

IALA Methodology for capturing e-Navigation user needs

e-Navigation is an International Maritime Organization (IMO) led concept based on the harmonisation of marine navigation systems and supporting shore services driven by user needs. It is formally defined as:

*"E-navigation is the harmonised **collection, integration, exchange, presentation and analysis** of **maritime 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"*

It is therefore of great importance that all users are identified and their need assessed. A proposed list of key e-Navigation users is attached as Annex 1 and the following methodology is proposed for the capture of all users of e-Navigation on a global basis.

In order to systematically capture the specific 'user needs' of all users, it is requested that all users first break down their operation into navigational 'primary needs' and then assess these primary needs using the proposed template (Annex 2). As an example, the IALA e-Navigation committee has broken the user needs of a generic SOLAS class merchant mariner into the following primary navigational needs: Voyage Planning, Safe Navigation, Collision Avoidance, Manoeuvring and Conning, Communication, and Recording/Record Keeping. Annexes 3, 4, 5 and 6 contain examples of Voyage planning, Safe Navigation, and Collision Avoidance from this set, and an additional assessment for the act of Pilotage.

Once a primary navigational need has been identified, the needs for the harmonised provision and presentation of the 'maritime information' must be identified as referenced in the definition of e-Navigation i.e. collection, integration, exchange, presentation and analysis. For ease of understanding, it may be useful to rephrase each question in isolation such as "what is the user need for the harmonised collection, or harmonised integration of maritime information for the primary task of collision avoidance?".

The following advice for addressing the headings of collection, integration, exchange, presentation and analysis is suggested:

Collection - List the Harmonised Collection of information that is needed for you as a user for this primary need e.g. data from GPS, nautical publications, safety notices, etc... This section should detail the various pieces and sources of data needed to carry out the 'primary task' that you would benefit from if they were available from a single source or in a common format i.e. 'Collection'. If any preferred details of the source or format are known they should be mentioned.

Integration - Once data has been 'collected', it will need to be Integrated in a harmonised way into a system in order for it to be used in conjunction with other data for the benefit of the end user. If there are any specific system requirements or limitations for such integration e.g. software, hardware, protocols or system integrity needs they should be mentioned here in either detailed or general terms.

Exchange - issues Harmonised Data exchange should be considered between any two parties such as ship/ship or ship/shore or broadcast needs such as from one party to many. If specific exchange issues such as radio frequency, bandwidth or protocols are known they should be stated.

Presentation - List any special requirements from your specific user need for the presentation of information that will improve your decision making ability. This may include the grouping of information, presentation options such as video and/or audio, or a preferred layout of equipment and controls.

Analysis - Analysis needs may refer to any additional functionality for decision support tools, or the rapid and systematic processing of routine tasks.

Additional Comments – This section should be used to identify any restrictions or limitations assumed when defining the primary need, such as when defining 'safe navigation' you might state that the task of 'collision avoidance' has been dealt with separately for simplification. Or to make any other suggested 'user needs' that you feel have not been addressed elsewhere in the exercise.

Following an extensive consultation of user needs from stakeholders, the resultant collection of user needs will be collated into an amalgamated user needs document that will be delivered to the IMO. The next steps will involve the creation of an IMO e-Navigation strategy and development plan.

Annex 1

Identification of potential e-Navigation user groups

The development of this list of user groups incorporates discussions from the Intersessional Meeting of the Operations and Strategic WG in July 2007, the 26th meeting of the VTS Committee and the 3rd meeting of the E-NAV Committee.

In order to categorize potential users consideration has been given to the likely methods that would be used for sharing information between users. These are:

Ship to shore / Shore to ship	(ship with VTS/VTM or Coastguard-centre and vice versa)
Shore (VTS/VTM) to Shore 1	(maritime/nautical information towards maritime organizations and stakeholders)
Shore (VTS/VTM) to Shore 2	(public and transport/cargo information supporting the logistic chain)

The user groups listed here will comprise various individual users and administrations may need to identify appropriate user group organisations to solicit information about those particular e-Navigation user needs.

The table included below remains a work in progress and should not be considered to be a comprehensive list of all the possible e-Navigation user groups. It is not intended that there is correlation between the columns, rather this table provides three separate lists. The general distinction between Shoreside (1) and Shoreside (2) is that organisations listed under Shoreside (1) have a responsibility for safety, whilst those in Shoreside (2) generally do not.

SHIPSIDE
Merchant vessels (incl. all types of cargo and passenger vessels ¹)
High Speed Craft incl. displacement and non-displacement vessels
Assets for mobile VTS
Pilot vessels
Coastguard vessels
SAR vessels and aircraft
Law Enforcement vessels <ul style="list-style-type: none">- police- customs- border control- immigration- fishery inspection
Nautical Assistance Assets (e.g. tugs, salvage vessels, tenders, fire fighting vessels)
Counter pollution vessels

¹ Commercial Tourism (charterers, sailing vessels etc) not included due to different legislation

Military vessels
Fishing vessels
Leisure Pleasure craft
Tourism
- Leisure craft
- Commercial charter vessels
- Water buses
Ferries
Dredging (all types of vessels)
Floating & non-floating AtoN
Ice patrol/ Ice breakers
Offshore energy production
- Rigs (gas & oil)
- Supply vessels
- Lay barges
- Survey vessels (maintenance)
- construction vessels
- Cable layers
- Guard ships
- production storage vessels
Offshore renewable energy installations
- windmill parks
- maintenance vessels
- non-floating AtoN
Hydrographic Survey vessels
Oceanographic Research vessels

SHORESIDE (1)
Ship owners & operators, sfety managers
VTM Organizations (competent authorities within the concept)
VTs – Organizations (centres) <ul style="list-style-type: none">- VTS operators (tactical/operational)- Management (strategic)
Pilot Organizations
Coastguard Organizations (or equivalents)
Search and Rescue organizations
Law Enforcement Organizations <ul style="list-style-type: none">- Police- Customs- Border control- Immigration- Fishery inspection
National administration (Flag State)

Coastal administration
Port authorities (operational)
Security organizations (ISPS)
Port State Control
Organizations dealing with incident management
Ship owners & operators
Safety managers
Counter Pollution Organizations
Military Organizations
Fairway maintenance organizations (contracting & operational parties)
AtoN regulating, monitoring and service providing organizations (this includes lighthouse authorities)
Meteorological organizations
Object/Ships owners & operators & Safety managers
Hydrographic & geodetic organizations

SHORESIDE (2)
Ships owners & operators, logistic stakeholders
Media (news organizations)
Integrated coastal management authorities
Marine accident investigation organizations
Health & Medical Organizations
Insurance & Financial institutions
Governmental and other national/regional organizations (competent authorities)
Port authorities (strategic)
Ministries (policy)
Marine environment management
Ship owners & operators
Logistic stakeholders
Fisheries management
- Tourism agencies
- Ship owners & operators
Logistic stakeholders
Administrations (competent authorities)
AtoN regulating, monitoring and service providing organizations (this includes lighthouse authorities)
Ships owners & operators,
Logistic stakeholders
Energy organizations
International and national hydrographic authorities
Oceanic Research Institutes
Training organizations
Equipment manufacturers & system maintenance organizations

Annex 2

Template for collecting e-Navigation user needs

User: <i>[Define user here i.e. Merchant mariner, Flag administration, VTS operator etc..]</i>		
Primary need: <i>[State primary need as a clear mission statement here e.g. “e-Navigation should support mariners in the maintenance of safe passing, safe clearing distances and collision avoidance”]</i>		
	User Need	Comments / Specifics

<p>Collection</p>	<p>“e-Navigation should allow the collection of all appropriate information needed to support the task of the Primary Need by all available means.”</p>	<p><i>[List the information needed for the Collection that you as a user have for this primary need e.g. data from GPS, nautical publications, safety notices, etc...</i></p> <p><i>This section should detail the various pieces and sources of data needed to carry out the ‘primary task’ that you would benefit from if they were available from a single source or in a common format i.e. ‘The Collection’.</i></p> <p><i>If any preferred details of the source or format are known they should be mentioned.]</i></p>
<p>Integrate</p>	<p>“e-Navigation should integrate all appropriate data and information needed to support the primary need.”</p>	<p><i>[Once data has been ‘collected’, it will need to be Integrated into a system in order for it to be used in conjunction with other data and for the benefit of the end user. If there are any specific system requirements or limitations for such integration e.g. software, hardware, protocols or system integrity needs they should be mentioned here in either detailed or general terms.]</i></p>

Exchange	<p>“e-Navigation should allow for the exchange of any data or information needed to support the primary need.”</p>	<p><i>[Data exchange issue should be considered between any two parties such as ship/ship or ship/shore or broadcast needs such as from one party to many. If specific exchange issues such as radio frequency, bandwidth or protocols are known they should be stated.]</i></p>
Presentation	<p>e-Navigation should facilitate the clear presentation of all information pertaining to the primary need in a manner that supports the decision making process, engages the user and minimises any risk of distraction or over burden.</p> <p>It should also provide easy to use facilities for a user to interact with the system and input data.</p>	<p><i>[List any special requirements from your specific user need for the presentation of information that will improve your decision making ability. This may include the grouping of information, presentation options such as video and/or audio, or a preferred layout of equipment and controls.]</i></p>
Analysis	<p>“e-Navigation should support the user through the appropriate analysis of data and information to support the primary need.”</p>	<p><i>[Analysis needs may refer to any additional functionality for decision support tools, or the rapid and systematic processing of routine tasks.]</i></p>

Any other Comment:

[This section should be used identify any restrictions or limitations assumed when defining the primary need such as when defining 'safe navigation' you might state that the task of 'collision avoidance' has been left out and dealt with separately for simplification. Or to make any other suggested 'user needs' that you feel have not been addressed elsewhere in the exercise.]

Annex 3

User: Generic SOLAS Merchant Mariner		
Primary need: e-Navigation should support mariners in the maintenance of safe passing and clearing distances and collision ² avoidance.		
	User Need	Comments / Specifics
Collection	“e-Navigation should allow the collection of all appropriate information needed to support the task of the Primary Need by all available means.”	This may include but would not be limited to information from Radar, ARPA, AIS, any shore VTS, audio, gyro compass and visual identification.

² Collision is taken to mean between vessels that are underway

<p>Integrate</p>	<p>“e-Navigation should integrate all appropriate data and information needed to support the primary need.”</p>	<p>e-Navigation should integrate all appropriate data and information needed by a mariner to identify and monitor targets and to make appropriate decisions to maintain safe distance and to monitor the safe passage of all targets including throughout any manoeuvres. This may include but would not be limited to information from Radar, ARPA, AIS, gyro compass, official navigational charts and visual identification. Thought should be given to the assimilation of targets from all sensors, and the process of integration should support the role of the mariner and not lead to distraction and overburden.</p>
<p>Exchange</p>	<p>“e-Navigation should allow for the exchange of any data or information needed to support the primary need.”</p>	<p>e-Navigation should allow for the exchange of any data or information (pertaining to the identification of targets or the prevention of collision) between ships and between ships and shore, to facilitate the maintenance of safe passing and clearing distances at all times. Thought should be given to the sharing of such information in a standard format, and in automatic or user selectable modes.</p>

<p style="text-align: center;">Presentation</p>	<p>e-Navigation should facilitate the clear presentation of all information pertaining to the primary need in a manner that supports the decision making process, engages the user and minimises any risk of distraction or over burden.</p> <p>It should also provide easy to use facilities for a user to interact with the system and input data.</p>	<p>e-Navigation should facilitate the clear presentation of all information pertaining to the maintenance of safe distances in a manner that minimises any risk of distraction or overburden, engages the mariner and supports the decision making process.</p> <p>The presentation of target data should be developed in compliance with SOLAS Ch V Reg 15 and make best use of association and standardised symbology.</p> <p>The presentation needs to provide the best possible level of situational awareness to support the mariner’s decision making process. This should include the ready availability of hydrographic information, positional data, met-ocean data, shore provided information and own ship sensor information such as echo sounder depth.</p> <p>The presentation should support the role of the mariner and not lead to distraction and overburden.</p>
<p style="text-align: center;">Analysis</p>	<p>“e-Navigation should support the user through the appropriate analysis of data and information to support the primary need.”</p>	<p>Consideration should be given to decision support systems to aid in the assessment of risk and avoidance of single person or single point of failure errors.</p>

Any other Comment:

The exercise has assumed the collision avoidance and management of safe space around a vessel only and in isolation of any other safe navigation requirements these will be contained in another user needs collection exercise.

Annex 4

User: <i>Ship's Passage Planning</i>		
Primary need: Should support mariners planning for berth to berth navigation taking into account issues including: <ul style="list-style-type: none">♦ Safety of Navigation♦ Cost/time efficiency♦ Regulatory/environmental requirements		
	User Need	Comments / Specifics

Collection	<p>“e-Navigation should allow the collection of all appropriate information needed to support the task of the Primary Need by all available means.”</p>	<p>e-Navigation should allow the collection of all appropriate data and information, in internationally standardised formats, needed to support the task of planning a passage in compliance with all appropriate flag state, coastal state, port state and company requirements.</p> <p>The following information should be provided in both predicted and real time, as appropriate:</p> <ul style="list-style-type: none"> Tidal Water level information Hydrographic information Tidal streams/currents Under-keel allowances Information from pilot books/sailing directions Company/personnel specific experience and historical data Chart dangers (rocks, shoals fixed and floating obstructions) Traffic schemes (traffic separation, routeing, etc) Meteorological information Port information AtoN information Environmental info (PSSA, Special Areas etc) Appropriate current ENC's Electronic ephemera data (nautical almanac) Ship information - static Ship information – hydrodynamic Ship information – Cargo and loading and stability Ship information - Bunker capacity economy and endurance. Navigation warnings Communications information including reporting requirements Pilot pick up drop off areas and procedures VTs information Feedback from Voyage data recorder reviews Other vessel's intentions
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<p>Integrate</p>	<p>“e-Navigation should integrate all appropriate data and information needed to support the primary need.”</p>	<p>e-Navigation should integrate all appropriate data and information needed by a mariner to appraise, plan, execute and monitor the voyage plan.</p> <p>Intelligent integration using automatic or manual methods, ensuring data integrity and using common coordinate and time references.</p>
<p>Exchange</p>	<p>“e-Navigation should allow for the exchange of any data or information needed to support the primary need.”</p>	<p>e-Navigation should allow for the exchange of appropriate data and information that maintains the passage plan.</p> <p>Provide real-time voyage and environmental data to information suppliers and receive updated, real-time information and forecasts for planning.</p> <p>Route sub-sets of the voyage plan and subsequent historical data to appropriate interested parties.</p>

<p>Presentation</p>	<p>e-Navigation should facilitate the clear presentation of all information pertaining to the primary need in a manner that supports the decision making process, engages the user and minimises any risk of distraction or over burden.</p> <p>It should also provide easy to use facilities for a user to interact with the system and input data.</p>	<p>e-Navigation should facilitate the clear and timely presentation in appropriate formats of pertinent user defined information and data to support the phases of passage planning appraisal, planning, execution and monitoring.</p> <p>Suitable independently controllable visual display(s) providing required elements of plan with interactive communications at all required locations, utilising industry best practice for human machine interface and providing ‘S’ mode.</p> <p>Provide preview facilities for selected elements of planned passage</p> <p>Inclusion of simulation mode for training purposes.</p>
<p>Analysis</p>	<p>“e-Navigation should support the user through the appropriate analysis of data and information to support the primary need.”</p>	<p>e-Navigation should support the mariner through the appropriate pre-voyage, on passage and post passage analysis and assist in the decision making process.</p> <p>As above (presentation) with inclusion of rule/regulation based planning</p>
<p>Any other Comment:</p> <p>The appropriate level of information integrity is a common requirement for all users needs.</p>		

Annex 5

User: Mariner, SOLAS Merchant Vessel		
Primary need: e-Navigation should support mariners in navigating safely from berth-to-berth		
	User Need	Comments / Specifics

Collection	<p>“e-Navigation should allow the collection of all appropriate information needed to support the task of the Primary Need by all available means.”</p>	<p>Collection includes, for instance:</p> <ul style="list-style-type: none"> • information in the passage plan • official electronic nautical charts and publications • met data (predicted and real-time) • oceanographic data (predicted and real-time) • real-time AtoN data (visual, AIS, radar detection of AtoN) • Notices to Mariners • Ship’s static data • Ship dynamic characteristics • Any handling and structural constraints • Own ship sensor data eg. radar, echo-sounder, GPS • VTS supplied data • Departure, planned arrival and alternative port data • Real-time maritime safety information
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<p>Integrate</p>	<p>“e-Navigation should integrate all appropriate data and information needed to support the primary need.”</p>	<p>Thought should be given to evaluating data for quality including accuracy and integrity before integration. Integrated data, including position and time information, should be based on a common reference frame. Any integration should not prevent the mariner from having access to data from individual sources. The user shall be able to override any automatic function, such as an autopilot. Pre-processing of raw data from sensors may be used to improve usability. Integration should only be used to create added-value to the navigation process.</p>
<p>Exchange</p>	<p>“e-Navigation should allow for the exchange of any data or information needed to support the primary need.”</p>	<p>Thought should be given to the sharing of such information in a standard format, and in automatic or user selectable modes.</p>

<p style="text-align: center;">Presentation</p>	<p>e-Navigation should facilitate the clear presentation of all information pertaining to the primary need in a manner that supports the decision making process, engages the user and minimises any risk of distraction or over burden.</p> <p>It should also provide easy to use facilities for a user to interact with the system and input data.</p>	<p>The human-machine interface should be developed in compliance with standards developed by the Organization (IMO). The presentation should make best use of association and standardised symbology.</p> <p>The presentation needs to provide the best possible level of situational awareness to support the mariner's decision making process. This should include the ready availability of all relevant data at all times.</p> <p>The presentation should support the role of the mariner and not lead to distraction and overburden.</p> <p>Suitable presentation facilities should be provided at all operational positions to permit the required tasks. Presentations shall be task orientated.</p> <p>Consideration should be given to allow the ship to be safely navigated in the event of a primary presentation failure or other major navigation equipment failure, always ensuring that the ship remains seaworthy.</p> <p>The bridge team should be suitably alerted in the event of an equipment failure or when the navigational situation needs attention.</p>
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Analysis	<p>“e-Navigation should support the user through the appropriate analysis of data and information to support the primary need.”</p>	<p>Consideration should be given to decision support systems to aid in the assessment of risk and avoidance of single person or single point of failure errors.</p> <p>Tools shall be provided to support the user in navigational tasks in any easy way allowing an interactive mode between human element and system.</p>
<p>Any other Comment:</p> <p>The tasks of ‘collision avoidance’ and pilotage have not been addressed as these are covered in other Primary Need statements.</p>		

Annex 6

User: Pilot and the ships' bridge team		
Primary need: e-Navigation should support Pilotage activities in the maintenance of safe conduct of a ship in pilotage waters.		
	User Need	Comments / Specifics

Collection	<p>“e-Navigation should allow the collection of all appropriate information needed to support the task of pilotage by all available means.”</p>	<p>This may include but would not be limited to information from VHF, Radar, ARPA, AIS, DGPS, any shore VTS, audio, gyro compass and visual identification, the Master/Pilot Exchange, ship particulars, real-time speed and course, Doppler log accurate data, ISPS level, real-time hydro- and meteo- data from Shore Authority</p> <p>Passage plan data to be shared with vessel bridge team (data from Pilot Portable Unit)</p> <p>International standardised format/protocol for interface</p> <p>Thought should be given as to how Master and Pilot can exchange info.</p> <p>Thought should be given as to how Master and Pilot can exchange views the other’s display – possibly a common display</p>
Integrate	<p>e-Navigation should integrate all appropriate data and information needed by the pilot and bridge team to identify and monitor targets and to make appropriate decisions to maintain safe distance and to monitor the safe passage of all targets including throughout any manoeuvres.</p>	<p>This may include but would not be limited to information from VHF, Radar, ARPA, AIS, gyro compass, ENC’s and visual identification, Real-time hydro- and meteo- data,</p> <p>Thought should be given to the assimilation of targets from all sensors, and the process of integration should support the role of the pilot and bridge team and not lead to distraction and overburden.</p>

<p>Exchange</p>	<p>e-Navigation should allow for the exchange of any data or information (pertaining to the identification of targets or the prevention of collision) between ships and between ships and shore, to facilitate the maintenance of safe passing and clearing distances at all times.</p>	<p>Thought should be given to the sharing of such information in a standard format, and in automatic or user selectable modes.</p> <p>Thought should be given to the ability to share/agree an initial/draft/intended passage plan between pilot and ship before a pilot boards.</p>
<p>Presentation</p>	<p>e-Navigation should facilitate the clear presentation of all information pertaining to the safe passage of the ship during the pilotage act that minimises any risk of distraction or overburden, engages the pilot and bridge team and supports the decision-making process</p>	<p>The presentation of target data should be developed in compliance with SOLAS Ch V Reg 15 and make best use of association and standardised symbology.</p> <p>The presentation needs to provide the best possible level of situational awareness to support the pilot and bridge team's decision-making process. This should include the ready availability of real-time hydrographic information, positional data, met-ocean data, shore provided information and own ship sensor information such as echo sounder depth.(Doppler log)</p> <p>The presentation should support the role of the pilot and bridge team and not lead to distraction and overburden</p> <p>Thought should be given to an intuitive display that should be available to the Pilot immediately on boarding to observe internationally agreed basic information (S-mode display).</p>

Analysis	e-Navigation should support the pilot and bridge team through the appropriate analysis of data and information so as to assist in the decision-making process.	Consideration should be given to decision support systems to aid the pilot. Pilot often ‘stands alone’ when in critical stages of manoeuvring – then based upon the pilot’s experience/expertise/knowledge and/or ‘gut feeling’.
<p>Any other Comment:</p> <p>Collision avoidance and safe navigation has not been considered here since they are considered in a separate listing and typically these things are less relevant to pilotage which is conducted in restricted waters where consideration of CPA information is not necessary.</p> <p>Also, information presentation requirements have not be expressly considered, since all information presentation should provide easy to use facilities for a user to interact with the system and input data.</p> <p>Actual depth data and UKC information was not expressly considered since it was felt these requirements are obvious and should probably be covered under a different user needs list.</p> <p>A list of sensors has not been included as this is also covered in a separate list..</p>		