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DEVELOPMENT OF AN E-NAVIGATION STRATEGY IMPLEMENTATION PLAN

Report from the Correspondence Group on e-navigation to NAV 57

Submitted by Norway

SUMMARY

Executive summary:	The Correspondence Group on e-navigation has presented the developed complete, overarching architecture on e-navigation, an enabling maritime data framework, the progress of the gap analysis, as well as a draft outline for the final Strategy Implementation Plan on e-navigation. The action points reflect the issues relevant to NAV 57.
Strategic direction:	5.2
High-level action:	5.2.6
Planned output:	5.2.6.1
Action to be taken:	Paragraph 61
Related documents:	MSC 85/26, annexes 20 and 21; MSC 86/23/4; MSC 86/26, section 23; NAV 55/WP.5; NAV 56/8; NAV 56/WP.5, annex 1; NAV 56/INF 10(Republic of Korea); STW 42/WP.1; COMSAR 15/WP.6/Rev.1

Background

1 The Maritime Safety Committee at its eighty fifth session approved the Strategy for the development and implementation of e-navigation, and then at its eighty sixth session approved a proposal for a coordinated approach to the implementation of the e-navigation strategy. The proposal outlines a joint plan of work for the NAV, COMSAR and STW Sub-Committees for the period 2009-2012. According to the plan, NAV 56 finalized the user needs, the initial system architecture, and completed an initial gap analysis, initial cost benefit and risk analysis, taking into account the recommendations of COMSAR 14.

2 Working groups for implementation of the e-navigation strategy have been established by the NAV, STW and COMSAR Sub-Committees respectively. These working groups are being assisted by a Correspondence Group.

3 Norway would like to thank the following Member States, intergovernmental organizations, governmental and non-governmental organizations for their participation in the correspondence group: Argentina, Australia, Bahamas, Belgium, Brazil, Bulgaria, Canada, Chile, China, Cote d'Ivoire, Denmark, Finland, France, Germany, Ghana, Greece, India, Ireland, Islamic Republic of Iran, Italy, Japan, Kenya, Republic of Korea, Luxemburg, Marshall Islands, The Netherlands, Nigeria, Philippines, Poland, Portugal, Russian Federation, Senegal, Singapore, South Africa, Spain, St. Kitts & Nevis, Sweden, Turkey, Ukraine, United Kingdom, United States, European Commission, BIMCO, CIRM, IALA, ICS, IFSMA, IHMA, IHO, IMPA, IMRF, IMSO, Nautical Institute, OCIMF and WMO.

Terms of reference for the re-established correspondence group

4 NAV 56 re-established the correspondence group under the coordination of Norway and instructed it to take into account document MSC 86/23/4 relating to the joint work plan for COMSAR, NAV and STW Sub-Committees for the period 2009-2012, the comments and general views expressed at NAV 56 and, decisions taken by NAV 52 including the guidance in MSC/Circ.1091 on Issues to be considered when introducing new technology on board ship and MSC/Circ.878-MEPC/Circ.346 on Human Element Analyzing Process (HEAP). The Correspondence Group on e-navigation should undertake the following tasks:

.1 consider documents NAV 56/8, MSC 85/26 (annex 20, paragraph 9.7.2 and annex 21, paragraph 5) and NAV 56/WP.5, annex 1, and finalize the system architecture;

.2 consider documents NAV 53/13 (annex 3), NAV 56/INF.10 (Republic of Korea) and MSC 85/26 (annex 20, paragraph 9.7.3 and annex 21, paragraph 6), and progress the initial gap analyses focusing on technical, regulatory, operational and training aspects;

.3 submit a report to STW 42 (24 to 28 January 2011) raising specific questions, if required, that should be addressed by STW;

.4 submit a report to COMSAR 15 (7 to 11 March 2011) outlining an overall conceptual, functional and technical architecture and the progress made in the initial gap analyses focusing on communication and SAR issues;

.5 submit a consolidated progress report to NAV 57 (6 to 10 June 2011) outlining the further analyses for navigation and related shore-based services issues, the completed and ongoing work including a provisional outline/draft of the Strategy Implementation Plan and progress on the cost benefit and risk analyses; and

.6 based on the requirements stipulated in the e-navigation strategy section 8 (MSC 85/26, annex 20) to identify and describe an enabling data framework to support user needs and ensure maximum interoperability.

The overarching e-navigation architecture

5 A further development of the e-navigation architecture has been performed. It visualizes how the current e-navigation architecture was derived from the high level concept, and introduces important principles of the e-navigation architecture. Relevant principles for a shore-based system architecture harmonized for e-navigation are established.

6 At NAV 56, a 'common data structure' was endorsed (NAV 56/8: Figure 2: Conceptual e-navigation architecture). The scope of this 'common data structure' is confined to the maritime domain, hence the title the Common Maritime Data Structure (CMDS). The CMDS will serve as a common reference for all implementers of e-navigation and thereby accommodate for a certain degree of harmonization.

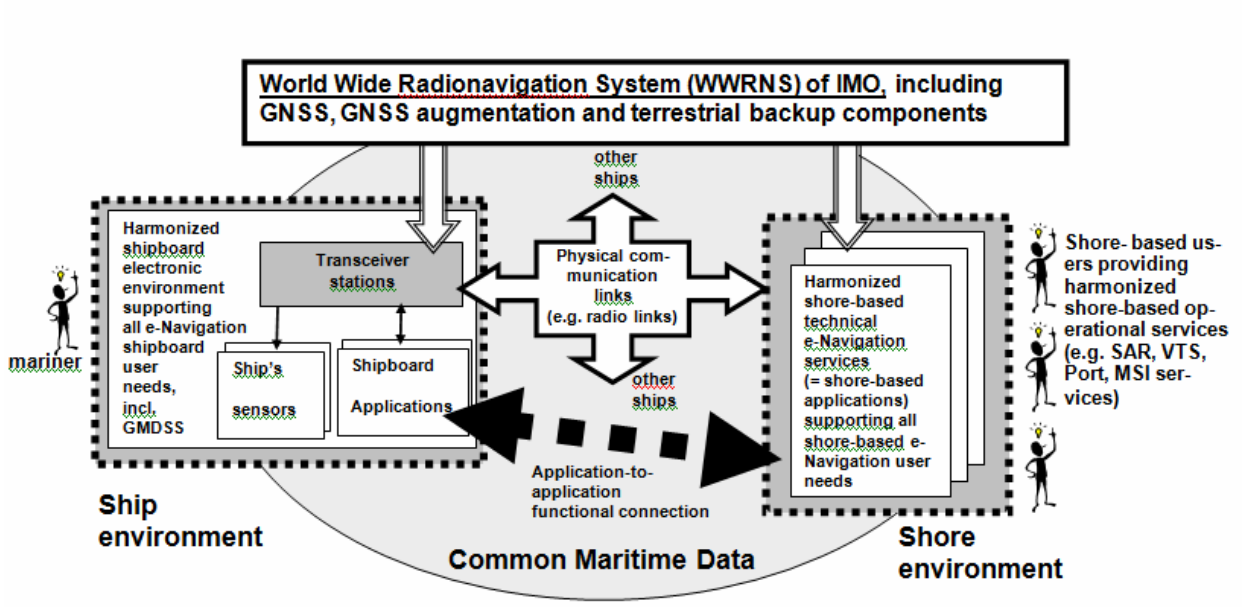

Figure 1 (as endorsed by NAV 56/8, Figure 2)

7 Figure 1 did not convey the full notion of the e-navigation concept. When considering the e-navigation architecture, one should think in terms of information/data flow, application interactions, and user interfaces. It is therefore necessary to refine the figure into an information/data flow oriented graphical representation.

8 Figure 2 shows the principle of an information/data flow in the e-navigation architecture while the structural details of both the technical shipboard and shore-based e-navigation system architectures are not yet shown. This brings into focus the 'operational service' level and the 'Functional links used by Technical services' and the 'Physical links used by Technical services'.

This is a further development as it highlights the fundamental distinction between information and data domains; explaining the relationship between the user requested information items; putting the concepts of Operational Services, Technical Services as well as Functional and Physical Links into a hierarchical perspective; identifying the place of the concept of 'Maritime Service Portfolio'; and unfolding the relationship of shore-to-shore data exchange.

The figure shows the complete overarching e-navigation architecture, and defines two additional important features:

.1 The Common Maritime Data Structure (CMDS) that spans the whole of the horizontal axis;

.2 The World Wide Radio Navigation System (WWRNS).

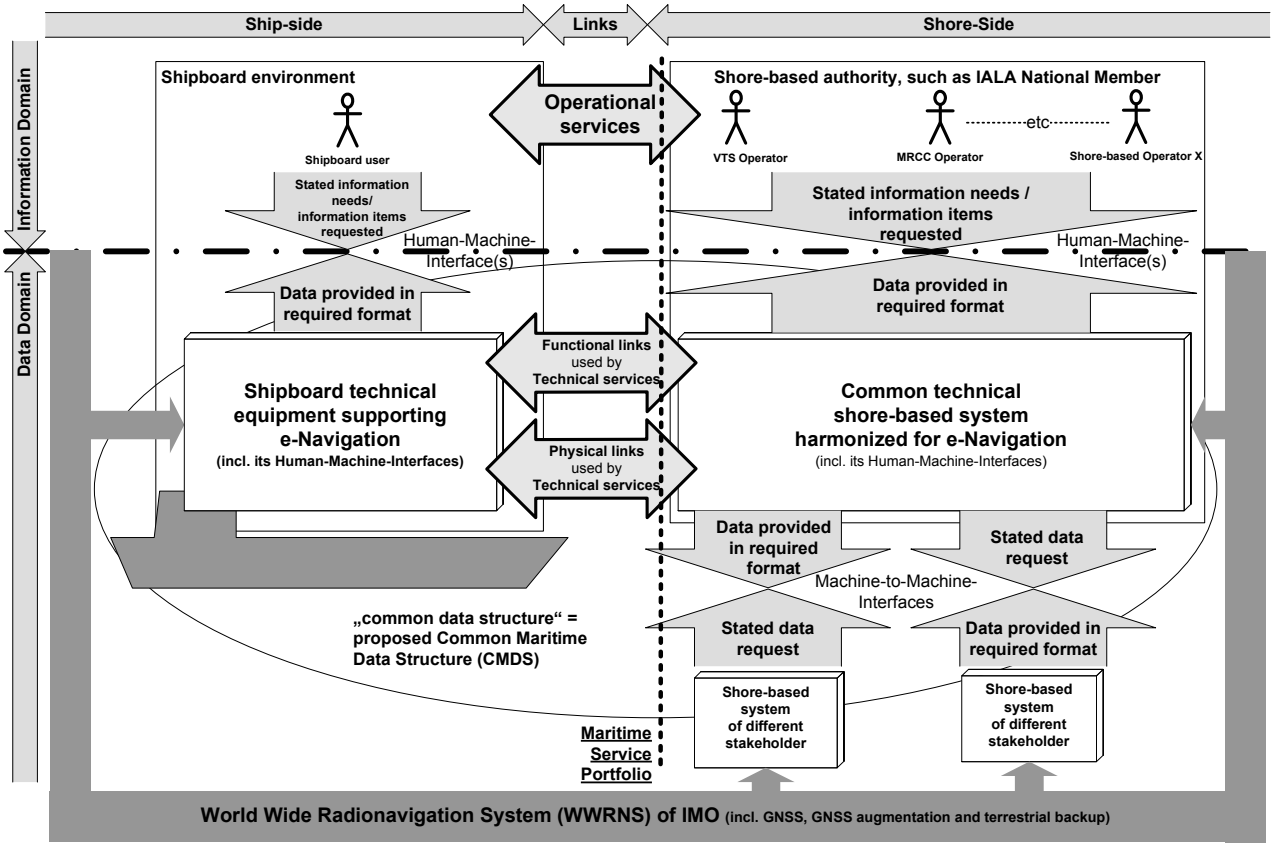

Figure 2. The complete overarching e-navigation architecture.

9 The Sub-Committee is invited to endorse the complete overarching e-navigation architecture.

An enabling maritime data framework

10 COMSAR 14 recognized the need to achieve a common data structure in order to meet the goals of e-navigation and to respond to the needs of the stakeholders within the maritime domain. In general it was agreed, taking into account the original principles for e-navigation, that:

.1 formats for the collection, exchange and distribution of data should be harmonized and standardized where practicable and appropriate;
.2 processes and procedures for the collection, exchange and distribution of data should be arranged in a uniform way, where practicable, and in accordance with the internationally agreed standards;
.3 the services providing the data and information, as well as the systems used for these purposes, should be interoperable in such a way that the use and re-use of data can be enhanced; and
.4 consequently the development of open standard interfaces should be encouraged.

11 At NAV 56, a review of existing and emerging data structures and frameworks were recommended to ensure its efficiency and interoperability with other data information systems (NAV56/INF.9). The Correspondence Group was tasked with this development.

12 The scope of the ‘common data structure’ is confined to the maritime domain. Hence, the Common Maritime Data Structure (CMDS) will serve as a common reference for all implementers.

The functional relationships of the CMDS are illustrated in Figure 3:

.1 The CMDS can represent any maritime entity, can be extended by the addition of new entities, and is accessible to any stakeholder or implementer.

.2 The CMDS is an abstract representation of parts of the maritime domain. Specifically, it represents the entities and relationships among the entities that exist in this domain but does not represent processes.

.3 The CMDS contains no details about physical representation of the entities within it. However, the CMDS can be used to guide the development of databases and interfaces.

.4 The CMDS is flexible and extendable for meeting future requirements. New entities can be added by any stakeholder through a process known as registration.

Figure 3 illustrates how the CMDS would be created – based on user requirements – and how it would influence the components of the e-navigation architecture when creating hardware and software used for e-navigation purposes.

Figure 3. Scope and Impact of the Common Maritime Data Structure (CMDS)

13 The Sub-Committee is invited to note how the Common Maritime Data Structure (CMDS) could be developed.

Creating a framework for data access and information services under the scope of SOLAS

14 At NAV 56, it was agreed to organize a work shop, which should focus on the relevance and best alignment of the various data frameworks, and look for answers to three questions:

.1 Can there be a common data structure to use as a base line for e-navigation?
.2 Which principles should be used to ensure interoperability?
.3 What working relationships should be developed to ensure harmonization with other global initiatives?

The work shop took place during 4-5 November 2010 at the headquarters of the International Hydrographic Organization in Monaco. The outcome of the work shop was submitted to the Correspondence Group.

15 IALA has been addressing the need for a data framework to support the delivery of shore based e-navigation services.

16 The IHO has developed the S-100 data model to support a variety of hydrographic-related digital data sources, products and customers. S-100 is not an incremental revision of S-57, but it is a new geospatial standard for marine data and information that can include both additional content and support of new data exchange formats. The S-100 is flexible with capacity to also include other types of information.

17 COMSAR 15 (March 7-11, 2011) endorsed that IHO's S-100 data model should be used as a baseline for creating a framework for data access and information services under the scope of SOLAS; and also that IMO, in consultation with other organizations, should consider the establishment of a Harmonization Group on creating a framework for data access and information services under the scope of SOLAS, based on the example of the IMO/IHO Harmonization Group on ECDIS including the draft Terms of Reference for the IMO/IHO Harmonization Group on Data Modelling (HGDM) (Annex 1 of this document, and COMSAR 15/WP.6/Rev.1,Annex 1).

18 The Sub-Committee is invited to endorse that IHO' S-100 data model should be used as a baseline for creating a framework for data access and services under the scope of SOLAS.

19 The Sub-Committee is also invited to endorse that IMO in consultation with other organizations, should consider the establishment of a Harmonization Group on creating a framework for data access and information services under the scope of SOLAS, based on the example of the IMO/IHO Harmonization Group on ECDIS including the draft Terms of Reference for the IMO/IHO Harmonization Group on Data Modelling (HGDM) (Annex 1 of this document).

The possibilities of using the Geospatial Registry, operated by IHO

20 Recognizing the need for a central registry for storing the fine data objects, IHO and IALA are currently exploring the possibilities of using the Geospatial Information (GI) Registry, operated by IHO. It is considered to be flexible and extendable for meeting future requirements.

21 New entities could be added by any stakeholder through a process known as registration. Once registered, an entity is available to all stakeholders; there is open, public access. Stakeholders may be designated as a domain owner within the GI Registry with full control over its products and derived standards.

Figure 4 shows the GI Registry, and how different stakeholders might be included, - using the IALA domain as an example.

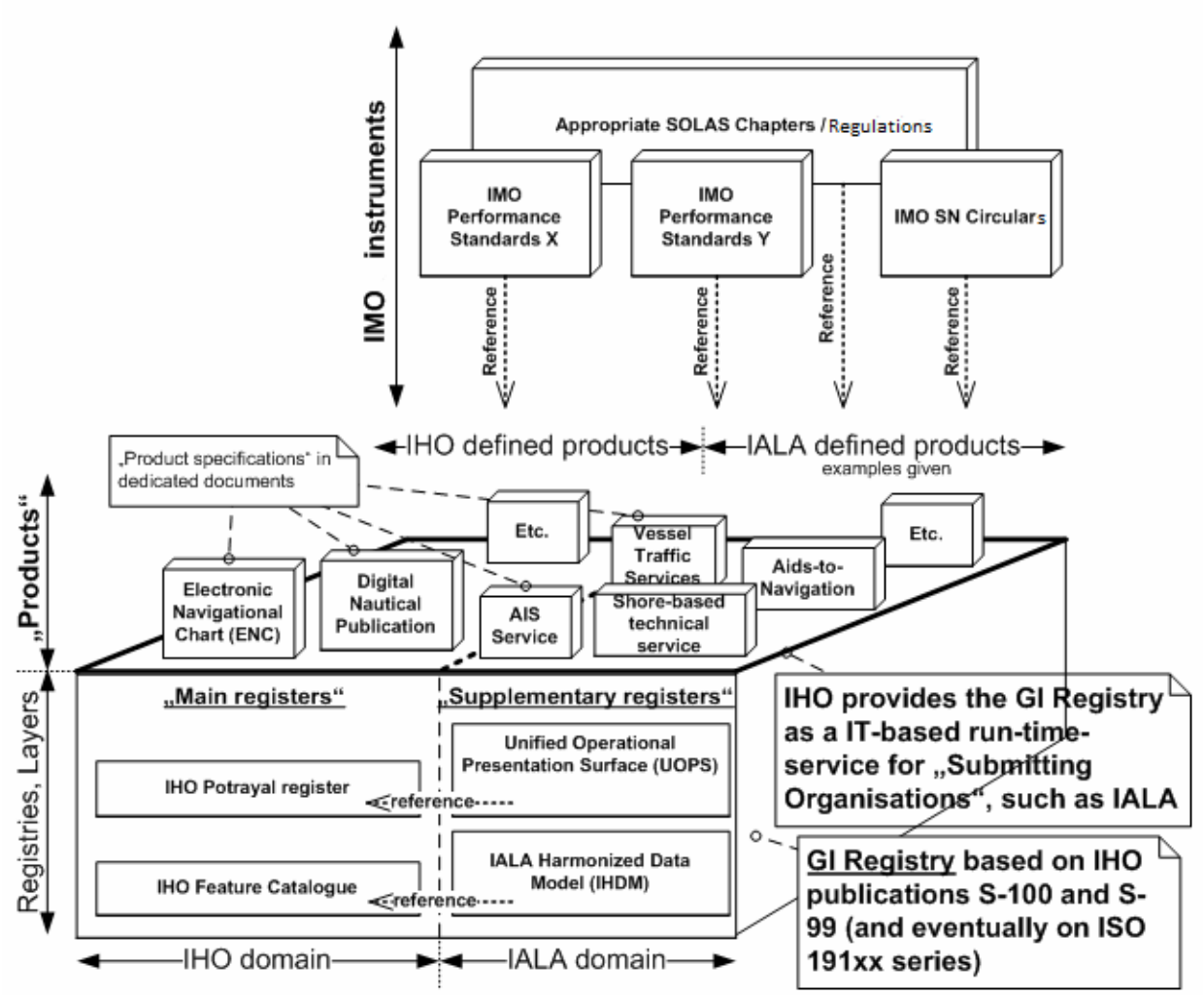

Figure 4 Representation of the IHO GI Registry.

22 The Sub-Committee is invited to take note that IHO and IALA currently are exploring the possibilities of using the Geospatial Information (GI) Registry, operated by IHO.

Maritime Service Portfolio (MSP)

23 COMSAR 15 noted that COMSAR 14 and NAV 56 had identified and adopted the user needs with regard to the e-navigation concept of the Maritime Service Portfolios (MSP), corresponding to needs for services and communication in different areas and for different operations.

A 'Maritime Service Portfolio (MSP)' defines and describes the set of operational and technical services and their level of service provided by a stakeholder in a given sea area, waterway, or port, as appropriate.

Hence, a 'Maritime Service Portfolio' may also be construed as a set of 'products' provided by a stakeholder in a given sea area, waterway, or port, as appropriate.

24 COMSAR 15 also noted that at COMSAR 14 and NAV 56, the user needs with regard to the e-navigation concept identified and adopted different Maritime Service Portfolios (MSP) corresponding to needs for services and communication in different areas and for different operations, and it was agreed that the areas could be divided into:

.1 harbour operations;
.2 operations in coastal and confined or restricted waters
.3 transocean voyages;
.4 offshore operations; and
.5 operations in Arctic, Antarctic and remote areas.

Examples of such possible services might be local warnings, ice conditions, ENC updates, real time tidal information, etc.

25 Integrated shipboard systems are a key shipboard platform that would fulfil the requirement for the 'shipboard equipment supporting e-navigation', and further development of systems such as Integrated Navigation System (INS) or Integrated Bridge System (IBS) might be examples to that end.

26 The Sub-Committee is invited to consider further development of Maritime Service Portfolios in order to achieve harmonization, modernization, integration and simplification on board as well as ashore.

Gap analysis

27 COMSAR 14 and NAV 56 had endorsed the proposed methodology for carrying out the gap analysis.

28 As the Correspondence Group on e-navigation has further developed the initial gap analysis, it has been important to take into account the human element throughout the process. For this reason, the Correspondence Group has proposed that the sequence of the four elements should be: operational, technical, regulatory and training, recognizing that these elements are inter-related and need to be considered in a coordinated manner.

29 Inputs from the Correspondence Group were summarized in a standardized way to identify specific and focused topics, in order to optimize the usability of the gap analysis. This will become even more important as the results of the gap analysis shall serve as a basis for the subsequent risk- and cost-benefit analyses. The summary was commented on by the Correspondence Group, and the result was presented in the report of the Correspondence Group to COMSAR 15. (COMSAR 15/11, Annex 1: Gap analysis, ship board; Annex 2: Gap analysis, shore based; Annex 3: Gap analysis, SAR).

30 COMSAR 15 considered the template modified by the Republic of Korea based on document NAV 56/INF.10., for identifying practical e-navigation solutions based on operational, technical, regulatory and training aspects on a developed example of gap analysis. The

example related to lack of presentation of warning broadcasts on navigation displays. This example of gap analysis and practical e-navigation solutions is shown in Annex 2 of this document, corresponding to COMSAR15/WP6/Rev.1,Annex 2.
It was agreed that the Correspondence Group on e-navigation should develop practical e-navigation solutions for other identified gaps taking into account the human element. (COMSAR 15/WP6/Rev.1. Paragraphs 15 and 16, Annex 2).
A number of other examples provided by members of the Correspondence Group are displayed in Annex 2. These may be further developed at NAV 57 if time permits.

31 It is underlined that the reason for performing the gap analysis is to identify practical e-navigation solutions, which might be seen in two different perspectives:

.1 to update existing operational, technical, regulatory and training elements in order to simplify, modernize, harmonize and integrate functions; and
.2 to identify new concepts.

32 COMSAR 15 endorsed that e-navigation could provide the necessary data/information for SAR purposes and keep SAR within the scope of the e-navigation concept.
However, one should carefully consider which data ships should receive.
The SAR Working Group at COMSAR 15 provided advice to the Working Group on e-navigation. (COMSAR 15/WP.6/Rev.1, Annex 3). This is included in Annex 2 of this document.

33 The Sub-Committee is invited to further develop the gap analysis as set out in Annex 2 of this report.

Operational gap analysis

34 The e-navigation should be flexible enough to accommodate the existing equipment as well as new equipment. Due to the required cost its implementation might become far-reaching. The use of existing equipment performance standards (INS, Radar, ECDIS, AIS, GNSS etc.), should be widely used in developing the e-navigation concept.

Use of the modular concept (SN.1/Circ.274) as well as the INS revised performance standards for concept for resolution MSC.252(83) would allow for an incorporation of further e-navigation functionality.

Consideration should also be given to engaging end users, equipment manufacturers, service providers and other stakeholders.

The challenge of familiarisation for Human Machine Interface is considerable amongst different units and standardisation in this area should be a high priority.

35 It would be advisable to consider the development of standardized, module-based bridge design adapted to the functions of the individual ship, in order to facilitate the smooth familiarization of ship borne personnel when transferring from one ship to another, noting IMO Guidelines for Bridge Equipment and Systems, their Arrangement and Integration. The guidelines should be applied to new and as far as practicable to refitted ships.

36 INS might be considered to be a dominant factor for the development of e-navigation on board, and might provide a task oriented approach which offers the possibility to integrate further functionality specified with the e-navigation process.

37 Simulation might be used to evaluate the development and usability of e-navigation applications. At STW 42 the issue was raised whether it would be essential to develop a simulator that gives the possibility to test the output of an IBS main area of a standard bridge, including the interface between INS and engine automation, and commence the testing of regular user friendly and easy communication of data in a common format through the use of simulators. A procedure has to be developed for testing how to evaluate the various concepts and applications.

Simulator tests could be one important tool in the design process

Technical gap analysis

38 The process so far has compared the capabilities and properties of existing systems with the architectural requirements needed to meet the identified user needs. The result should enable technical solutions to be found, and to identify any technology or system development that might be needed, based solely on the user needs.

A program of development work needs to be done to provide technology solutions to user requirements in their entirety, taking into account that existing systems may lack the needed interoperability and could require modifications.

39 COMSAR 15 also noted and endorsed that SOLAS regulation IV/15.8 relating to transmitting and receiving general radio communications to and from shore based radio systems or networks subject to SOLAS regulation IV/15.8 was of direct relevance to the e-navigation concept. (COMSAR 15/WP.6/Rev.1, Paragraphs 14 and 30.6)

40 COMSAR 15 further noted and endorsed that there was a need for resilience in the overall system. Navigation and communications equipment should be able to reliably indicate that they were functioning correctly. If redundancy was used to provide resilience, the system should be able to transfer automatically to an alternative source, with appropriate indication being given to the user. In addition, information concerning the authenticity of the data was needed including its source (COMSAR 15/WP.6/Rev.1, Paragraphs 27 and 30.10).

41 Accurate and reliable position data has always been recognised as an essential element of e-navigation. It is required for almost all the main applications: for example navigation, reporting, collision avoidance.

It is recognised that Global Navigation Satellite Systems (GNSS) will be the primary position input for e-navigation. These systems are extremely reliable and provide levels of service meeting all but the most stringent applications in maritime navigation. GNSS available at present do not have inherent integrity monitoring, but this can be provided by augmentation systems such as differential GNSS.

GNSS will become more resilient as multiple satellite constellations are deployed, each with its independent monitoring and control. Augmentation systems (Space-Based or Ground-Based Differential GNSS) or Receiver Autonomous Integrity Monitoring (RAIM) can enhance integrity, ensuring that Position, Navigation and Timing (PNT) information is correct, or immediately warning the user when it is not.

42 At COMSAR 15 it was considered that the review of the GMDSS would most likely go ahead. Depending on approval by the Committee next year, radio communication requirements for e-navigation would be best brought to the attention of the COMSAR Sub-Committee and be taken into account during the review of the GMDSS. It was adhered to two parallel processes, the e-navigation process could give in the future inputs to the scoping exercise process and to a possible GMDSS review process.

43 MSC 88 (MSC 88/26, paragraph 11.15) requested the Secretariat to convey the outcome of the Joint IMO/ITU Expert Group on Maritime Radio-communication matters to the Chairman of the e-navigation correspondence group re-established by NAV 56. The outcome is reflected in document COMSAR 15/4, paragraphs 64 and 65:

> "**New abilities to communicate safety and security information for ships and ports**
>
> 64 Taking into account the draft CPM report and documents IMO/ITU EG 6/4/2 (United Kingdom), IMO/ITU EG 6/3/1 and IMO/ITU EG 6/3/1/Add.2 (Secretariat) the Group decided to follow the text in the draft CPM report in supporting an exclusive primary allocation to the maritime mobile service in the band 495-505 kHz in all three regions and a co-primary allocation in the band 510-525 kHz in Region 2.
>
> 65 The Group had a long debate on the need for making a statement that the existing maritime mobile primary allocation in the band 415 kHz – 526.5 kHz should be maintained. This was to fulfill the possible requirement in future for the promulgation of additional security-related information, the implementation of e-navigation and the implementation of the revised elements and procedures of the GMDSS."
> The Correspondence Group has taken this information into account.

Regulatory gap analysis

44 The analysis identifies gaps in the present regulations and equipment performance standards that need to be addressed, and will be used to consider amendments to existing regulations or equipment performance standards, particularly in the present frameworks that need to be filled, e.g., in the provision of services in international waters.

45 A modular concept might allow more flexibility for future changes of regulations or performance standards.

46 The Correspondence Group had noted that at FAL 36 e-navigation was discussed. In the Report of the Facilitation Committee on its thirty-sixth session it was however stated that: "The Committee, while noting the discussion of the Group regarding e-navigation nevertheless decided not to establish a separate correspondence group on e-navigation, as it was

considered unnecessary and would clearly duplicate the extensive work already being carried out by other IMO committees and sub-committees in this respect." (FAL 36/17, Paragraph 5.39). Eventual relations between the FAL Committee and the e-navigation development may be re-addressed at a later stage, possibly as a consequence of the outcome of the gap analysis.

Training gap analysis

47 The analysis tries to identify what measures should be taken to ensure that individuals, who are entrusted with its operation, receive an appropriate level of instruction and have the required levels of competences to use any technology or systems introduced as a component of e-navigation.
To that end the Correspondence Group had identified a number of training-related questions that were presented at STW 42 (January 2011) towards the development of an e-navigation strategy implementation plan.

48 STW 42 recalled that adequate knowledge of the English language was essential to enable the officers to perform their duties. According to international surveys on user needs on e-navigation, language skills still is a major challenge, and STW 42 recognized that it might be necessary at a later stage for amending the IMO Standard Marine Communication Phrases (SMCP), as appropriate.

The scope of the SMCP should be considered reviewed not only to cover the English language provisions set out in the revised tables A-II/1 and A-III/1 of the STCW Code but, it needs also to encompass the common information displayed on navigational equipment, including safety messages, in order to ensure that seafarer properly understand messages relating to ship's safety and operations, and also is able to perform the officer's duties with a multilingual crew. Furthermore, e-navigation may require new phrases and protocols to be established within the SMCP, taking into account that SOLAS Reg V/14.4 already captures the essence of these comments.

Consideration should be given to providing automated translation during e-navigation communications.

National administrations should be encouraged to ensure that the use of SMCP and the translation into the local language/s are implemented.

49 The Sub-Committee is invited to take note of the ongoing operational, technical, regulatory and training gap analysis, as set out in paragraphs 34 to 48.

Two scenarios

50 Having assessed the user needs, functions and system architecture of e-navigation, – and expecting the future development, one might predict a variety of scenarios for the personnel on board and for skills, competencies, qualifications and training needs. To illustrate the wide spectrum of possible e-navigation related developments, the two following scenarios might be of special relevance:

.1 The navigating navigator
This is a scenario where the monitoring equipment is kept relatively traditional on board and ashore. The navigators' own skills will still be essential to the safe navigation of the ship, and the bridge team will be the main backup to the safe functioning of the ship. This will have to be reflected in the principles of the training and certificates required, – which should combine de facto skills and competences with the formal documentation of having fulfilled authorized training programs. There is, however, also a question of whether one should emphasize assessment of the de facto skills and competences, or alternatively if assessment should include a more formal documentation of having fulfilled authorized training programs.

.2 The monitoring navigator
In this scenario the data solutions and monitoring equipment are much more sophisticated. The navigator will have to rely more heavily on automated processes, standardized and harmonized procedures and equipment. Data structures, displays and services will have to be interoperable. A main task will be to monitor the system displays and the indicators of the system's health or resilience. This scenario will include an even closer cooperation with organizations ashore to assist a safe voyage from berth to berth. A consequence of this scenario is that the required competence of the seafaring professional could be affected, and there would be implications for the development of the training, education and required competencies for seafarer certificates.

51 STW 42 underlined that the navigator’s own skills would remain essential for the safe navigation of the ship, and the bridge team would be the main backup for the safe functioning of the ship. It would not be advisable to be totally reliant on systems where the navigator only monitors the system displays and the indicators of the system’s normal functionality or resilience. Increasing use of electronic navigational equipment may, however, play a greater role in improving the safety of navigation in the future.

The topic was also discussed at COMSAR 15, and it was noted and endorsed that the navigator's traditional skills would remain essential for the safe navigation of the ship.
It was also expressed that this should not be an either/or scenario, but consideration needed to be given to the development from a purely navigating navigator toward a somewhat more monitoring navigator and that it would not compromise the skills of the navigator.
It was also important to keep the role of the navigator in mind, and what introduction of new concepts would actually mean for them.

In this context it might be relevant to make reference to the objectives of e-navigation as detailed in NAV 54/WP6, Annex 1, underlining the necessity to reduce the total work load on the navigator.

52 The Sub-Committee is invited to provide comments on these two scenarios.

53 The Correspondence Group also considered the scenarios to raise important issues, which should be addressed as part of the development of the final Strategy Implementation Plan on e-navigation. It should be taken into account that ships are navigating in areas where a variety of ships in respect of the size, use of technology, age with seafarers of different nationality/culture are present; and which may not follow the same international regulation/standards and procedures.

Accordingly, the Correspondence Group

.1 recognizes the need to maintain essential traditional skills and recognises that mariners also need to demonstrate competence in the effective monitoring of electronic systems.

.2 notes that the training required to meet both traditional and monitoring roles might need to be assessed in terms of the duration of training and assessment methods. The e-navigation implementation plan should indicate that any vessels that adopt aspects of e-navigation should identify and address training needs as part of their safety management system.

.3 recognizes that providing training for e-navigation applications before a watch-keeper uses such systems, is essential and that providing such training before joining the vessel (such as on line tutorials) may reduce the burden for training on board.

.4 recognizes that the need for refresher training to ensure effective use of systems may be essential.

.5 considers that the use of simulation for the assessment of competencies of ship and shore users might be essential. Further consideration should be given to effectively deal with type-specific issues.

.6 recognising that both traditional and monitoring skills need to be maintained, ship operators are encouraged to adopt drills and exercises for essential navigational skills as part of their SMS.

Reliability, availability, maintainability and security of systems impacting safety have to be improved along with user-friendliness. The situation of VTS operators ashore should also be considered, and a similar distinction might be useful for the analysis of their work.

54 Training will be a very important part of e-navigation; and like design, it should be a continuous process with frequent feed-back from experience.

55 It may be important to consider the necessity of the development of appropriate familiarization material for the actual bridge systems installed with future e-navigation applications to familiarize the mariner with the actual bridge configuration.

56 At STW 42, the issue of standardization of bridge design was discussed, and the following views were expressed:

.1 although the standardization of bridge design was a positive and desirable step, it was not clear how this could be achieved;
.2 the standardization of bridge design was within the remit of the NAV and COMSAR Sub-Committees and should be addressed by them;
.3 the development of S-mode and standard operating procedures for equipment would probably be the way forward; and
.4 training should focus on detecting operational anomalies.

After some discussions, STW 42 agreed that development of S-mode and standard operating procedures for equipment would be a welcome development in this context, whilst standardization of bridge design layout would be difficult to accomplish.

There have been inputs to the Correspondence Group concerning the use of the notion of “S-mode”, or the alternative use of “default mode”.

Further procedure for risk and cost-benefit analyses

57 NAV 56 endorsed the initial risk and cost-benefit analyses describing the methodology according to IMO’s FSA procedures. When the gap analysis is completed, the analysis will serve as a basis for risk and cost-benefit analyses.

58 Transmission and reception of e-navigation data to and from ships may have an influence as well on shore based data and services as on ship based data, services and functions. As this may have both strong technical and economical influence, it should be considered in the cost-benefit analysis.

Outline of a draft Strategy Implementation Plan on e-navigation

59 A mandate for a final Strategy Implementation Plan on e-navigation was given by MSC 86. (MSC 86/23/4).
A draft outline of the plan is given by the Correspondence Group in Annex 3.

60 The Sub-Committee is invited to provide preliminary comments on the outline of the draft Strategy Implementation Plan.

Actions requested of the Sub-Committee

61 The Sub-Committee is invited to consider the following issues and decide as appropriate:

.1 Endorse the complete overarching e-navigation architecture. (Paragraph 9);

.2 Endorse how the Common Maritime Data Structure (CMDS) could be developed. (Paragraph 13);

.3 Endorse that IHO' S-100 data model should be used as a baseline for creating a framework for data access and services under the scope of SOLAS. (Paragraph 18);

.4 Endorse that IMO in consultation with other organizations, should consider the establishment of a Harmonization Group on creating a framework for data access and information services under the scope of SOLAS, based on the example of the IMO/IHO Harmonization Group on ECDIS including the draft Terms of Reference for the IMO/IHO Harmonization Group on Data Modelling (HGDM) (Paragraph 19 and Annex 1);

.5 Take note that IHO and IALA were currently exploring the possibilities of using the Geospatial Information (GI) Registry, operated by IHO. (Paragraph 22)

.6 Consider further development of Maritime Service Portfolios in order to achieve harmonization, modernization, integration and simplification on board as well as ashore. (Paragraph 26);

.7 Take note of the ongoing operational, technical, regulatory and training gap analysis, as set out in paragraphs 34 to 48;

.8 Further develop the gap analysis. (Paragraph 33 and Annex 2);

.9 Provide comments on the two scenarios of the navigating navigator and the monitoring navigator. (Paragraph 50 to 52);

.10 Provide preliminary comments on the outline of the draft final Strategy Implementation Plan. (Paragraph 59 and 60 and Annex 3); and

approve the report in general.

ANNEX 1

DRAFT TERMS OF REFERENCE FOR THE IMO/IHO HARMONIZATION GROUP ON DATA MODELLING (HGDM)

In creating an e-navigation architecture, it is important to identify information and data flows, and the interaction between applications and user interfaces. Consequently, there needs to be a data structure to optimize the use, interoperability, flow and accessibility of relevant information and data within the maritime domain (including both ship and shore aspects). It is therefore important to harmonize efforts in data modelling, with the aim of creating and maintaining a robust and extendable maritime data structure. This maritime information and data structure will require some form of overarching coordination to ensure the ongoing management and maintenance of the structure.

There may be several management roles to be performed by such a coordinating body, (for example, the maintenance of registries and the development and adoption of product specifications). This management role may be shared between relevant organizations. [The structure is a highly important element by which e-navigation can modernize the operational environment of the maritime industry and also fulfill the requirement of document MSC 85/26, annex 20.]

[The IMO Sub-Committee on Safety of Navigation agreed to establish a small group to work mainly by correspondence and in conjunction with IHO to further develop a common data structure in conjunction with ongoing efforts in data modelling. This would include harmonization and standardization of:

.1 formats for the collection, exchange and distribution of data;
.2 processes and procedures for the collection; and
.3 development of open standard interfaces.]

The HGDM should be constituted of representatives of IMO and IHO Member States and Secretariats, and organizations with an official IMO/IHO observer status.
The HGDM should be chaired by an IMO Member State and supported by the secretariat of the IMO.
The HGDM reports to the IMO Sub-Committee on Safety of Navigation (NAV), and to the IHO through the IHB Directing Committee, as appropriate.

The HGDM should:

.1 as requested by the IMO or the IHO, consider matters related to the framework for data access and information services under the scope of SOLAS, using as a baseline IHO's S-100 data model, and prepare appropriate documentation; and

.2 review the results of studies by the IMO, the IHO and other related organizations which address aspects of access to information services under the scope of SOLAS, and advise the IMO and the IHO as to whether they are compatible with the e-navigation concept taking into account the identified user needs as they exist at the time.

ANNEX 2.

Gap analysis focusing on practical e-navigation solutions.

1 Annex 2 presents the gap analysis focusing on practical e-navigation solutions. The template used for this presentation is a further development of the template endorsed by NAV 56 (NAV 56/INF 10 (Republic of Korea).

2 Each identified gap is related to the corresponding “Key element” and “Core objective”.

.1 Key strategic elements for e-navigation based on user needs (MSC 85/26/Add.1, Annex 20, Sec. 9):

.1 Architecture

.2 Human element

.3 Convention and Standards

.4 Position fixing

.5 Communication technology and information systems

.6 ENCs

.7 Equipment and standardization

.8 Scalability

.2 Core Objectives of e-navigation(MSC 85/26/Add.1, Annex 20 Sec.5)

.1 safe and secure navigation of vessels

.2 vessel traffic observation and management from shore/coastal

.3 communication(voice/data) among 4S (ship/ship, ship/shore, shore/ship, shore/shore)

.4 improving the efficiency of transport and logistics

.5 effective operation of contingency response and SAR services

.6 demonstrate defined levels of accuracy, integrity and continuity

.7 integrate and present information to maximize safety benefits and minimize any risks

.8 integrate and present information to manage the workload and support decision-making

.9 incorproate training and familiarization requirements

.10 global coverage, consistent standards and compatibility, interoperability of equipment systems

.11 support scalability.

3 Each identified gap is also related to corresponding functions, as listed in NAV 56/WP.5/Rev.1, paragraph 11 to 30.

A1 Ensure seaworthiness

A1.1 Check that Navigation Equipment and Systems Conforms with Requirements for Passage through Intended Sea Areas

A1.2 Check Validity of Ship Certificates

A1.3 Check Availability and Quality of Voyage Plan

A1.4 Check that Cargo is Safely Loaded, Stowed and Secured

A1.5 Check that Navigation Equipment is Operational

A1.6 Check that Steering Gear is Checked and Tested

A1.7 Check that Engine is Operational

A1.8 Check the availability of fire control plans and training manuals.

A1.9 Check that crew is properly instructed about assigned emergency duties

A1.10 Check that Nautical Charts and Nautical Publications are up to Date

A1.11 Take Actions Based on Seaworthiness Assessment

A2 Use Shore Based Information Services

A2.1 Use Nautical Charts Provision Service

A2.2 Use Nautical Publication Service

A2.3 Use Maritime Safety Information (MSI) Service

A2.4 Use Routeing Information Service

A2.5 Use Port Authority Instruction

A2.6 Use Meteorological Information Service and Warnings

A2.7 Use Hydrographic Information Service

A2.8 Use Ice Information Service

A3 Elaborate and Update Voyage Plan

A4 Elaborate Passage Plan in Cooperation with Pilot

A5 Coordinate Pilot, Tugs and Shore Services

A6 Establish and Maintain Situation Awareness

A6.1 Assess Navigation Conditions

A6.2 Detect Objects Critical to Navigation

A6.3 Assess Information Provided by Nautical Chart

A6.4 Assess Voyage Plan

A6.5 Assess Ship's Course and Speed

A6.6 Assess Traffic Situation

A6.7 Define Ship Position

A6.8 Determine Under Keel Clearance

A7 Assess Navigation Risk

A7.1 Assess Watchfulness of Navigator

A7.2 Assess Navigation Safety Issues in Voyage Plan.

A7.3 Assess Collision Risk.

A7.4 Assess Grounding Risk

A7.5 Manage Alarms

A8 Observe and Analyse Available Information

A9 Decide on Actions

A9.1 Take Manoeuvring Decisions

A9.2 Use of Support and Control Function Decisions

A9.3 Decide on Voyage Plan Update

A9.4 Decide on Passage Plan Updates in Cooperation with Pilot

A10 Conduct Ship Manoeuvring

A11 Manage Information from On-board Systems and Sensors

A11.1 Collect Ship Position Data

A11.2 Collect Safety and Security Related Sensor Data

A11.3 Collect Cargo Stowage Status Information

A11.4 Collect Engine Status Information

A11.5 Provide Information to Relevant Functions

A12 Manage Crew Information

A13 Manage Cargo Information

A13.1 Manage Dangerous Goods Information

A13.2 Manage Waste Information

A14 Manage Ship Construction Information

A15 Manage Library of Certificates

A16 Manage Ship Reporting

A16.1 Manage Mandatory Reporting

A16.2 Manage Voluntary Reporting

A16.3 Manage Information Exchange on Safe Loading and Unloading

A17 Make Information from Shore Based Information Services Available to Relevant Functions

A18 Handle Emergency on Other Ship

- A18.1 Exchange Information with MRCC and Receive Instructions from Same
- A18.2 Act as On-Scene-Coordinator after Appointment from MRCC or by own Decision
- A18.3 Follow Instructions from On-Scene-Coordinator
- A18.4 Conduct Search and Rescue (SAR)

A19 Support Incident Handling and Emergency Management on Own Ship

- A19.1 Assess Situation and Decide Actions
- A19.2 Report Situation to MRCC of Respective Search and Rescue Region.
- A19.3 Support Accident Avoidance
- A19.4 Support Automated Actions
- A19.5 Handle Emergency

A20 Support Investigation

- A20.1 Record Voyage Data (e.g. by means of VDR)

A21 Establish Ship Security Plan

A22 Establish Security Level

A23 Detect Security Threat

A24 Submit Security Alert

A25 Prepare Pilotage

- A25.1 Acquire Request for Pilotage
- A25.2 Acquire Information about Ship
- A25.3 Draft Passage Plan

A26 Conduct Pilotage

- A26.1 Agree with Master on Content of Pilot Card
- A26.2 Acquire Real-time Information on Conditions for the Passage
- A26.3 Exchange Relevant Information with Master
- A26.4 Acquire Situational Information from Master
- A26.5 Agree with Master on Passage Plan
- A26.6 Support Safe Navigation
- A26.7 Refuse Pilotage due to Danger to the Safety of Navigation or the Environment
- A26.8 Report Incidents or Accidents to Authorities

A27 Establish VTM Policy Areas

A28 Establish Ships' Routeing Regulations

A29 Establish Rules for Mandatory Pilotage

A30 Identify Flag State Ships

A31 Identify Ships Bound for Port State

A32 Identify Ships in Coastal Responsibility Area

A33 Monitor Traffic Situation

- A33.1 Acquire Information about Conditions
- A33.2 Manage Information about Conditions
- A33.3 Assess Environmental Conditions
- A33.4 Monitor Traffic
- A33.5 Assess Traffic Situation

A34 Provide Information Services (INS)

- A34.1 Provide Navigation Warnings
- A34.2 Provide Navigation Information
- A34.3 Provide Traffic Information
- A34.4 Provide Route Information
- A34.5 Provide Hydrographical Information
- A34.6 Provide Aids To Navigation Information
- A34.7 Provide Meteorological Information
- A34.8 Provide Meteorological Warnings

A35 Provide Traffic Organization Services (TOS)

- A35.1 Plan Traffic Organization Criteria
- A35.2 Plan Traffic Flow
- A35.3 Decide on Priority

A36 Provide Navigation Assistance Services (NAS)

- A36.1 Provide Navigation Advice Services
- A36.2 Provide Navigation Instructions

A37 Manage Incident

- A37.1 Detect and Verify Incident
- A37.2 Assess Incident
- A37.3 Handle Incident

A38 Manage Information Transfer to Authorities

A39 Manage Emergency Response

- A39.1 Manage Search and Rescue Management (SAR)
- A39.2 Manage Pollution Response Management
- A39.3 Manage Hazardous Goods Emergency

4 According to the notion of “Maritime Service Portfolios”, there may be different needs for communication and services in different areas and for different operations. Accordingly each identified gap has been related to one or more of the operational areas:

.1 harbour operations,

.2 operations in coastal and narrow water,

.3 transocean voyages,

.4 offshore operations,

.5 operations in arctic and remote areas.

5 The following list presents all registered user needs and all identified gaps so far. Many of the gap topics still remain to be analysed for the specification of their practical e-navigation solutions. For that reason there are a great number of open spaces still to be filled in. The distribution of the examples of accomplished gap topics is done according to the corresponding user need.

GAP ANALYSIS FOCUSING ON PRACTICAL E-NAVIGATION SOLUTIONS													
USER FIELD													
	Category of User need												
		Sub-category of user need											
			◦ User needs										
				Aspects of Gap	**Identified Gap** (selected from COMSAR 15/11 Annex 1/2/3 as an Example)	**Relationship to the strategy**		**Related Functions** (selected from the functions listed in NAV 56/WP.5/Rev.1, Annex 1, p. 11-30)	**Existing equipment, systems, technologies**	**Operation Area**	**Proposed practical e-navigation solutions to addre**		
						key element	core objective				**Operational** ◦ procedural / automation ◦ [human element]	**Technical** (eg. H/W , S/W, equipment, links, data structure)	**Regulatory** ◦ regulation ◦ standard
SHIPBOARD USER	Information/Data management	Common Data Structure/Harmonized Data Formats	◦ User-Selectable Presentation of Information Received via Communication Equipment ◦ Maritime Safety Information(MSI) ◦ Standardized and Automated Reporting ◦ Reduction of Administrative Burden and Increase use of Electronic Documentation ◦ Automated Updating of Base Line Data and Documents ◦ Alert Management										
				Technical	Lack of harmonized data formats for the transfer of information received via communication equipment (e.g., Maritime Safety Information, MSI) to the navigational systems for presentation.								
					There are no standardized data formats established for ship reporting.								
					Lack of harmonized data formats for support of data entry for documentation by means of information requested from other systems.								

					Lack of standard formats for data exchange with regard to updating of data and documents, chart and voyage planning publications.								
				Regulatory	Lack of international standards for navigation data formats.								
					Lack of international standards for navigation data formats and water level and current information as well as a standard for dates.								
					Lack of interface standards for status of equipment.								
				Operational	No identified Gap								
				Training	No identified Gap								
SHIPBOARD USER	Information/Data management	Improved Reliability and Indication of Reliability	◦ Indication of Reliability ◦ Improved Reliability										
				Technical	Lack of effective and harmonized means for assessment of the accuracy and plausibility of indicated information.								
					Control of software and hardware updates is not sufficient.								
					Interoperability of systems and sensors is not realized.								
					Lack of effective ways to indicate levels of reliability.								

					Lack of self-checking functionality of the electronic equipment.								
					Insufficient reliability of position fixing systems.								
					Absence of structured communication link to notify anomalies and malfunctions of shipboard navigational systems such as ECDIS.								
				Regulatory	Lack of standardized regulations for determination (standardized algorithms) of integrity, quality, reliability assessment, and reliability thresholds.								
					Lack of performance standards for interoperability of systems and sensors (according to the modular concept).								
				Operational	Lack of assessments to quantify reliability parameters (e.g., specific assessment of electronic position fixing systems).								
				Training	*No identified Gap. But there are some comments. (COMSAR 15/11 Annex 1, page 6) Improved competence of installation and repair technicians could provide better reliability of systems and equipment.*								
					When new means are introduced under the framework of e-navigation adequate training is necessary.								
					Training for standardized status information is necessary.								
SHIPB	Informa	Nautica	◦ Automated Updating of Base Line Data and Documents ◦ Effective and Robust Communications										

				Technical	ENC coverage is inadequate.									
					Lack of timely delivery of ENCs and updates via internet.									
					Lack of digitized nautical publications (Pilots, tide tables, light list, etc.).									
					Lack of real-time tidal data, AIS data and ENC updates.									
					Signal security, system security, input security as well as management of access/protocols are insufficient.									
					Lack of navigation charts and publications in digital format.									
				Regulatory	Lack of standardized symbology.									
					Lack of definition of parameters for ENC liability.									
					Regulation of upgrading of navigation equipment operating systems is missing.									
					Lack of free available electronic charts. Unnecessary complexity introduced by encryption of electronic charts.									
				Operational	Current design of electronic charts and publications does not provide enough "decisional" support as opposed to "informational" support.									
				Training	*No identified Gap. But there are some comments. (COMSAR 15/11 Annex 1, page 10)*									

SHIPBOARD USER	EFFECTIVE AND ROBUST VOICE COMMUNICATION AND DATA TRANSFER	Effective and Robust Voice Communication and Data Transfer	◦ Effective and Robust Communications									
				Technical	Insufficient reliability of data communications				◦ Inmarsat, ◦ Other satellite systems		◦ Data communications to be standardized. ◦ Information to be presented to the mariner in a “standard mode”, independent of communication service (i.e. satellite, terrestrial etc).	Near coastal water data communic-ation may be performed by means of VHF-data (to be developed and standard-ized). In areas beyond the coverage of existing satellite systems, HF-data should be developed covering the most necessary functions	Requirements to be develope and ◦ if necessary priority access
					Possible lack of bandwidth and unclear assignment of adequate bandwidth for identified e-navigation communication needs.				◦ Inmarsat ◦ VHF ◦ MF ◦ HF			◦ Changing of bandwith of VHF channels from 25 kHz to 12,5 kHz may make available channels for e-navigation in the VHF-system.. ◦ Satellite communi-cation to be adjusted. Consider revision of the HF bands.	◦ ITU, ◦ Liaison statement from IMO to ITU
					Lack of reliability standards for communication technology.								
					Lack of systems for source and channel management for communication equipment.				◦ Inmarsat ◦ VHF ◦ MF ◦ HF		Automatic selection of source and channels.		◦ ITU, ◦ IMO

					Lack of technical solutions for processing, filtering of information exchanged via communication equipment.				◦ Inmarsat ◦ VHF, ◦ MF, ◦ HF ◦ Other communications carriers		Received information to be decoded and adjusted for presentation in “clear text” to the mariner.	S-100: Filtering performed through effective software and the possibility of presentation (monitors)	Develop filteri procedures (regulations).
					Lack of integrated GMDSS equipment.								
					Insufficient provision of short range but wider bandwidth communication means such as WiMAX. Lack of seamless and communication mean dependent protocol for exchanging navigation information between ships				None				
					Limited resources for communication infrastructure.								
					Absence of structured communication link to notify anomalies and malfunctions of shipboard navigational systems such as ECDIS.								
				Regulatory	Lack of regulations for communication equipment and systems addressing the identified e-navigation communication needs.				SOLAS Chapter IV (GMDSS) and Chapter V (Navigation)				SOLAS to be amended into an e-navigatio chapter.
					IMO resolutions for navigation and communication are not harmonized.				◦ SOLAS CH IV & V. ◦ NAV 56/WP.5/Rev.1, Annex 5		Standards for communications and navigation to be presented to the mariner as a whole.	◦ Harmonization of instrument requirements ◦ Harmonisation of functional requirements	New performance standards to b developed or existing standards to b amended.

				Operational	Insufficient use of IMO Standard Marine Communication Phrases (SMCP).				◦ Res. A.918(22) : IMO Standard Marine Communication Phrases ◦ Res.A.954(23) :Proper use of VHF Channels at Sea. ◦ MSC/Circ.794 : Draft IMO standard Marine Communication Phrases (SMCPs)		Available to the mariner	SMCP to be developed and adjusted to the e-navigation concept	Require SMCP to be available to the navigato at watch at all times.
					Currently, collecting information pertaining to a distress situation consumes valuable time.				◦ Inmarsat, ◦ VHF, ◦ MF, ◦ HF, ◦ cellular – depends on distance		Simplification of distress and safety instruments and procedures.	Integrate a simplified GMDSS into the e-navigation concept	◦ GMDSS amendments, ◦ Make it easi to establish voice communicatio
				Training	Insufficient training strategies for the use of IMO Standard Marine Communication Phrases (SMCP).				◦ Res. A.918(22) : IMO Standard Marine Communication Phrases ◦ Res.A.954(23) :Proper use of VHF Channels at Sea. ◦ MSC/Circ.794 : Draft IMO standard Marine Communication Phrases (SMCPs)		To be used regularly	SMCP to be revised and simple to read and understand	Requirements for using SMC to be included in regulations. Program for training on board to be developed

					Gaps may appear as new tools and techniques become available for sourcing information.								
					No identified gap but some comment : Those working with information management systems need to be competent and need to stay current.								
SHIPBOARD USER	NAVIGATIONAL BRIDGE SYSTEMS AND EQUIPMENT	Improved Ergonomics, Standardization and Alert Management	◦ Improved Ergonomics ◦ Standard Interface ◦ Alert Management										
				Technical	Equipment and systems are often not self-descriptive, appropriately designed for the task at hand, controllable, compliant with the users' expectations, as well as fault tolerant.								
					Gap is that seafarers are not provided with equipment that they think is easy to use: ergonomic problems of navigation equipments exist in a sense that operations of some products are confusing, which sometimes hinders smooth operations.								
				Regulatory	Lack of unified symbology.								
					Existing documents (performance standards, guidelines, etc.) with regard to ergonomics are missing harmonization and are seldom applied.								
					Existing documents (performance standards, guidelines, etc.) with regard to ergonomics are not applied for communication equipment and systems (incl. GMDSS).								

					Existing documents (performance standards, guidelines, etc.) for alert management are not applied.								
					Currently, there are no guidelines or guidance for usability evaluation.								
					Lack of standardization for operation of functions to observe the passage plan.								
				Operational	Lack of good human machine interface for the communication means.								
					Seafarers sometimes experience difficulties in accessing necessary information because of ergonomic problems.								
					Lack in presentation of manoeuvring information/data(engine-room telegraphs) on navigational display.								
				Training	Bridge layouts, equipment and systems are seldom designed from an ergonomic and user friendly perspective.								
					Difficulties exist for personnel to transfer from ship to ship.								
SHIPBO AR	NAVIGA TIONAL	Present ation of	◦ User-Selectable Presentation of Information Received via Communication Equipment ◦ Maritime Safety Information(MSI)										

				Technical	Upon receiving real-time Maritime Safety Information (MSI) and other navigational warning/broadcasts relevant for the vessel's navigation, there is no appropriate and suitable interfacing technique that could allow these data/information to be available (visible) in real-time to the mariner.								
					Insufficient network of storage, sharing and distribution of MSI.								
					Insufficient means for sorting and display of Maritime Safety Information (MSI) such as NAVTEX, SafetyNET.								
					Lack of technical solutions for processing, routeing, and filtering of information received via communication equipment to enable transfer of the information to navigational systems.								
					Lack of technical solutions for presenting communication information/Maritime Safety Information (MSI) on navigational displays.								
					Lack of user-selectable and task oriented presentation of information received via communication equipment (including MSI) on navigational systems.								
					Lack of interface messages between sender and receiver for monitoring of local/coastal warning broadcasts/watching GMDSS system (NAVTEX, NAVAREA message).								
					Lack of integrated secondary screen option for digital publications and MSI.								

				Regulatory	IMO resolutions for navigation and communication are not harmonized.								
				Operational	Unless having prior subscription, the current system does not allow for Maritime Safety Information (MSI) and other navigational warnings/broadcast, etc., to be received in real-time mode and be integrated with the navigation display.								
					Unavailability of information in real-time with possible presentation on the navigational display to support bridge operation.								
					Insufficient techniques and procedures for exchange of data between ship shore and on board.								
					Lack of presentation of calling message of pilot on navigational display.								
					Lack of presentation of warning broadcasts on navigation displays.	1,2,5,8	1,3,5,6,7,8,10	TBD	NAVTEX SafetyNET VHF	1,2,3,4,5	◦ For appropriate MSI to be presented on a navigational display using standard symbology and text support ◦ Navigation system need to identify appropriate MSI during route planning and voyage planning ◦ [Human element consideration should be given to	◦ Database and presentation library to display the MSI ◦ Message based on S-100 and portrayal ◦ Standard interface btw suitable carriers such as NAVTEX, AIS and Display ◦ It should be a display with standards	◦ Standards fo presentation and symbolog ◦ SOLAS Ch.V/18 & Ch.IV ◦ IMO Res.A.705(17 ◦ IMO Res.A.706(17 ◦ Joint IMO/IHO/WMO Manual on MS ◦ S-100

												the effective use of symbology and prevention of information overload]	◦ Enables consistency of alerts to users	
					Lack of information about special berthing requirements on navigation systems.									
					Lack of real-time environmental information (current, tide, weather) received automatically.									
				Training	When new means are introduced under the framework of e-navigation adequate training is necessary.									
SHIPBOARD USER	NAVIGATIONAL BRIDGE SYSTEMS AND EQUIPMENT	Documents in Electronic Form and Automated Updates of Information	◦ Reduction of Administrative Burden and Icrease of Electonic Documentation ◦ Automated Updating of Base Line Data and Documents ◦ Effective and Robust Communications											
				Technical	*No identified gap but some comment : Information should be provided in proper electronic format for data rather than the documents being digital copies of existing paper publications*									
					New equipment/system or task based on INS-task concept MSC.252(83) for management of information formerly available in printed format is necessary.									

					Information may be difficult to localize in electronic documents.								
					Lack of automatic updating of documents.								
					Electronic systems can not automatically determine the status of available data and automatically retrieve the most current and comprehensive data.								
				Regulatory	Legal aspects regarding access and usage rights of updating information are not solved.								
					Documentation requirements possibly not allow for documentation in electronic form.								
					To many regulations are adding to the administrative burden of the mariner on board.								
				Operational	Insufficient indication of information updates.								
					Ineffective access to information.								
					Lack of automatic update of navigation charts and publications in real-time on demand on ECDIS.								
				Training	When new means are introduced under the framework of e-navigation adequate training is necessary.								
SHI	SHI	Ship	◦ Standardized and automated reporting										

				Technical	With the exception of Polling, current system does not provide provision for automatic ship reporting.				Manually generated reports except in one or two local areas - AIS. Polling only used for LRIT. LRIT provides insufficient information of ship reporting.	Coastal and Ocean	1) Automate ship reporting sourcing ship information from ship to populate VTS or MDA system without human intervention. 2) Use ubiquitous system to meet Voluntary, Mandatory and Statuary ship reporting needs. 3) Source information on Cargo, hull and passengers from origin (e.g. safeseanet)	1) Dynamic information (Position, Course and speed) provided into system by ship via suitable carriers offering validation of data. (AIS and AIS-S) 2) Static data to be provided from source and indexed to the ships dynamic data by a data exchange system fit for purpose to provide all static parts. (International data exchange?)	1) Change of A.851.(20) - 2) Architecture fo sourcing information on static information.
					Lack of automated and standardized ship reporting function.				radio telephone, telex or email.	Coastal, Remote Coastal and deep sea.	Usage of a vessel technology that includes the most types of vessels ensuring the most compete picture possible. AIS and AIS-S . AIS now has precedence for being used in for reporting.	Follow precedence of using AIS for ship reporting by Sweden.	Change of A.851.(20) to include the us of automated processes suited to ship reporting such as AIS and AI S.
					Single-window and/or automated and single entry for any required reporting information into the system for it to be shared by authorized authorities ~~without further intervention by the~~ ship during navigation, except it has any relevance for navigational purposes (VTS/PILOT/HARBOUR/COLREG).				None used	Coastal, Remote Coastal and deep sea.	Access of information to support Maritime Incidents and casualties.	International data exchange to enable shore authorities to index AIS report ~~and ship ID to~~ latest information on Cargo, Hull and Passenger. The IDE and SafeSeaNet are	Investigate the use of a globa version of the SafeSeaNet architecture a ~~the IDE solely~~ to find out where the information is held.

														examples of relevant existing systems. When located, use e-mail or EDI to retrieve information.	
					Automated entry of internal ship data for reporting (including updates of information) is not available.				Manual interface with minimal keyboard display	Usually done prior to sailing in port	Ensure that accurate information is made available to the AIS and as such to message 5 by automated means.	1) Link between Port competent authority to ship for update of M5 automatically into the ships AIS.- 2) Change of ships name and MMSI information to be possible only by a representative of a competent authority. - 3) Automate the process to install static information into ship reporting equipment such as message 5 of AIS. 4) Owner / operators be provided with AIS-S so that they can inform the ship when static data is not correct (ISM?)	Evolve 851 (2 2) recommend procedures fo populating the AIS or other automated device with correct information.
					Communication with pilot could be improved.					Port and VTS			
					Insufficient means for ship reporting.				Manually generated reports except in one or two	Coastal, Remote Coastal and deep	Remove need for human interface and communication of manually	Stimulate ship reporting through automated means by	Evolve 851 (2 as it presently barrier automated

										local areas - AIS.	sea.	operated systems and provide automated systems based on shipboard AIS that will seamlessly populate VTS and MDA systems, anywhere in the world.	providing the tools needed.	means by recommended the use of manually generated shi information, even when the ship is not always the be source, and manually integration an assessment b Authorities.
				Regulatory	Single-window and/or automated and single entry for any required reporting information into the system for it to be shared by authorized authorities without further intervention by the ship during navigation, except it has any relevance for navigational purposes (VTS/PILOT/HARBOUR/COLREG).					Minimal keyboard display	Port Vicinity	Ensure that accurate information is input to the AIS and as such to message 5 by automated means.	- 1) Link between Port competent authority to ship for update of M5 automatically into the ships AIS. Change of ID information to be possible only by a representative of a competent authority. - 2) Automate the process to install static information into ship reporting equipment such as message 5 of AIS. - 3) Owner / operators be provided with AIS-S so that they can inform the ship when not correct (ISM code?)	1) Evolve 851 (20). - 2) provide a standardized procedures ar state sets for collating, communicatio and installing the informatio

					Legal aspects regarding access and sharing of reporting information are not solved.				Up to individual countries	Coastal, Remote Coastal and deep sea.	Legal aspects for the use of data from ships (e.g. AIS and AIS-S) to be used ashore should not interfere with the use of the ships data to support safety of navigation, pollution prevention and SAR in remote areas of the world in the spirit of A.851(20).	AIS fitted to aircraft, Hale, or satellite should be treated the same as terrestrial AIS. The carrier of information should be accepted whether it is of commercial or non commercial origin. Just as in the case of GMDSS.	To ensure tha commercial services providing information critical for ship reporting, guidelines ma be required.
					No identified Gap but have some comments. (COMSAR 15/11 Annex 1, page 26)								
					National reporting requirements are not harmonized.				Manually generated reports - Telex or Mail. Morse is no longer recommended.	Coastal, Remote Coastal and deep sea.	Delivery of ship reporting information concerning the ships its voyage, cargo and dynamic status (position and velocity)	Analyze all information requirements of ship reporting and determine which if any are obsolete, and the best source of the information required.	Evolve 851 (2
					Lack of standardized reporting formats.				Manually generated reports - Telex or Mail. Morse is no longer recommended.	Global	Simplify procedures and provide appropriate automated processes for accessing high quality information.	1) Reduce information required from ship, concentrating on that in the control of the ship. - 2)Source other information as and when required from origin of the information through	Evolve 851 (2

													international exchange. 3) Provide new recommendations for procedures for accessing, and technological solutions for retrieving information.	
				Operational	Reporting procedures are not globally standardized.				Manually generated reports - Telex or Mail. Morse is no longer recommended.	Port, VTS Coastal, remote Coastal and deep sea.	Shipboard and radio communication technology should facilitate provision of information from a device that provides automatically the identification position, velocity, draft and other information required for safety of navigation from anywhere in the world.	1) Use AIS in VTS Port and coastal infrastructure vicinity, and AIS by satellite for remote coastal areas and deep sea. Will provide a globally standardized system for provision of ship information. 2) By indexing the ID of the ship through a global exchange would enable access for sourcing information on Hull, Cargo, passengers as required.	Evolve 851 (2

					The needs to report, for safety, commercial and legislative reasons require time and effort.			Ensure seaworthiness	Most components in place but not interfaced to computing and communication devices.	Port, VTS Coastal, remote Coastal and deep sea.	Shipboard and radio communication technology should facilitate provision of information from a device that provides automatically the identification position, velocity, draft and other information required for safety of navigation from anywhere in the world.	1) As above but additionally, to provide on board technology to automatically compare real time parameters to known safe envelopes for critical ship attributes that may effect safety of navigation, pollution or seaworthiness, degradation of which requires reporting. 2) Provide for automatically communicating this status to Flag and or coastal states. Provide interface to sensors, VDR or ship condition monitoring system.	1) Evolve 851 (20) - 2) Provi performance requirements for interfacing critical attribut through interface to sensors, VDR or Ship condition monitoring
				Training	When new means are introduced under the framework of e-navigation adequate training is necessary.									
					When standardized reporting formats are introduced adequate training is necessary.									
					The design of reporting and administrative activities require too much training in their use.									
SHIPB CARD	TRAIN ING	Trainin g and	◦ Familiarization Requirements												

				Technical	Insufficient familiarization material for safety-related equipment.							
					Current training regime does not go far enough to specify type specific training needs for seafarers.							
				Regulatory	Lack of specifications of familiarization material for new and existing performance standards.							
					Current training regime does not go far enough to specify type specific training needs for seafarers.							
				Operational	Insufficient familiarization and awareness training of seafarers and relevant personnel in the detection and reporting of anomalies to appropriate channel, feedback and recording of subsequent action/measures.							
				Training	Considering the wide-scope and complex nature of e-navigation, the current training regime for shipboard users appears inadequate. The gap in training could be attributed to under three main headings: (i) Ship specific (e.g., type, voyage, location, etc.), (ii) User specific (e.g., operational level, management level) or even, (iii) System specific (e.g., layout, equipment, workstation), (iv) Training in use of all navigational products and symbology.							
					When new means are introduced under the framework of e-navigation adequate training is necessary.							

					Training of mariners for new functionality and systems.								
					Lack of auditable and structured training regime for type specific complex systems such as the operation of ECDIS.								
SHIPBOARD USER	N/A	N/A	*General Issues to be considered with regard to regulation on COMSAR 15/11 Annex 1, page.29*										
				Regulatory	International agreement on carriage standards is needed, such as the back-up for electronic navigation systems.								
					The regulation for type approval of "e-navigation displays systems" must be defined to encourage innovation, i.e. be different than what is currently in ECDIS which are too heavy and costly.								
					"Lifetime regulatory compliance" should be discontinued for systems that are dependent on software for their key functions. Instead, software dependent systems should only be suitable for regulatory compliance when using software that complies with the most current version(s) of the relevant standard(s).								
					Type approval procedure for navigation equipment should become more flexible and progressive.								
					Regulations for new navigational display systems should be standardized.								

SHOREBASED USERS	INFORMATION/DATA MANAGEMENT	Common Data Structure/Harmonized Data Formats	◦ Effective and Robust Communications ◦ Collection of information ◦ Provision of information to vessels ◦ Shore-to-shore information exchange										
				Technical	Lack of a common maritime information/data structure harmonizing the policies for the security and use of data.								
					Insufficient identification of harmonization needs for standards, formats and protocols.								
					Tools that have the capability to manage increased levels/volumes of information are not in use.								
				Regulatory	Lack of protocols, formats and data structure that enable shore based authorities to exchange information with other authorized shore based users.								
					Inconsistent rules that require some coastal states to maintain domain awareness.								
					No identified Gap but have some comments on COMSAR 15/11 Annex2, page 3								
				Operational	*No identified Gap*								
				Training	*No identified Gap*								

SHOREBASED USERS	INFORMATION/DATA MANAGEMENT	Improved Reliability	*Related User Needs(NAV 56/WP.5/Rev.1, annex 3)* ◦									
				Technical	*No identified Gap.*							
				Regulatory	*No identified Gap.*							
				Operational	*No identified Gap.*							
				Training	*No identified Gap.*							
SHOREBASED USERS	ROBUST COMMUNICATION	Robust Communication	◦ Effective and robust communication									
				Technical	There is a gap between information capability of current information management systems and those that will be required as volumes of information increases.							
				Regulatory	In the Initial GAP Analysis of the Annex of 23/8/10 does not fully extend to the shore to ship communication that is necessary to give the ship the information it needs.							

				Operational	*No identified Gap.*								
				Training	*No identified Gap.*								
SHOREBASED USERS	SYSTEMS AND EQUIPMENT	Presentation of Information	◦ Management of information ◦ Provision of information to vessels										
				Technical	Insufficient delivery and presentation of maritime information that shore based authorities are required to provide to ships.								
					Insufficient collection of data required to establish accurate marine domain awareness.								
				Regulatory	*No identified Gap.*								
				Operational	Lack of harmonized presentation of domain awareness to improve situational awareness for allied and other support services.								
				Training	*No identified Gap.*								
SHORE BASED	TRAINING AND	Training and	*Related User Needs(NAV 56/WP.5/Rev.1, annex 3)* ◦										

				Technical	*No identified Gap.*								
				Regulatory	*No identified Gap.*								
				Operational	*No identified Gap.*								
				Training	Not only the shipboard users but also shore-based users (e.g., Pilot, VTS operators, etc.) need to be appropriately trained in order to efficiently use and obtain the maximum benefit of e-navigation.								
SHOREBASED USERS	SHIP REPORTING	Ship Reporting	◦ Collection of information ◦ Management of information ◦ Shore-to-shore information exchange										
				Technical	*No identified Gap.*								
				Regulatory	*No identified Gap.*								
				Operational	The needs to report, for safety, commercial and legislative reasons require time and effort.								

				Training	*No identified Gap.*								
SHOREBASED USERS	TRAFFIC MONITORING	Traffic Monitoring	*Related User Needs(NAV 56/WP.5/Rev.1, annex 3)* ◦										
				Technical	Tools that have the capability to manage increased levels/volumes of information are not in use.								
					Insufficient delivery and presentation of maritime information that shore based authorities are required to provide to ships.								
					Lack of procedures that enable shore based authorities to monitor quality of navigation systems on board as well as quality of information and effectiveness of communication.								
				Regulatory	Lack of protocols, formats and data structure that enable shore based authorities to exchange information with other authorized shore based users.								
				Operational	Lack of harmonized presentation of domain awareness to improve situational awareness for allied and other support services.								
				Training	*No identified Gap.*								

SHOREBASED USERS	VTS	N/A	*This refers to acquiring information at the VTS from ship and shore to develop accurate domain awareness for the early identification of risk and effective response to support efficie security of marine traffic and environment protection.* ◦ 1. Monitor Traffic Situation 1.1 Acquire and manage information 1.2 Monitor individual ship 1.3 Assess traffic situation 1.4 Assess environmental conditions									
				Technical	Current VTS hardware may not have the capacity for increased collection, integration, exchange, presentation, storage and analysis of data.	2,5,7	2,6,7	A33 A33.1/2/3/4/5	-	1,2	To provide guidance to VTS authorities on type and volume expected within an e-Nav environment	Migrate to new hardware and software. VTS to consider how it receives and integrates additional information. Address bandwith and processing capabilities.	n/a
					Some operating systems and software are no longer supported. In some VTS', there is a problem of interoperability between applications						Consider IALA guidance on inter-VTS exchange format (IVEF) service. In the review of IALA Rec V 128, address issue of system and software life cycles	Migrate to new software. VTS to consider how it receives and integrates additional information. Address bandwith and processing capabilities.	n/a
					Bandwidth limitations shore / ship. Shortage of VHF marine frequencies INMARSAT C is a "store and forward" system. Speed of data exchange and capacity varies. There can be unintended interference between ship						To provide guidance to VTS authorities on expected volume of data transfer and bandwidth implications within an e-Nav environment.	Evaluate new technologies (e.g WiMax, Voice over IP) to meet ship/shore operational requirements	Consider regulations t assure inter-operability between ship/shore

					transmissions (e.g. AIS) and shore based infrastructure.						Communication means to be transparent and user friendly to the end user		
					No standardized format for data exchange between VTS centres and other e-Nav stakeholders.						IALA Rec on harmonised functional requirements for networking and info exchange (IVEF). Work on this has been finalised by the IALA e-NAV/VTS Committees (awaiting Council approval - as of March 2011). This work needs to synchronised between VTS and e-NAV	systems and software will need to support the new IVEF	To be completed
					Inaccurate AIS data.						Vessels to have procedure within the SMS to check for accuracy of AIS data on a regular basis. Shore authorities to have procedure to notify vessel and report to PSC. Reduction in	Technical solutions to address standards of installtion and sensor reliability	Regular inspection by Port State Control and annual inspection (MSC 87 amendments to SOLAS) w minimise inaccurate broadcasts from AIS

												improved design and integration		
				Regulatory	*No identified Gap.*									
				Operational	*No identified Gap but have some comments on IALA e-Nav9-7-1, page.6*									
				Training	Not all VTS Operators are trained to IALA V-103 model training courses. Not all VTS training organisations have accredited VTS training courses							IALA to maintain the V 103 suite of model courses to evolving operational needs. Encourage training organisations to become accredited according to IALA guidelines	Use of simulation for training and assessment should be considered	The need for mandatory training for VTSOs, including certification / accreditation of training institutes
SHOREBASED USERS	VTS	N/A	*Efficient provision of information to the mariner in difficult navigational and meteorological circumstances or in case of defects and deficiencies. This service is normally provided at vessel or by the VTS when deemed necessary. This pertains to VTS operator providing assistance in determining vessel's position and providing advice to assist in the on board na making. VTS operator should have confidence that the information collected and sent to the ship is correct. Must be capable of establishing effective communication with the bridge* ◦ 1.0 Provide Navigational Assistance Services (NAS) 1.1 Provide navigation information, warning and advice 1.2 Provide instructions subject to the authority of the VTS.												

				Technical	Current VTS hardware/software may not have the capacity for real time display of vessels' track to provide a NAS or TOS service						VTS authorities should assess the hardware and software requirements for providing NAS and TOS	Migrate to new hardware and software. VTS to consider how it receives and integrates additional information. Address bandwith and processing capabilities.	n/a
				Regulatory	*No identified Gap*								
				Operational	*No identified Gap*								
				Training	*No identified Gap*								
SHOREBASED USERS	VTS	N/A	*The traffic organization service concerns the operational management of traffic and the forward planning of vessel movements to prevent congestion and dangerous situations, and relevant in times of high traffic density or when the movement of special transports may affect the flow of other traffic. The service may also include establishing and operating a sys clearances or VTS sailing plans or both in relation to priority of movements, allocation of space, mandatory reporting of movements in the VTS area, routes to be followed, and spee observed or other appropriate measures which are considered necessary by the VTS authority.* ◦ 1.1 Provide Traffic Organisation Services (TOS) 1.2 Plan traffic organisation criteria 1.3 Plan traffic flow 1.4 Allocation of time slots 1.5 Assign and monitor anchoring 1.6 Issue a clearance and allocate departure time 1.7 Monitor adherence to applicable rules										

				Technical	*No identified Gap*								
				Regulatory	*No identified Gap*								
				Operational	Lack of common understanding of the scope and procedures of NAS and TOS internationally						Implementation of NAS guidance (IALA Guideline No 1068) Development of TOS guidance	n/a	Consideratio should be given to providing procedural guidance for NAS and TO in IALA V 10 model cours and the STCW convention
				Training	*No identified Gap*								
SHOREBASED USERS	VTS	N/A	*The services of the VTS centre should be maintained during an emergency response. Other authorities e.g. SAR, Environmental responses and Security agencies might be respon external emergencies within the VTS area. If a marine incident occurs or is likely to occur in a VTS area, VTS can be used to support incident management and mitigation. In the co traffic safety VTS may support responsible authorities involved with Maritime Assistance Services (MAS), places of refuge, security incidents, Search and Rescue (SAR) operations and salvage operations. In some VTSs such operations are carried out under the supervision of the VTS authority.* ◦ Manage Incidents & Emergency Management by a VTS										
				Technical	*No identified Gap*								

				Regulatory	Lack of international guidance on security of data and its sharing						Develop guidance on the security of data and its sharing. Data security issues will need to be addressed in SOPs	Issues may include, AIS data, single window, encryption etc	Compliance with guidanc will have to b addressed by national law.
				Operationa	*No identified Gap*								
				Training	*No identified Gap*								
SHOREBASED USERS	VTS	N/A	*No specific user need given. Added by IALA e-NAV9 WG1*										
				Technical	There are no standard data formats for on board capture and presentation that cover the entire scope of information provided by a VTS						Both ship and shore will need procedures and training in best practice for the efficient use of VTS services. Human element issues for the presentation of VTS information onboard need to be considered	Both ship and shore systems will need to support the agreed common data structure and format for the exchange of e-navigation information.	Considerati should be given to the minimum equipment requirement for both shor and ship, to exchange e-navigation information
				Regulatory									

				Operational								
				Training								
SHOREBASED USERS	VTS	N/A	*No specific user need given. Added by IALA e-NAV9 WG1*									
				Technical								
				Regulatory	IALA VTS guidance may not be being developed in harmony with the concepts of e-navigation						IALA should establish procedures to ensure that guidelines and recommendations are harmonised with the development of e-navigation	n/a	n/a
				Operational								
				Training								
SHOREBASED	VTS	N/A	*No specific user need given. Added by IALA e-NAV9 WG1*									

				Technical									
				Regulatory									
				Operational									
				Training	There is a lack of understanding by seafarers as to the type of VTS service being provided in many ports						IALA needs to develop guidance for VTS authorities as to how they identify their operations and services to mariners	where data is provided in an e-navigation environment, information from a VTS should clearly indicate the type of service/s provided	
SHORT	VTS	N/A	*No specific user need given. Added by IALA e-NAV9 WG1*										

				Technical	Insufficient reliability of position fixing systems.	4	1,2,4,5,6,7,8	A1.5,A5, A6, A7, A8, A9, A10, A11, A16, A17, A18, A19, A20.1, A23, A24, A26, A30, A31, A32, A33	GPS, GLONASS	1.2.3.4.5	existing technology meets some of the requirements, but lacks integrity and is vulnerable to disruption. Current operational procedures may not be sufficient to cope with loss of position input.	existing technology can be used, with augmentation (differential GNSS) to provide integrity. Alternative systems are needed to overcome vulnerability to disruption	existing GNSS (GPS &GLONASS) are recognised as elements of the WWRNS. Performance Standards exist for GNSS and DGNSS receiving equipment. New or updated PS will be needed for alternative systems, or multi-system PS might be developed to avoid proliferation of standards and the consequent problems of keeping them up to date

				Regulatory									
				Operational									
				Training									
SEARCH ADS RESCUE	N/A	SAR	◦ SAR should have access to relevant information contained within the e-navigation domain ◦ Effective Communication and information sharing ◦ Priority for distress communications ◦ SAR Authorities need access to the details of all relevant onboard communication equipment and capabilities										
				Technical	Lack of mechanisms to provide SAR (RCC) function with the full range of relevant e-navigation information in digital format.								
					Lack of an automated data network connecting all stakeholders in SAR intervention, including improved communication between RCC and shore-, land-, sea- and air-based entities.								
					Hardware: Resources and capability available for infrastructure can be lacking and therefore tools needed for accessing digital data may not be available. Lack of data in digital format.								
					Currently, collecting information pertaining to a distress situation consumes valuable time.								

					Potential loss of priority for distress communication.									
				Regulatory	Lack of solutions for maintaining priority for distress communication.									
					Insufficient implementation of SAR facilities.									
					Gaps in SAR coverage on an international basis due to varying national implementation of regulations. Implementation of GMDSS across the world varies. Gap is between "aspiration" and "delivery".									
				Operational	Insufficient support of the use of LRIT data for SAR.									
					Insufficient access to and quality of information from ships in distress.									
					Lack of an effective SAR system in some parts of the world. Lack of adequate number of trained personnel.									
				Training	Insufficient training in correct use and activation of priority messages.									
					Lack of access to the details of all relevant onboard communication and capabilities for SAR authorities.									
					Gaps may appear as new tools and techniques become available for sourcing information.									

					Ships manning does not take account of the potential of SAR, and also of the practice for SAR.										
SEARCH ADS RESCUE	COMSAR 15 SAR WG	N/A	◦ support the effective operation of contingency response, and search and rescue services												
				Technical											
				Regulator											
				Operation											
				Trainin											
SEARCH ADS RESCUE	COMSAR 15 SAR WG	N/A	◦ improved safety, through promotion of standards in safe navigation supported by: .1 improved decision support enabling the mariner and competent authorities ashore to select relevant unambiguous information pertinent to the prevailing circum .2 a reduction in human error through provision of automatic indicators, warnings and fail-safe methods												
				Technical											
				Regulator											
				Operation											
				Trainin											

SEARCH ADS RESCUE	COMSAR 15 SAR WG	N/A	◦ the current functions of the present GMDSS need to be supported and enhanced: .1 transmission of ship to shore distress alerts by at least two separate and independent means; .2 reception of shore to ship distress alert; .3 transmission and reception of ship-to-ship distress alerts; .4 transmission and reception of Search and Rescue (SAR) coordinating communications; .5 transmission and reception of on-scene communications; .6 transmission and reception of locating signals; .7 transmission and reception of maritime safety information (MSI); .8 transmission and reception of general radio communications to and from shore based radio systems or networks; and .9 transmission and reception of bridge to bridge communications											
				Technical											
				Regulator											
				Operation											
				Trainin											
SEARCH ADS RESCUE	COMSAR 15 SAR WG	N/A	◦ how do we accommodate non-GMDSS alerting and communications technology, including mobile technology and future developments in maritime communicat												
				Technical											
				Regulator											
				Operation											

				Trainin									
SEARCH ADS RESCUE	COMSAR 15 SAR WG	N/A	◦ how do we accommodate the whole SAR system including non-SOLAS rescue crafts and SAR aircrafts?										
				Technical									
				Regulator									
				Operation									
				Trainin									
SEARCH ADS RESCUE	COMSAR 15 SAR WG	N/A	◦ Need of other data: .1 passenger/crew list; .2 passenger tracking systems data; .3 hazardous cargo; .4 evacuation plans; .5 ships plans; .6 number of lifeboats/liferafts/life saving appliances (Survival suits); .7 EPIRB/SART and AIS/SART data; .8 SAR- co-operation plan data for passenger ships; and .9 ship's IMO number										
				Technical									
				Regulator									

				Operation										
				Trainin										
SEARCH ADS RESCUE	COMSAR 15 SAR WG	N/A	◦ Additional Information – Responder .1 receive data as a vessel comes into area of SAR operations that informs shore stations on the ship's communications options available. Not just GMDSS but c Email/Fax/Broadband; .2 information on a vessel's capabilities for supporting SAR operations; Fast Rescue Craft/Hospitals/Fire fighting; .3 identify vessels that provide Met data – direct access to met data on ships; .4 use vessel data for coverage prediction based on height of eye above sea level; and .5 understand constraints of ship data for example: type/draught/manoeuvring capabilities.												
				Technical										
				Regulator										
				Operation										
				Trainin										
SEARCH ADS RESCUE	COMSAR 15 SAR WG	N/A	◦ On-Scene Action .1 datum markers identifiable by all on-scene assets, for example: for drift/sea current and weather info; .2 locating devices; .3 monitor execution of search coverage plan; and .4 individual casualty location and tracking.											
				Technical										

				Regulator											
				Operation											
				Trainin											

ANNEX 3

Draft outline of a Strategy Implementation Plan on e-navigation.

1 According to MSC 86/23/4 the final Strategy Implementation Plan (SIP) should at least include:

.1 Identification of responsibilities to appropriate organizations/parties,

.2 Transition arrangements,

.3 A phased implementation schedule along with possible roadmaps,

.4 Priorities for deliverables, resource management and a schedule for implementation and the continual assessment of user needs,

.5 Proposals for a systematic assessment of how new technology can best meet defined and evolving user needs,

.6 A plan for the development of any technology and institutional arrangements necessary to fulfill the requirements of e-navigation in the longer term,

.7 Proposals on public relations and promotion of the e-navigation concept to key stakeholder groups,

.8 Identification of potential sources of funding for development and implementation, particularly for developing regions and countries and of actions to secure that funding.

The CG having analyzed the mandate, proposes a coordinated approach to item 2, 3 and 4; and for item 5 and 6, thus being handled respectively as one item.

Identification of responsibilities to appropriate organizations/parties.

2 NAV 54/25, Annex 12, Annex 1 has defined the responsibilities for ownership and control of the e-navigation concept by IMO.

Issues concerning the responsibility for the quality, the liability and legal aspects on the use and the reuse, and the protection, storage, consistency, maintenance and enrichment of data and information are of fundamental importance to make e-navigation possible and operational. e-navigation related responsibilities may affect all levels mentioned and these responsibilities must be clearly identified and addressed in an unambiguous way.

Without effective measures to ensure the reliability of data that may be exchanged within e-navigation there is a risk that unreliable or otherwise potentially dangerous information may be displayed without ships having the ability to discriminate between safe or unsafe information.

In the context of e-navigation, the IMO may need to clarify whether the chart and nautical publications carriage requirements may be satisfied by the delivery of data services rather than products and if necessary, adjust the relevant IMO instruments accordingly.

Dealing with continual advances and innovation requires the establishment of an effective change management process that captures and considers innovation as it happens. Such continual advances and innovation will occur, and it is therefore appropriate that the e-navigation implementation strategy should embody a change management system to ensure that e-navigation will benefit from advances in technology and innovation and to prevent the development of e-navigation being unnecessarily tied to technology that becomes superseded.

3 Referring to the responsibilities that come with IMO ownership and control of the concept, the following questions might be addressed:

.1 How could responsibilities for the design, implementation, operation and enforcement of e-navigation, acknowledging the rights, obligations and limitations of flag States, coastal States, port States and the various authorities within those States be identified?

.2 How might IMO take the lead in setting the performance standards appropriate for e-navigation covering all the dimensions of the system: ship borne, ashore and communications, - given that these standards should be based on user needs and should encourage technology neutrality and interoperability of system components?

.3 What will be necessary to ensure that the concept accommodates and builds on existing maritime systems and funding programs?

.4 How to assess and define the training requirements associated with e-navigation and assist the relevant bodies in developing and delivering the necessary training programs?

.5 What would it take to monitor the implementation of the concept to ensure that contracting States are fulfilling their obligations and ensuring that e-navigation users within their jurisdiction are also complying with requirements?

Transition arrangements, a phased implementation schedule along with possible roadmaps, and priorities for deliverables, resource management and a schedule for implementation and the continual assessment of user needs.

4 This is to some extent elaborated on in NAV 54/25, Annex 12.

“Transition planning,” takes into account the phasing needed to deliver early benefits and to make the optimum use of existing systems and services in the short term. The implementation plan should be phased such that the first phase can be achieved by fully integrating and standardizing existing technology and systems and using a reduced concept of operations. .

There might be different implementation plans according to the differences in the start status of the various stakeholders.”

With the implementation of the e-navigation strategy, there will most likely be different sets of services provided and different levels of these services, operational, technical (- and commercial) in adjacent areas throughout the same voyage of a vessel from berth to berth.

5 IMO has recognized the benefits of using a modular concept, to enable scalability and implementation. Scalability is recognised as one of the “key strategy elements” of the e-navigation strategy. (MSC86/23/4 and in particular MSC85 report, Annex 20, §9.1.8). This introduces by its very nature differences in service portfolios and/or service levels on a global, regional, and even national scale, both for operational e-navigation services and for technical services being offered from ashore to the mariner and/or shipboard technical equipment.

6 The development of e-navigation might be considered in terms of a modular concept. The advantages of introducing e-navigation through a modular concept might include the following:

.1 Provide a more effective means for describing e-navigation to others by clearly identifying the core areas of interest.
.2 More effectively manage parallel work programmes.
.3 Help in evaluating and measuring progress of development.
.4 More clearly identifying the relationship between core and other aspects of e-navigation.

7 A roadmap might help identifying overlooked issues and facilitate planning. Breaking down the process of implementing e-navigation into a number of smaller manageable well defined steps, might both facilitate a common understanding of the process and the concept, and it would greatly enhance the possibility of success.

8 A methodology for continual assessment of user needs was introduced at NAV 55/11/4, UK: “Development of an e-navigation strategy implementation plan: methodology for developing e-navigation user needs using a task-based approach”. The Correspondence Group considers this a good methodology for assessing user needs, but it might be further developed.

Proposals for a systematic assessment of how new technology can best meet defined and evolving user needs, and a plan for the development of any technology and institutional arrangements necessary to fulfill the requirements of e-navigation in the longer term.

9 This part of the plan will be a direct consequence of the conclusions of the technology and legal categories of the gap analysis. NAV 53/13 underlined the importance of active endorsement from the shipping industry as crucial to the success of e-navigation, and recommended that further work should include a formal study by an appropriate organization to provide credible and rigorous information about the likely cost implications to the industry of developing and implementing e-navigation.

10 As part of the e-navigation Strategy Implementation Plan process, it may be necessary to discuss whether there should be developed procedures for the possible rapid maintenance and updating of equipment on board and their performance standards. This should not compromise any future type approval regime, which might be considered as a need to develop.

Software updating could i.e. be one of the most essential issues of an e-navigation environment. As the technical evolution is progressing, it should be possible to update procedures and equipment accordingly.

The Correspondence Group considers the consequent application of the modular concept to performance standards and equipment may enhance the updating of equipment on board and their performance standards.

Handling these topics, it will be of fundamental importance to continuously integrate the needs of the human element in the process.

11 During NAV 56 it was recognized that there is a need to establish procedures and criteria applicable to the usability assessment of navigation equipment, as suggested by Japan. (NAV 56/8/9 and NAV 56/20, paragraphs 8.25+8.26) The ultimate aim of such guidelines is to provide seafarers with systems that are easier to understand and use, while reducing user discomfort and occasional stress; today, the concept of usability is in general accepted as a critical success criteria in interactive systems.

Usability is an important e-navigation item.

In order to conduct an appropriate usability assessment it may be necessary to review the current performance standards of the navigational equipment in the light of e-navigation user needs. The performance standard, either as an individual component or as a whole of e-navigation system, has a significant role in establishing the criteria for usability of the navigation equipment.

Usability studies may be considered performed as well by a variety of methodologies like usability by trail, the use of simulation or through an on-board workshop as effective tools for usability assessment. Simulation could be used to check and verify usability of equipment against the newly set or pre-defined performance standard, as appropriate.

After a number of years, sufficient experience of e-navigation operations may allow a review process to determine to what extent further integration between shore based and shipboard systems could safely be considered.

12 One important aspect of this challenge will be the integration of test-bed outcomes. Results from test beds are important to the overall e-navigation process, and they assist in keeping the focus on user needs. Guidelines and harmonization in this area would increase the value of the test beds as input to the e-navigation process.

13 The final Strategy Implementation Plan could also be enhanced by the introduction of a methodology for updating, further development and integrating new ideas in e-navigation.

Proposals on public relations and promotion of the e-navigation concept to key stakeholder groups.

14 At the outset the knowledge of e-navigation as an international effort is low or absent among the practical users/navigators.

Throughout the development the promotion of e-navigation has been difficult, as it was hard to demonstrate the practical consequences to users and stakeholders.

The final Strategy Implementation Plan will build on the gap, risk and cost-benefit analyses, which in themselves are based on specific issues of practical consequence. MSC 86/23/4 describes several expected outcomes of the gap analysis, like:

.1 technical gap analysis that should result in “a program of development work that needs to be done to provide technology solutions to user requirements in their entirety”.
.2 regulatory gap analysis that should serve as a basis for “any institutional reform that is needed should be proposed for implementation”.

e-navigation should be more easily promoted if the Strategy Implementation Plan meets the expected requirements. “A stable and realistic implementation plan will create forward enthusiasm and momentum for e-navigation across the maritime sector.” (NAV 54/25, Annex 12.)

Identification of potential sources of funding for development and implementation, particularly for developing regions and countries and of actions to secure that funding.

15 World Bank and Regional Development Banks could be relevant institutions, provided member countries within the relevant regions are actively cooperating in the process. As an initial step it may be useful to get an overview of existing investments in the sector.

There will be a need to separate funding of investments and funding of operating costs.

The costs may be related to maritime states: Flag States or Coastal States, original equipment manufacturers or to ship owners/operators as detailed in NAV 53/13, and may include needs as well on board as ashore.