Harmonised Portrayal of e-Navigation-related Information

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ABSTRACT: A Guideline on the Harmonised Portrayal of e-Navigation-related Information was recently completed by IALA. The purpose of this Guideline is to provide guidance regarding the presentation and display of e-Navigation-related information. The basic, over-riding premise of this Guideline is that shipborne and shore-based equipment, systems, and services should portray e-Navigation-related information to all users (both onboard and ashore) in a consistent manner. However, since e-Navigation is an evolutionary process, this goal-based guideline describes over-arching objectives to be achieved, while freedom to innovate is left to both developers and users. An explanation is provided about key aspects of the Guideline. In particular, a website has been established to show examples of useful ways to portray e-Navigation information for current as well as some future types of equipment, systems, and services.

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. (MSC MSC 85/26/ Add.1 Annex 20)*

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 19117:2012). This can include visual, sound and through a sense of touch (haptics). However, as it relates to e-Navigation, the term 'portrayal' primarily refers to visual means of displaying 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" at 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 created an e-Navigation Committe, and 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." (IALA e-NAV11-19-6)

Since e-Navigation is an evolutionary process, it was felt that should be descriptive – not prescriptive. Until more practical experience is gained, it was premature to prescribe specific means to present/display e-Navigation related information. As such, the intent was to publish a general, goal-based guideline whereby over-arching objectives are defined, but freedom to innovate is left to both developers and users.

2.1 *Core objectives*

The 85th Session of IMO MSC agreed on a number of **core objectives** related to the e-Navigation concept. The following are those that are directly associated with the presentation and display (i.e., portrayal) of e-Navigation information.
– *facilitate safe and secure navigation of vessels having regard to hydrographic, meteorological and navigational information and risks;*
– *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;*
– *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;*

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 the development of a 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.

2.2 *Basic premise and caveats*

The basic, over-riding premise of the Guideline is:
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.

3 DEFINITIONS

When deveoping any type of 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, présentation, and portrayal. The following terms were defined and examples provided based on what are contained in widely recognized dictionaries or technical references. This included the *Oxford Dictionary*[1], *Merriam Webster Dictionary*[2], IALA Dictionary, IHO Dictionary[3], and relevant ISO standards.

3.1 *Basic definitions*

Consistent - showing steady conformity to character; constant
Example/context: The use of **consistent** symbology across on all displays helps to reduce misunderstanding and confusion.

Data - 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 - an electronic device [used] for the visual presentation of data
Example/context: An ECDIS **display** is capable of portraying both chart and navigation-related information

Feature - abstraction of real world phenomena

Feature attribute - characteristic of a feature.

Geographic information - implicitly or explicitly associated with a location relative to the Earth.

Icon - a graphic symbol on a computer screen or display
Example/context: The own-ship **icon** (i.e., symbol) on ECDIS represents the location of the vessel in real-time.

Information - the communication or reception of knowledge or intelligence
Example/context: Data becomes **information** when it presented in a manner which is understandable to humans

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[1] http://oxforddictionaries.com
[2] http://www.merriam-webster.com
[3] http://hd.iho.int/en/index.php/Main_Page

Intuitive - readily learned or understood
Example/context: Showing water as blue and land as orange/brown is an **intuitive** electronic chart colour scheme.

Obvious - clear, self-evident or apparent ; 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 – presentation of information to humans
Example/context: e-Navigation information can be **portrayed** in a variety of ways

Presentation - the manner in which something is displayed; 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 - a mark or character used as a conventional representation of an object, function, or process
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 - clear, precise; apparent; unmistakable,
Example/context: the use of both 'standard' and 'simplified' symbols could lead to **ambiguity**.

Uniform - not changing in form or character; having always the same form ; consistent; constant
Example/context: Portraying information a uniform manner reduces confusion as to meaning or intent.

Uniqueness - being the only one of its kind; unlike anything else
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 - An auxiliary presentation configured by the user for a specific task-at-hand.
Example/context : Based on the current situation or task-at-hand, a watchstander can decide if the presentation should include radar and/or chart information, in combination with other navigation or ship-related data.

3.2 *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).

4 BASIC GUIDANCE ON PORTRAYAL

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

1 <u>Alpha-numeric</u> - Unless there is a need to display pre-formatted text or numbers, use a 'san-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).
2 <u>Graph</u> - 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).
3 <u>Point, line, or polygon</u> - 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.
4 <u>Symbol</u> - Similar to the guidance contained in IMO SN.1/Circ.290, the following guiding principles apply to the display of symbols or icons:
5 Use consistent symbology across all displays
6 Uniqueness – only one possible meaning
7 Non-ambiguous – ability to determine differences (i.e. distinct)
8 Intuitively obvious – an easily recognized symbol, icon, or pattern
9 Have a basic symbol for different categories. Further attributes should be enhancements (not changes) to the basic symbol.
10 <u>Geo-spatial</u> - 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.
11 <u>Imagery</u> - 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.

4.2 *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. 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.

5 OPERATIONAL REQUIREMENTS

5.1 Information 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 overview and tactical.

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

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

5.2 Information 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. nighttime 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.

5.3 Shipborne-perspective

The International Chamber of Shipping "*Bridge Procedures Guide*" (2007) 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.*"

5.4 Shore-based

The IALA VTS Manual 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.

5.5 Level of information

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

Level 1 - Required by IMO
This pertains to equipment or systems that are required to meet mandatory carriage requirements (e.g., under SOLAS V). At the present time, this includes the following:
– ECDIS
– Radar
– AIS
– INS
– GMDSS (or equivalent)

Level 2 – May 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 Belt (strait between Sweden and Denmark), and Arctic regions (Canada, Denmark, Norway, Russia, and USA),

Level 3 - Innovative or Future Applications
In conjunction with a number of government-sponsored R&D projects and testbeds, there are an increasing number of commercially-available, innovative applications (e.g., *iPod*) that have been developed and used to 'improve' navigation practices.

6 EXAMPLES OF E-NAVIGATION PORTRAYAL

The IALA Guideline includes an Annex that provides examples of new applications or systems that may be e-Navigation-related. The compilation is a collection

of single-page summaries that include 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

The collection of e-Navigation related portrayal examples will continue on the companion web site, thus making the 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 submit portrayal examples though an interface on the web site.

REFERENCES

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