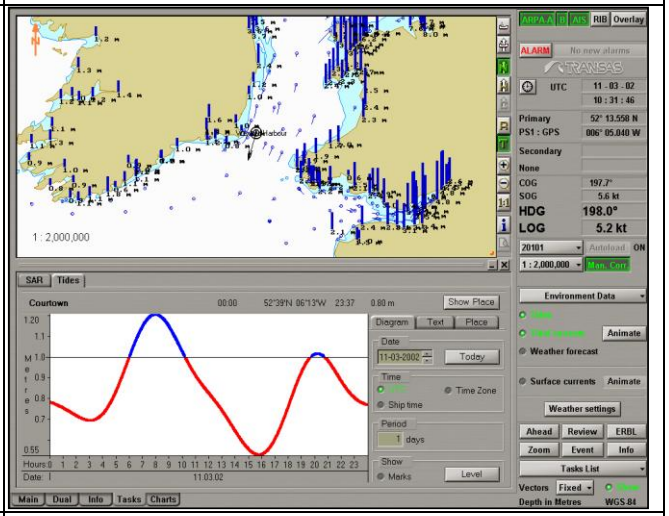
#	Name	Description	Function	Example
8	MSI **Reference doc** e-Nav9-INF8	Maritime Safety Information *(EfficienSea* Project*)*	Visualize MSI for the operator in ECDIS/GIS display. Visualize MSI for decision making.	
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Dr. Thomas Porathe Chalmers University, Sweden thomas.porathe@chalmers.se	Intuitive functionality – easy to understand. Combination of text and graphic presentation. Indicates if MSI has been assessed Use of transparent symbol	MSI symbol may cover other important information (no smart charting)	

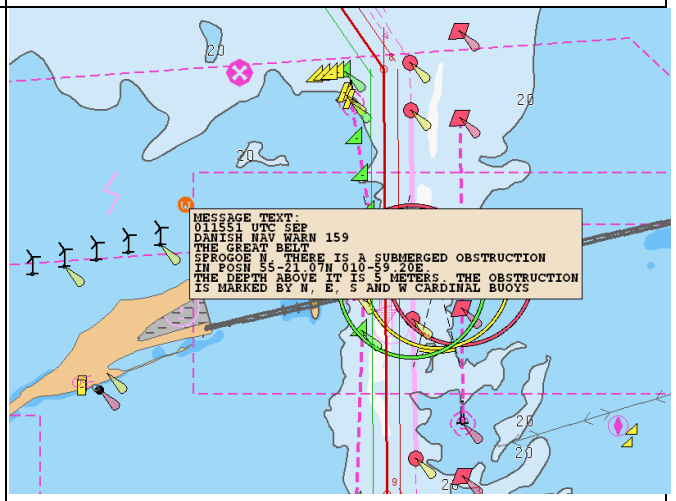
#	Name	Description	Function	Example
9	METOC **Reference doc** e-Nav9-INF8	Metrological and Oceanographic Data (*EfficienSea* Project)	Visual Presentation of Predicted Metrological and oceanographic data in the chart display. Prediction is based on current speed and the planned schedule.	
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Dr. Thomas Porathe Chalmers University, Sweden thomas.porathe@chalmers.se	Consistent use of WMO symbol to represent wind. Quick and easy to understand information on the predicted prerequisites along the planned route	No intuitive indicator for wave and current Current vector may be too large	May want to use more semi-transparent symbols.

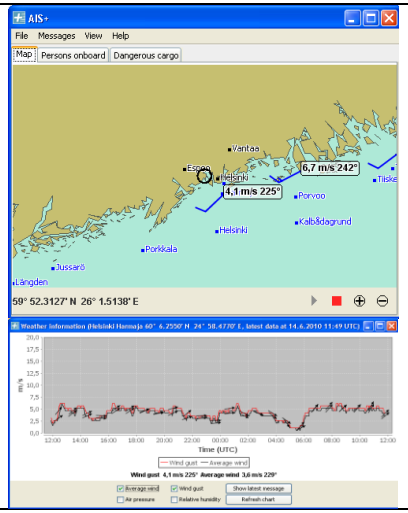
#	Name	Description	Function	Example
10	Dynamic No-Go Areas	Dynamic High Resolution No-Go Areas (*EfficienSea* project) Displays high resolution No-Go areas for a ship of a defined draught for a specified day and time	Coordinates for the specified rectangle are sent to the server which queries the depth database	
	Reference doc			
	e-Nav9-INF8			
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Dr. Thomas Porathe Chalmers University, Sweden thomas.porathe@chalmers.se			

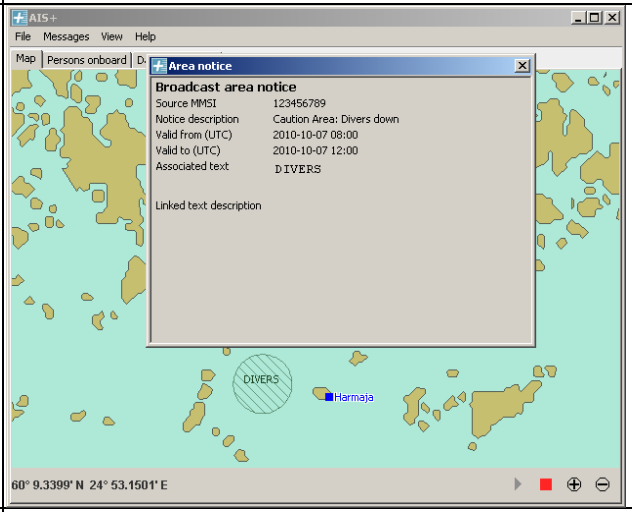
#	Name	Description	Function	Example
11	Route Suggestions **Reference doc** e-Nav9-INF8	Route suggestion from Shore to Ship (*EfficienSea* project)	Possible to transfer route with up to 15 route segments including start and end time. AIS capacity limits the number of WP	
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Dr. Thomas Porathe Chalmers University, Sweden thomas.porathe@chalmers.se	The transferred route gives an exact presentation of the recommended route and can be used for planning onboard the vessel.	The transferred route cannot be used for monitoring as a number of parameters such as turn radius or XTE are not included in the data exchange. Routes have not been checked for monitoring or Track Control.	Drawbacks can be eliminated if the exchange protocol is modified or other means of communication is used as part of e-navigation

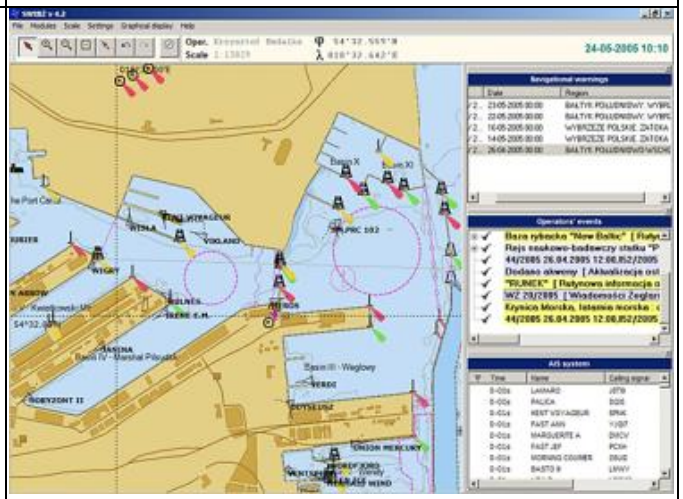
#	Name	Description	Function	Example
12	Intended Routes	Route exchange: ships showing intended routes (*EfficienSea* project) Ships transmitting "intended route" by sending 16 way points ahead from the onboard route plan	Possible to transfer route with up to 15 route segments including start and end time. AIS capacity limits the number of WP	
	Reference doc			
	e-Nav9-INF8			
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Dr. Thomas Porathe Chalmers University of Technology thomas.porathe@chalmers.se	User tests with captains and pilots have been done in the full mission bridge simulator at Chalmers University of Technology, Sweden.	Tests showed showing positive results and the users gave positive comments. However some commented that intended route negotiations should not be used in COLREG situations.	An interesting new behavior was detected during those simulations. Without having been told so, the OOWs started to move waypoints ahead of their position to "negotiate" a clear passage as soon as they realized that they were on a collision course with the other vessel. This new behavior needs to be investigated in depth to find out if it poses any threat to safety.

#	Name	Description	Function	Example
13		Presentation of Tides and Currents in Transas ECDIS	Visual and numeric presentation of data Tidal level shown as columns Current data shown as vectors Animation (play ahead is possible)	
	Reference doc			
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Transas Marine	Easy to understand well proven during more than 20 years /. Use of time-series graph. Intuitive colour scheme.	Only shows predicted data (tide tables);	In future, will need to simultaneously display real-time and 'forecast' water levels.

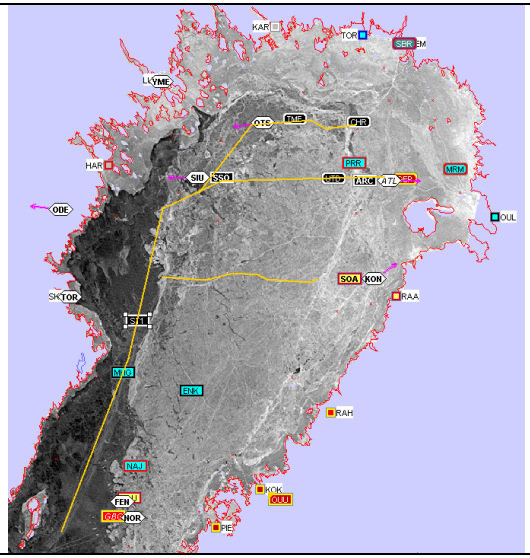
#	Name	Description	Function	Example
14		NAVTEX Message presented in Transas ECDIS	To visualize NAVTEX warning Highlight NAVTEX warnings in the vicinity of the vessel or the vessels route	
	Reference doc			
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Transas	Easy to understand well proven during more than 20 years Similar method and symbols can be used for e-Nav MSI presentation	There is no accuracy control or verification of the broad casted NAVTEX information. Text box obscures other chart and navigation information.	Could use a semi-transparent text box.

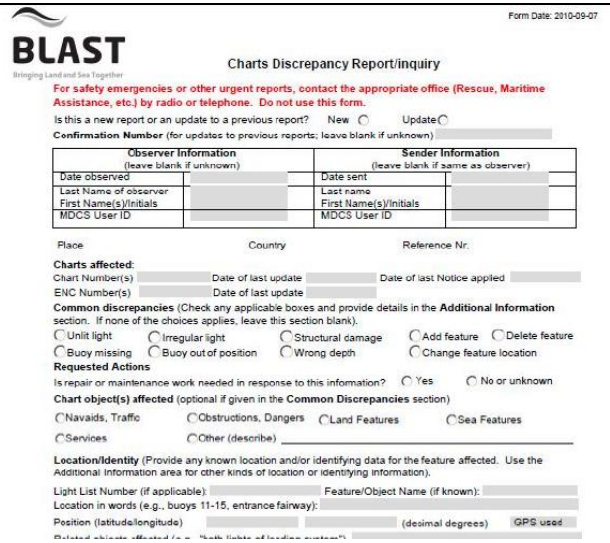
#	Name	Description	Function	Example
15	AIS+ WI	Meteorological and hydrographic data	Displays ships position plus current and historical weather on separate chart display.	
	Reference doc			
	e-Nav9-INF8			
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Markus Porthin VTT Technical Research Centre of Finland Markus.porthin @vtt.fi	Graphic display both as symbol, a standard wind barb and alphanumerical data direct in a chart gives the mariner real time wind speed and direction directly linked to a geographical position. History fluctuation is easily spotted in a time series graph. User defined settings possible.	You still need to look at devise not integrated in the bridge equipment. Or, if integrated, in i.e. ECDIS, when displaying the notice area other vital chart information might get cluttered.	Some real-time information could be integrated in ECDIS to be shown on demand but more comprehensive information is better displayed on another screen.

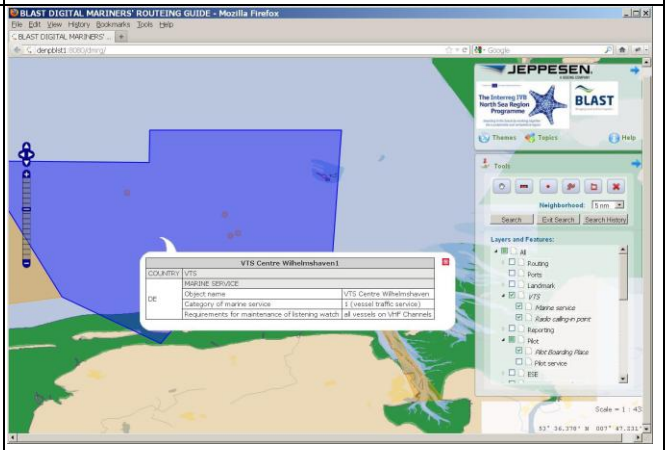
#	Name	Description	Function	Example
16	AIS+ AN	Area Notice	Displays ships position plus a geographic area and additional selectable written information on a separate chart display.	
	Reference doc			
	e-NAV9-INF8			
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Markus Porthin VTT Technical Research Centre of Finland Markus.porthin @vtt.fi	Geographical position and notice area limits in relation to ships position are easily identified. Information expands when clicking the notice area.	You still need to look at devise not integrated in the bridge equipment. Or, if integrated, in i.e. ECDIS, when displaying the notice area other vital chart information might get cluttered.	The area notice would benefit from more integration. But doing so graphic overload in i.e an ENC is a risk. Integrating with existing ENC symbology is desired. Use semi-transparent text box.

#	Name	Description	Function	Example
17	MarSSIES	Maritime Safety and Security Exchange Information System	visualization, share and exchange information; tool for maritime traffic monitoring, security and environment protection	
	Reference doc			
	eNAV 4 PP Presentation			
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	SPRINT SA Artur Baranowski artur.baranowski @sprint.pl	Multiple data integration; Touchable interface, Presentation on web and chart (graphics and text), Visualization based on ENC (S-57, S-52),Alerting and warnings; Unlimited numbers of additional layers, Portable version of GUI (small ports, marinas)	Shore based system. No input from ship based expertise is included yet. Lacking practice from ship on portrayal.	Needs to be revisited from a ship based portrayal point of view,

#	Name	Description	Function	Example
18	3D Charts **Reference doc** http://www.diva-portal.org/smash/record.jsf?searchId=2&pid=diva2:120506&rvn=6	Egocentric view 3-D conning display Tactical egocentric view conning display. Cognitive off-loading by removing mental rotations when comparing map information and real world view. Tested in laboratory experiments and in ship and simulator studies	ENC information is used together with over water height data and models of lighthouses, conspicuous buildings etc.	
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	Dr. Thomas Porathe Chalmers University of Technology thomas.porathe@chalmers.se	Faster decision making and fewer errors compared to north-up exocentric maps in tactical (conning) situations	Situation awareness visa vie own ship and direction to immediate dangers is improved but the situation awareness visa vie own route planning and position in the world might be degraded. A common frame of reference (north) is best in communication with other ships and shore	

#	Name	Description	Function	Example
19	IBNet – Ice Breacer Net **Reference doc**	IBNet is a decision support system for the Finnish and Swedish icebreakers in the Baltic Sea. IBNet contains information of importance for the ice breakers, such as registers over ships and their ice classes, ports, current shipping restrictions and AIS based positions of ships which the system then color codes depending on ship type and destination to improve the overview.in ship and simulator studies	Index of ice conditions. The past track of each ship is displayed colour coded by speed. As ships in the ice most often go full speed ahead, the speed through the water will give an indication of the severity of the ice	
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	VTT, Finland (http://www.vtt.fi/sites/ibnet/index.jsp?lang=en)	The interviewed bridge crew of Frej was very positive. The satellite image updated every day is intensively studied. Changes due to wind drift of the ice are studied, openings, and ridges are visible.	Even if the system allows overlay of some geographical features like the coastline, or the 10 m depth couture, it is not an ECDIS and integration with other types of chart information is not possible.	

#	Name	Description	Function	Example
20	Maritime Data Collection System **Reference doc** http://blast-project.eu/media.php?file=520	The Maritime Data Collection System (MDCS) is a web- based system that allows coastal agencies and hydrographic agencies of countries within the BLAST project to gather new information for use in nautical publications and charts for the North Sea. Charts and sailing directions are still manually updated based on observation reaching the different hydrographic and coastal administrations from mariners and other reporters. These reports are delivered by radio, telephone or email.	In every country there may be several authorities that have the responsibility of updating nautical publications of different kinds. Often it can be difficult for the mariner to know to whom he should report a detected discrepancy. MDCS will allow members of the public, or professionals like pilots, fishermen and seafarers to enter information through a generic web interface in the whole of the North Sea Region and the information will automatically be routed to the proper authority.	 Form Date: 2010-09-07 BLAST Bringing Land and Sea Together Charts Discrepancy Report/inquiry For safety emergencies or other urgent reports, contact the appropriate office (Rescue, Maritime Assistance, etc.) by radio or telephone. Do not use this form. Is this a new report or an update to a previous report? New ◯ Update ◯ **Confirmation Number** (for updates to previous reports; leave blank if unknown) **Observer Information** (leave blank if unknown) / **Sender Information** (leave blank if same as observer) Date observed / Date sent Last Name of observer / Last name First Name(s)/Initials / First Name(s)/Initials MDCS User ID / MDCS User ID Place Country Reference Nr. **Charts affected**: Chart Number(s) Date of last update Date of last Notice applied ENC Number(s) Date of last update **Common discrepancies** (Check any applicable boxes and provide details in the **Additional Information** section. If none of the choices applies, leave this section blank). ◯ Unlit light ◯ Irregular light ◯ Structural damage ◯ Add feature ◯ Delete feature ◯ Buoy missing ◯ Buoy out of position ◯ Wrong depth ◯ Change feature location **Requested Actions** Is repair or maintenance work needed in response to this information? ◯ Yes ◯ No or unknown **Chart object(s) affected** (optional if given in the **Common Discrepancies** section) ◯ Navaids, Traffic ◯ Obstructions, Dangers ◯ Land Features ◯ Sea Features ◯ Services ◯ Other (describe) _____ **Location/Identity** (Provide any known location and/or identifying data for the feature affected. Use the Additional Information area for other kinds of location or identifying information). Light List Number (if applicable): Feature/Object Name (if known): Location in words (e.g., buoys 11-15, entrance fairway): Position (latitude/longitude) (desimal degrees) GPS used
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	BLAST-project/Jeppesen michael.bergmann@jeppesen.com	Generic, easy to use text/graphical input interface for all types of nautical discrepancy reporting with automatic addressing.	Need to have internet accesses.	

#	Name	Description	Function	Example
21	Digital Mariners' Routeing Guide **Reference doc** http://blast-project.eu/media.php?file=613	The digital mariners' routing guide project consists of a presentation of datasets compiled from nautical publications in an online application that provides information necessary to preparing for a voyage between selected ports in the North Sea. This information includes ships routing measures, marine services, reporting requirements, areas where special regulations apply, etc.	The datasets are designed to conform to the new standards for marine information being developed by the International Hydrographic Organization and other international bodies	
	Contacts	**Advantage**	**Disadvantage**	**Recommendation**
	BLAST-project/Jeppesen michael.bergmann@jeppesen.com	Single window approach to all relevant nautical information for the route planning.		Should be displayed on planning station.