INTERNATIONAL MARITIME ORGANIZATION

DEVELOPMENT OF AN E-NAVIGATION STRATEGY IMPLEMENTATION PLAN

Report of the Correspondence Group on e-navigation

Submitted by Norway

	SUMMARY
Executive summary:	The Correspondence Group on e-navigation has presented the further development of the overall conceptual, functional and technical architecture on e-navigation, as well as the progress of the initial gap analysis. The action points reflect the issues relevant to COMSAR 15.
Strategic direction:	5.2
High-level action:	5.2.6
Planned output:	5.2.6.1
Action to be taken:	Paragraph 11
Related documents:	MSC 85/26, annex 20; MSC 86/23/4; NAV 53/13, annex 3; COMSAR 14/17; NAV 56/20, NAV 56/WP.5/Rev.1, NAV 56/INF.9 and NAV 56/INF.10

Introduction

1   In accordance with the decision taken by C 104, that documents other than information documents containing more than 20 pages will not be translated into all working languages in their entirety, a summary of the report of the Correspondence Group on e-navigation is provided in the ensuing paragraphs.

2   Accordingly, the full text of the report and its annexes is provided in the English language only.

Summary

Background

3   NAV 56 re-established the Correspondence Group on e-navigation (CG) to continue work on its task, and invited its members to submit relevant views, proposals and comments to COMSAR 15 and NAV 57, as appropriate. IALA and IHO were invited to finalize their gap analyses on the shore side aspects and to report, as appropriate.

The Future Path of the Navigator: Two scenarios

4   Having assessed the user needs, functions and system architecture of e-navigation, – and expecting the future development, one may 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 navigating navigator scenario and the monitoring navigator scenario may be of special relevance.

Communication challenges in the Polar areas

5   It is noted that recent results from tests with satellite detection of AIS confirm earlier studies and user needs connected to increasing activities and operations in remote Arctic areas. This region is renowned for its challenging climate and vulnerable environment, which increase the degree of complexity when carrying out operations. Efficient and reliable communication is crucial to ensure safe operations and interoperability on board and ashore. An improved robust communication system for the region will be necessary for a future e-navigation concept. Norway will conduct research and studies on this issue of communication challenges in the High North, and will propose future concepts on how to approach this challenge.

Further development of the conceptual, functional and technical architecture of e-navigation by creating a framework for data access and information services under the scope of SOLAS

6   Norway proposed at NAV 56 to host a workshop on these issues, while the International Hydrographic Organization (IHO) offered their headquarters in Monaco as venue for the workshop. The workshop took place on 4 and 5 November 2010, and discussed the relevance and best alignment of the various data frameworks.

Functional requirements of SOLAS regulation IV/4

7   There may be a need to increase the efficiency, functionality and quality related to GMDSS in the future in concert with the implementation of e-navigation. Wireless e-mail and broadband communication using various carriers, such as VHF, satellite and MF/HF should be taken into consideration. While developing the e-navigation concept, one might consider an integration of the functions of chapter IV and chapter V of SOLAS.

8   In summary the existing functional requirements should be further developed to simplify, modernize, harmonize and integrate radio communication functions with relevant navigational functions, in line with e-navigation principles.

E-navigation and the scoping exercise on the need for the review of the GMDSS

9   The CG is of the view that there could be need for a possible convergence between the scoping exercise to establish the need for a review of the GMDSS and the work to progress e-navigation. COMSAR should therefore consider how the process of the scoping exercise of the GMDSS and the development of e-navigation might be harmonized.

Inputs and comments to the initial gap analysis from the members of the CG

10   Seven Member States, IHO and IALA submitted their inputs to the initial gap analysis. These were summarized in a standardized way trying to identify as specific and focused topics as possible, 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 CG,

and the result is presented in annex 1: Gap analysis, shipboard; annex 2: Gap analysis, shore-based; annex 3: Gap analysis, SAR, of this document.

Actions requested of the Sub-Committee

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

> .1   with respect to the navigating navigator and the monitoring navigator scenarios, how would this influence the user needs on communications?
>
> .2   advise on the recommendations for creating a framework for data access and information services under the scope of SOLAS, where IHO's S-100 data model should be considered as a baseline, as an important element in the e-navigation concept;
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> .3   advise whether 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;
>
> .4   consider whether existing functional requirements for radiocommunication equipment should be further developed, in order to simplify, modernize, harmonize and integrate radiocommunication functions with relevant navigational functions, in line with the principles of the e-navigation concept;
>
> .5   consider the convergence between the scoping exercise of the GMDSS and the work to progress e-navigation; and how the process of the scoping exercise of the GMDSS and the development of e-navigation could be harmonized; and
>
> .6   further develop the gap analysis for the user needs relevant to the Sub-Committee's work.

**REPORT OF THE CORRESPONDENCE GROUP ON E-NAVIGATION
(ENGLISH ONLY)**

Background

1   The Work programme on e-navigation, (MSC 86/23/4), outlines a joint plan of work for the COMSAR, NAV and STW Sub-Committees for the period 2009-2012. NAV 56 re-established the Correspondence Group (CG) to continue work on its task, and invited its members to submit relevant views, proposals and comments to COMSAR 15 and NAV 57, as appropriate. IALA and IHO were invited to finalize their gap analyses on the shore side aspects and to report, as appropriate.

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

3   According to the joint plan of work (MSC 86/23/4), COMSAR 15 is expected to perform further gap analysis and further C/B- and risk analyses.

COMSAR 14 and NAV 56 endorsed the proposed methodology for carrying out the gap analysis. The process carried out in co-operation with the members of the CG has so far identified the gaps between the present status and the future situation illustrated by the agreed user needs. There remains a work to be done detailing and specifying the actions necessary to fill the gaps, which will be addressed through the further process.

The CG will proceed with the initial gap analysis, taking into account the outcome of STW 42 and COMSAR 15, and submit the results to NAV 57.

The CG has not been in a position to prepare discussion material on C/B- and risk analyses because the gap analysis needed to be finalized first, in order to serve as the basis for the subsequent risk- and cost-benefit analyses.

Terms of Reference

4   At NAV 56, the Sub-Committee re-established the CG under the coordination of Norway, with the following Terms of Reference.

The CG 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.

Paragraph 4 is of special relevance to COMSAR 15.

The Future Path of the Navigator: Two scenarios

5 The CG submitted a document to STW 42 (STW 42/6). Some of the topics were related to the future path of the navigator and to the gap analysis. To the extent the conclusions at STW 42 have relevance to the further process of the gap analysis, they will be integrated in the report to NAV 57.

6 Having assessed the user needs, functions and system architecture of e-navigation, – and expecting the future development, one may 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 may 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 programmes. 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 programmes.

.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.

An important question in this relation might be how the navigating navigator and the monitoring navigator scenarios would influence the user needs on communications.

7   At COMSAR 14 and NAV 56 the user needs with regard to the e-navigation concept identified and adopted different needs for 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 narrow water;

.3   transocean voyages;

.4   offshore operations; and

.5   operations in arctic and remote areas.

Communication challenges in the Polar areas

8   COMSAR 14 endorsed the view that the satellite detection of ships' automatic identification systems could become part of the e-navigation concept; however, there were numerous issues which still had to be studied and discussed, including the protection of the frequencies reserved for AIS, which was a matter of concern.

9   It is noted that recent results from tests with satellite detection of AIS confirm earlier studies and user needs connected to increasing activities and operations in remote Arctic areas. This region is renowned for its challenging climate and vulnerable environment, which increase the degree of complexity when carrying out operations. Efficient and reliable communication is crucial to ensure safe operations and interoperability on board and ashore. An improved robust communication system for the region will be necessary for a future e-navigation concept.   Norway will conduct research and studies on this issue of communication challenges in the High North, and will propose future concepts on how to approach this challenge.

10   It should also be considered whether these challenges are relevant for the Antarctic area.

Further development of the conceptual, functional and technical architecture of e-navigation by creating a framework for data access and information services under the scope of SOLAS

11   At NAV 56 the Sub-Committee noted that COMSAR 14 had endorsed the views of the e-navigation working group that the conceptual e-navigation architecture as depicted in Figure 2 of document COMSAR 14/12 was a good basis for further development and simplification by the CG.

It is an objective of the e-navigation work programme to develop an overall conceptual, functional and technical architecture, particularly in terms of process description, data structures, information systems, communication technology and regulations (MSC 86/23/4).

NAV 56 endorsed the list of user needs prepared by the CG and the recommendations of COMSAR 14 concerning system architecture with a focus on functional system architecture, and initial gap, risk and cost-benefit analyses.

COMSAR 14 also gave its considerations of the criteria for the selection of hardware and the development of corresponding software, (COMSAR 14/17). 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 international 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.

12   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 (NAV 56/INF.9). The CG was tasked with this development.

13   Norway proposed at NAV 56 to host a workshop on these issues, while the International Hydrographic Organization (IHO) offered their headquarters in Monaco as venue for the workshop. The workshop took place on 4 and 5 November 2010, and discussed the relevance and best alignment of the various data frameworks and looked 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 summary of the workshop has been submitted to the CG.

14   In this regard the CG noted that IALA has been addressing the need for a data framework to support the delivery of shore based e-navigation services. Whilst undertaking this work, and taking note of the identified e-navigation user needs, IALA has considered the wider implications for an e-navigation data framework resulting in the term Universal Maritime Data Model (UMDM).

15   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 includes both additional content and support of new data exchange formats. The S-100 is flexible with capacity to also include other types of information.

16   The CG has agreed on the following recommendations on this topic:

.1   IHO's S-100 should be considered as a baseline, as an important element in the e-navigation concept;

.2   IMO, in consultation with other organizations, should consider the establishment of a Harmonization Group based on the example of the IMO/IHO Harmonization Group on ECDIS;

.3   any organization which proposes to develop and/or maintain its own data structure relevant to e-navigation, shall be encouraged to join the Harmonization Group. Any such data structure shall be interoperable with existing data structures and relevant international standards that are already supporting the e-navigation concept. Harmonization should be achieved through interoperability, which should be considered a shared responsibility;

.4   noting that IALA and IHO are the stewards of two important e-navigation domains, technical representatives of IALA and IHO should continue their close liaison to explore how IALA and IHO could share, correlate, cross-reference and harmonize, as appropriate, to create and maintain a data model that draws on the expertise of both organizations;

.5   the e-navigation community is aware of other data structures already developed within other domains relevant to e-navigation. It is essential that owners of these data structures cooperate with the Harmonization Group to achieve interoperability, where appropriate;

.6   considerations should be given to different knowledge domain communities both in terms of their requirements and contributions in connection to e-navigation development;

.7   domain registries should be online in order to be easily searched;

.8   considerations should be given to providing technical advice/support to organizations that do not have technical capability or competency;

.9   implementations of any domain data structures should be harmonized and interoperable both technically and across different geographical regions;

.10   it can be expected that the availability and use of internet on ships at sea will increase and may provide extra opportunities for maritime data exchange and information services. Note needs to be taken of the multitude of Spatial Data Infrastructures (SDI) being developed in related domains (e.g., Meteorology, Oceanography, etc.) which are largely internet based. IMO should give careful consideration to the implications for e-navigation;

.11   the concept of re-use rather than re-invent should be an e-navigation data framework ground rule; and

.12   consideration needs to be given to the standards being used for the passing of data between individual components of systems both on board and ashore.

Functional requirements of SOLAS regulation IV/4

17   COMSAR 14 endorsed the views of the working group that tables identifying current related communication equipment, performance standards including test standards and possible future communication equipment systems, respectively had been developed, which should be further developed by the CG (COMSAR 14/17, paragraph 12.14.4).

18   Communication equipment required by SOLAS chapter IV, regulations 7 to 11 is developed to comply with the functional requirements prescribed by regulation 4 of the same chapter.

19   The functional requirements of SOLAS regulation IV/4 might therefore be given priority and reviewed independently of the equipment requirements. After having decided what functional requirements are needed in the future e-navigation system, the requirements for equipment should be studied in order to find out what existing equipment could carry out the functional requirements and what is needed to be developed.

Functional requirements as required by SOLAS regulation IV/4

20   Every ship, while at sea, shall be capable:

.1   except as provided in regulations 8.1.1 and 10.1.4.3, of transmitting ship-to-shore distress alerts by at least two separate and independent means, each using a different radio communication service;

.2   of receiving shore-to-ship distress alerts;

.3   of transmitting and receiving ship-to-ship distress alerts;

.4   of transmitting and receiving search and rescue coordinating communications;

.5   of transmitting and receiving on-scene communications;

.6   of transmitting and, as required by regulation V/19.2.3.2, receiving signals for locating;

.7   of transmitting and receiving maritime safety information;

.8   of transmitting and receiving general radio communications to and from shore based radio systems or networks subject to regulation 15.8; and

.9   of transmitting and receiving bridge-to-bridge communications.

21   Shortly, the equipment required to fulfil the functional requirements (SOLAS regulation IV/4) are currently as shown in the following table (SOLAS regulations IV/7 to IV/11).

This table is an excerpt from the table shown in "Admiralty List of Radio Signals" – Volume 5, with additional notes linking the equipment to the functional requirements as set out in SOLAS regulation IV/4.

Equipment	Sea Area					Notes
	A1	A2	A3 Sat.	A3 HF	A4	
VHF-DSC	X	X	X	X	X	1),2),3),4),5),8),9)
Two-way VHF telephony	X	X	X	X	X	5),8),9),
MF telephony with MF DSC		X	X			1),2),3),4),5),7),8),9)
DSC watch receiver 2187,5 kHz		X	X			2)
Inmarsat SES with EGC receiver			X			1),2),4),5),7),8)
MF/HF telephony with DSC and telex				X	X	1),2),3),4),8),9)
DSC watch receiver MF/HF				X	X	2)
Duplicated VHF with DSC			X	X	X	1),2),3),4),8),9),10)
Duplicated Inmarsat SES			X			1),2),4),5),7),8),10)
Duplicated MF/HF with DSC and telex					X	1),2),3),4),8),9),10)
NAVTEX receiver 518 kHz	X	X	X	X	X	7)
EGC Receiver	X[12]	X[12]		X[12]	X[12]	7)
Float-free satellite EPIRB	X	X	X	X	X	1),6)
Search and rescue locating devices (SART and AIS-SART)	X	X	X	X	X	6)
Hand-held VHF transceiver	X	X	X	X	X	4),5)
Distress alarm panel (passenger ships)	X	X	X	X	X	11)
Automatic position updating	X	X	X	X	X	12)
Two-way-on-scene transceiver 121,5 MHz and 123,1 MHz (passenger ships)	X	X	X	X	X	4)

NOTES:	
1)	Fulfils the functional requirements of SOLAS regulation V/4.1, item .1,
2)	Fulfils the functional requirements of SOLAS regulation IV/4.1, item .2,
3)	Fulfils the functional requirements of SOLAS regulation IV/4.1, item .3,
4)	Fulfils the functional requirements of SOLAS regulation IV/4.1, item .4,
5)	Fulfils the functional requirements of SOLAS regulation IV/4.1, item .5,
6)	Fulfils the functional requirements of SOLAS regulation IV/4.1, item .6,
7)	Fulfils the functional requirements of SOLAS regulation IV/4.1, item .7,
8)	Fulfils the functional requirements of SOLAS regulation IV/4.1, item .8,
9)	Fulfils the functional requirements of SOLAS regulation IV/4.1, item .9,
10)	Fulfils the maintenance requirements of SOLAS regulation IV/15.7 (duplication of equipment)
11)	Fulfils the requirements of SOLAS regulation IV/6.4 (and IV/6.6)
12)	Fulfils the requirements of SOLAS regulation IV/18
[1]	Outside NAVTEX coverage area
[2]	Exempt if HF NBDP MSI service available and receiving equipment on board

22   The functional requirements apply to all convention ships, regardless of trade area. While studying the future functional requirements, focus should also be set on which requirements are out-dated and which functions should be added. Since all convention ships are operating within the coverage of GMDSS at all times, residual functions should be removed. Communications equipment, performance standards and test standards are found in the report of the e-navigation working group (COMSAR 14/WP.6, annex 1).

23   There may be a need to increase the efficiency, functionality and quality related to GMDSS in the future in concert with the implementation of e-navigation. Wireless e-mail and broadband communication using various carriers, such as VHF, satellite and MF/HF should be taken into consideration. While developing the e-navigation concept, one might consider an integration of the functions of chapter IV and chapter V of SOLAS.

24   In summary the existing functional requirements should be further developed to simplify, modernize, harmonize and integrate radio communication functions with relevant navigational functions, in line with e-navigation principles.

Issues for consideration of the CG raised by COMSAR 14

25   COMSAR 14 reflected issues of terrestrial electronic fixing system, specific criteria for reliability and the need to further develop the preliminary SAR user needs (COMSAR 14/17, paragraphs 12.14.9, 12.14.11 and 12.14.12).

Reliability of radio communication functions

26   Radio communication functions forming part of the future e-navigation concept should be reliable according to its level of security. It is noted that this opens the possibility of various scenarios.

One example could be the following scenario:

Reliability of radio communication functions			
Functions		**Critical degree**	**Need/requirement**
Tx	Ship-to-shore distress alert	Critical	In case of an emergency all other ways out have probably been considered. Distress alerting and communications are the last source for being rescued. 100% reliability.
Rx	Shore-to-ship distress alert		
Tx/Rx	Ship-to-ship distress alert		
Tx/Rx	SAR communication		
Tx/Rx	On scene comm.		
Tx/Rx	Locating signals		
Tx/Rx	MSI	Noticeable	Sometimes critical
Tx/Rx	General radio communication	Critical in coastal areas	
Tx/Rx	Ship-to-ship communication	Critical	

27   It might be relevant to consider whether a section where the level of reliability is specified should be included in all performance standards for equipment forming part of the GMDSS in the e-navigation concept.

E-navigation and the scoping exercise on the need for the review of the GMDSS

28   COMSAR 14 endorsed the views of the Working Group that the development of e-navigation and the scoping exercise to establish the need for a review of the elements and procedures of the GMDSS should be harmonized and secondly, there should also be an identification of user needs for GMDSS. In addition, further consideration should be given as to which basic communication capabilities should be a part of the developing e-navigation concept (COMSAR 14/17, paragraph 12.14.13).

29   The CG appreciates the scoping exercise to establish the need for a review of the GMDSS is taking place and has noted that COMSAR 15 will discuss further issues on the scoping exercise.

30   One of the core objectives of e-navigation is to facilitate ship-to-ship, ship-to-shore, shore-to-ship and shore-to-shore communications, including data exchange.   There are several areas in this respect where GMDSS may be relevant to these types of maritime communications and hence to e-navigation:

      .1   GMDSS as a data communication network for e-navigation

            GMDSS equipment could be effectively used to increase the reliability of data communications. For example, the use of Fleet 77 fully supports GMDSS and includes advanced features such as emergency call prioritization. It is Internet Protocol (IP) compatible, supports an extensive range of commercially available off-the-shelf software, as well as specialized maritime and business applications. Fleet 77 also ensures cost-effective communications by offering the choice of Mobile Integrated Services Digital Network (ISDN) or Mobile Packet Data System (MPDS) channels and may be used for various web-based applications including: electronic charts download, real-time weather/oceanographic updates, large file transfer, SMS and instant messaging, videoconferencing, store-and-forward video, etc.   F77 enables cost-effective transfer of electronic notices of arrival, crew lists, certificates and records, etc.

            It is noted that moving into future Fleet broadband might have similar, but faster and more cost effective channels for delivery of voice and data both for general communications, especially IP connectivity, and greater bandwidth.

            Key discussions on the implementation of e-navigation should include technical improvements to existing GMDSS MF, HF and VHF equipment, such as moving to digitally-modulated emissions, utilization of high-speed data channels, use of SDR (Software Defined Radio) and, – applying IP technology to the GMDSS;

      .2   GMDSS as a provider of Maritime Safety Information

            The existing procedures and protocols currently in place as part of the World-Wide Navigational Warning Service (WWNWS) offer good examples of shore-to-ship structures, with a clearly defined scope, containing elements of collection, exchange, integration, presentation and analysis. In this regard, the provision of Maritime Safety Information (MSI) has the potential for tangible benefits. It is well recognized that the MSI provides navigational and meteorological warnings, meteorological forecasts and other safety-related messages crucial for safe navigation. However, although MSI has many current strengths, it also provides opportunities for improvement.

            When looking at what e-navigation may provide in the future, an improved network of storage, sharing and distribution of MSI should be identified as a key requirement. For example, the automatic integration and the display of NAVAREA Warnings, NAVTEX messages, etc., on ECDIS displays, using layering techniques, could be identified as an objective worth considering. This issue is also included in the e-navigation CG gap analysis.

            Another core objective of e-navigation is to support the operation of contingency response, and search and rescue services, which needs to be harmonized with the GMDSS;

.3   The Role of GMDSS in Search and Rescue Operations

The establishment of an efficient SAR function largely depends on an automated data network connecting all stakeholders in SAR intervention, including improved communication between RCC and shore-based, sea-based and air-based entities. By using the existing nine functional requirements of GMDSS, SAR authorities ashore as well as shipping in the immediate vicinity of an incident (e.g., a vessel in distress), could be rapidly alerted to a distress situation so that they may assist with minimum delay. Without "reinventing the wheel", technical improvement of the existing GMDSS equipment and further use of this equipment provides a cost-effective option for meeting identified e-navigation objectives.

Full advantage of the automated and standardized ship reporting function could be exploited using the GMDSS communication network. In this regard, it is essential to consider adequate bandwidth, reliability, standards of communication technology, etc., as an integral part of e-navigation. Clearly it is vitally important that the integrity of GMDSS is not jeopardized.

It is noted that GMDSS compliant equipment could be very flexible, and could become even more flexible as development continues.

31   The CG is of the view that there could be need for a possible convergence between the scoping exercise to establish the need for a review of the GMDSS and the work to progress e-navigation. COMSAR should therefore consider how the process of the scoping exercise of the GMDSS and the development of e-navigation might be harmonized.

Inputs and comments to the initial gap analysis from the members of the CG

32   Since NAV 56, the CG has given its relevant comments to the initial gap analysis, which should apply to all SOLAS ships. The basis for the work has been the user needs as described in annexes 2, 3, 4 and 5 to document NAV 56/WP.5/Rev.1. In annex 7 of that same report, the new Terms of Reference (ToR) were described, and the CG was asked to take special note of paragraph 2 of annex 7 concerning the gap analysis which states:

"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;"

33   A standard format was introduced to enhance the further process on the gap analysis. The "Stakeholder GAP analysis" template, which had been presented as annex 6 to document NAV 56/WP.5/Rev.1, was used as the format for new issues identified, but also used as a tool to standardize the presentation of the gap analyses. The CG has also received an enhanced version of the submission from the Republic of Korea: NAV 56/INF.10, which was taken into account for the gap analysis.

34   Seven Member States, IHO and IALA submitted their inputs to the initial gap analysis. These were summarized in a standardized way trying to identify as specific and focused topics as possible, 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 CG, and the result is presented in annex 1: Gap analysis, shipboard; annex 2: Gap analysis, shore-based; annex 3: Gap analysis, SAR, of this document.

35   These annexes 1, 2 and 3 are based on user needs as identified in document NAV 56/WP.5/Rev.1: annex 2: Shipboard user needs and priorities; annex 3: Shore-based user needs; annex 4: SAR Authority user needs for e-navigation and annex 5: Existing systems and new communication technologies supporting user needs and complying with equipment performance standards. The user needs described in annex 5 will be further developed, but has to some extent also been included in the initial gap analysis undertaken for COMSAR 15.

36   The initial gap analysis is presented in seven categories.

For each category the corresponding user needs are given:

    .1   Information/Data Management.

        .1   Common Data Structure/Harmonized Data Format. User needs:

            .1   user-selectable presentation of information received via communication equipment;

            .2   maritime safety information (MSI);

            .3   standardized and automated reporting;

            .4   reduction of administrative burden and increase use of electronic documentation;

            .5   automated updating of base line data and documents; and

            .6   alert management.

        .2   Improved reliability and indication of reliability.

           User needs:

            .1   indication of reliability;

            .2   improved reliability; and

        .3   Nautical charts and publications according to SOLAS chapter V.

           User needs:

            .1   automated updating of base line data and documents; and

            .2   effective and robust communications.

    .2   Effective and robust voice communication and data transfer.

        User needs:

        .1   effective and robust communications.

.3   Navigational bridge systems and equipment.

    .1   Improved ergonomics, standardization and alert management.

        User needs:

        .1   improved ergonomics;

        .2   standard interface; and

        .3   alert management.

    .2   Presentation of information received via communication equipment (e.g., MSI) on the navigational displays.

        User needs:

        .1   user-selectable presentation of information received via communication equipment; and

        .2   maritime safety information (MSI).

    .3   Documents in electronic form and automated updates of information.

        User needs:

        .1   reduction of administrative burden and increase use of electronic documentation;

        .2   automated updating of baseline data and documents; and

        .3   effective and robust communications.

.4   Ship reporting.

    User needs:

    .1   Standardized and automated reporting.

.5   Training and familiarization.

    User needs:

    .1   Familiarization requirements.

.6   Traffic monitoring.

    User needs:

    .1   Related user needs (NAV 56/WP.5/Rev.1, annex 3).

.7   SAR.

User needs:

.1   SAR should have access to relevant information contained within the e-navigation domain;

.2   effective communication and information sharing;

.3   priority for distress communications; and

.4   SAR Authorities need access to the details of all relevant onboard communication equipment and capabilities.

For a comprehensive presentation the complete initial gap analysis is attached in annexes 1, 2 and 3.

37   The issues of relevance to COMSAR 15 may be found in category 1.1: Common Data Structure/Harmonized Data Format, 1.2: Improved reliability and indication of reliability, 2: Effective and robust voice communication and data transfer, 3.2: Presentation of information received via communication equipment (e.g., MSI) on the navigational displays, 3.3: Documents in electronic form and automated updates of information, 7: SAR.

38   As the CG on e-navigation has further developed the initial gap analysis, it has been important to take into account the human element throughout the process, focusing on technical, regulatory, operational and training aspects, recognizing that these aspects are inter-related and need to be considered in a coordinated manner.

Technical GAP analysis

Identifying the capabilities and properties of existing systems with the architectural requirements needed to meet the identified user needs. The result will enable technical solutions to be found.

Regulatory GAP analysis

Identifying gaps in the present regulations and performance standards that need to be addressed. This analysis will be used to consider changes to existing regulations or performance standards.

Operational GAP analysis

To establish whether existing technology and systems can be adopted to meet the e-navigation user needs and enhance operations.

Training GAP analysis

To analyse what measures need to be taken to ensure that individuals, who are entrusted with its operation, receive an appropriate level of instruction to use any technology or systems introduced as a component of e-navigation.

39   For the user needs relevant to COMSAR the gap analysis might be further developed by COMSAR 15.

Actions requested of the Sub-Committee

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

> .1   with respect to the navigating navigator and the monitoring navigator scenarios, how would this influence the user needs on communications?
>
> .2   advise on the recommendations for creating a framework for data access and information services under the scope of SOLAS, where IHO's S-100 data model should be considered as a baseline, as an important element in the e-navigation concept;
>
> .3   advise whether 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;
>
> .4   consider whether existing functional requirements for radiocommunication equipment should be further developed, in order to simplify, modernize, harmonize and integrate radiocommunication functions with relevant navigational functions, in line with the principles of the e-navigation concept;
>
> .5   consider the convergence between the scoping exercise of the GMDSS and the work to progress e-navigation; and how the process of the scoping exercise of the GMDSS and the development of e-navigation could be harmonized; and
>
> .6   further develop the gap analysis for the user needs relevant to the Sub-Committee's work.

***

ANNEX 1

INITIAL GAP ANALYSIS – shipboard users

STRUCTURE

Information/Data Management

- Common Data Structure/Harmonized Data Format

- Improved Reliability and Indication of Reliability

- Nautical Charts and Publications according to SOLAS chapter V

Effective and Robust Voice Communication and Data Transfer

Navigational Bridge Systems and Equipment

- Improved Ergonomics, Standardization and Alert Management

- Presentation of Information Received via Communication Equipment (e.g., MSI) on the Navigational Displays

- Documents in Electronic Form and Automated Updates of Information

Ship Reporting

Training and Familiarization

INFORMATION/DATA MANAGEMENT

Common Data Structure/Harmonized Data Formats	Key Elements	Core Objectives
Related User Needs (NAV 56/WP.5/Rev.1, annex 2): − 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	MSC 85/26/Add.1 [1],[3],[5],[7]	MSC 85/26/Add.1 [3],[5],[7],[8],[10]

GAP	COMMENTS
Technical (Hardware, Software, Equipment, Links, Data Structure)	
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.	May result in decreased ship–shore data volume. Standardized data formats for single and/or automated entry for any required reporting information into the system for it to be shared by authorized authorities without further intervention by the ship.
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.	

Regulations/Standards	
Lack of international standards for navigation data formats.	International standards for navigation data formats need to be adopted and adhered to for the long term.
Lack of international standards for navigation data formats and water level and current information as well as a standard for dates.	International standards for navigation data formats and water level and current information need to be adopted and adhered to, as well as a standard for dates. This is critical for both under keel and overhead clearances.
Lack of interface standards for status of equipment.	
Operational (Procedural)	
Training (Human Element)	

Improved Reliability and Indication of Reliability
 	
Related User Needs (NAV 56/WP.5/Rev.1, annex 2):
  − Indication of Reliability
  − Improved Reliability
	Key Elements
	MSC 85/26/Add.1
	[1],[2],[4], [7]
		Core Objectives
		MSC 85/26/Add.1
		[1],[6],[7], [8]

GAP	**COMMENTS**	
Technical (Hardware, Software, Equipment, Links, Data Structure)		
Lack of effective and harmonized means for assessment of the accuracy and plausibility of indicated information.	INS performance standards MSC.252(83) cover requirements for validity, plausibility, latency, integrity and redundancy.	
Control of software and hardware updates is not sufficient.	A review needs to be undertaken of the effectiveness of existing measures such as type approval, and in particular whether for some systems there should be a need for revalidation or renewal of type approvals. Updates should be done at predefined standard time increments or ASAP when an urgent requirement is identified.	
Interoperability of systems and sensors is not realized.	Interoperability of systems and sensors provides verification of information from systems and sensors. INS performance standards MSC.252(83) addresses interoperability of systems and sensors.	
Lack of effective ways to indicate levels of reliability.	Graphical representation, e.g., ellipses of uncertainty, colour or shading changes, could be used. Consequent application of HEAP process. An example could be accuracy in terms of error ellipses generated by different navigation systems/techniques.	
Lack of self-checking functionality of the electronic equipment.	The checking function by Mariner should be transferred to self-check the electronic equipment. Self-checking function of each equipment should be included in standards; interface standard should be revised to include this functionality.	

	Checking result can be displayed on new navigational display system regularly. Provisions for "Built-in-integrity-test", which should be auto-activated as soon as the equipment is switched "on" and then at pre-set intervals or at the discretion of user.
Insufficient reliability of position fixing systems.	INS performance standards MSC.252(83) cover requirements for validity, plausibility, latency, integrity and redundancy. The "confidence level" could be displayed in terms of "traffic lighting" as in the case of RAIM-enabled GPS/DGPS. A facility is needed within electronic navigation systems (currently ECDIS) to efficiently and effectively enable the manual input of lines of position from radar (ranges and bearings) and from a gyro compass (bearings to fixed objects) to enable comparison with GNSS position inputs and to allow the system to continue to navigate safely when undertaking coastal navigation in the event of GNSS denial, for whatever reason.
Absence of structured communication link to notify anomalies and malfunctions of shipboard navigational systems such as ECDIS.	Pertains hardware and software.
Regulations/Standards	
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).	Circular for modular concept (SN.1/Circ.274). INS performance standards MSC.252(83) addresses interoperability of systems and sensors.
Operational (Procedural)	
Lack of assessments to quantify reliability parameters (e.g., specific assessment of electronic position fixing systems).	

Training (Human Element)	
	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.	- Application of the HEAP process - Familiarization material - Training requirements for new systems
Training for standardized status information is necessary.	

Nautical Charts and Publications	Key Elements	Core Objectives

Related User Needs (NAV 56 /WP.5/Rev.1, annex 2):
  − Automated Updating of Base Line Data and Documents
  − Effective and Robust Communications
	MSC 85/26/Add.1
	
	[3],[5],[6],[7]
		MSC 85/26/Add.1
		
		[1],[3],[4],[5],[7],[8],[10]

GAP	COMMENTS
Technical (Hardware, Software, Equipment, Links, Data Structure)	
ENC coverage is inadequate.	For those diminishing number of areas where ENC is not available, the IMO performance standards for ECDIS states that where ENCs are not available, "Raster Navigational Chart" (RNC) may be used in ECDIS to meet carriage requirements. However, when the ECDIS is using RNCs it should be used together with an appropriate folio of up to date paper charts. Note that RNCs are not accepted by all Maritime Safety Administrations. For some time to come there will also be some areas where electronic position fixing is not possible because of the lack of source survey information and appropriate geodetic control. Global zone maps of inadequate coverage areas should be made accessible to the mariner. Until new surveys are completed and appropriate geodetic control established chart coverage for some areas will remain inadequate. The use of electronic position fixing within these areas will be severely limited and recourse to traditional relative means to navigation will be necessary.
Lack of timely delivery of ENCs and updates via internet.	This is already being implemented by some service providers. Definition of timely. Weekly, monthly, as required due to importance of information? The IHO should make the decision. Timely delivery of ENCs and updates via multiple means of delivery, including the Internet to maximize the number of mariners capable of receiving updates and to provide redundant means of delivery. This is already being implemented by some service providers. Take up is limited by the availability and cost of bandwidth on board vessels.

Lack of digitized nautical publications (Pilots, tide tables, light list, etc.).	IHO is already developing appropriate S-100 based standards. Expected to be finalized after S-101. High Definition bathymetry: Available water depth must be improved to existing sources (charts and ENC) and we should aim to high definition bathymetry concept. Now this appears in "Ship's draught relation to available water depths", but this user need must stand by itself as it is also to squat and under keel clearance. Sedimentation variation should be included. Ice coverage: For forecast, some areas are covered by dynamic systems; database and web service under development; mean to disseminate via wireless internet exist; no international standard for navigation yet, but IHO proposed S10x is providing an umbrella for it. Overhead clearance: for fix structure the situation is the same as water level (refer to the precedent paragraph). For moving structures (like overhead cables) there is no existing technology in place for real time or forecast measure. Currents: some areas are well covered by dynamic systems; database and web service under development; mean to disseminate via wireless internet exist; no international standard for navigation yet, but IHO proposed S10x is providing an umbrella for it. Water level (including tide): some areas are well covered by dynamic systems (predictions, observations, forecasts, interpolation); data base exist; web service exist; and mean to disseminate via wireless internet exist; no international standard for navigation yet, but IHO proposed S10x is providing an umbrella for it.
Lack of real-time tidal data, AIS data and ENC updates.	Tidal data, AIS data and ENC updates to be gradually migrated into providing data in real-time. Additional data and information that is being required in real-time should be defined. The IHO is already developing appropriate S-100 based standards to meet these requirements including the methodology and mechanism for verification of data as well as data quality indicators. Internationally accepted vertical datum or acceptable local dates for inland waters need to be integrated.

Signal security, system security, input security as well as management of access/protocols are insufficient.	IHO is already developing appropriate S-100 based standards. Data security should be built into S-100 compliant ENCs and other nautical navigational products. Input security important so that there is at least some overview of what is going into the system. Even this check will only be as good as the individual overseeing the input.
Lack of navigation charts and publications in digital format.	Most paper catalogue and publications will be changed in digital. Checking INS or ECDIS in digital way. This should include adequate coverage area maps and a list of active, but not yet incorporated updates for each product. This is already provided for in the Performance Standards.
Regulations / Standards	
Lack of standardized symbology.	The IHO already has well established standards for chart and ENC symbols and works in close cooperation with International Electrotechnical Commission (IEC), and IALA to harmonize with non-chart symbols. Does this mean a joint committee? Or does IHO DIPWG just formally accept associate membership from IEC and IALA? If we are speaking solely of ENC symbology then it should be the latter. The Admiralty Chart Symbols Manual is a very good start for the application of electronic symbols in ECDIS. Instead of, seafarers changing their appreciation of new digital symbols, due consideration must be given to change the digital format/electronic footprint of chart symbols.
Lack of definition of parameters for ENC liability.	Liability becomes an important issue if ENC and information from digitized Nautical Publications is disassembled and repackaged in value-added services as part of e-navigation.
Regulation of upgrading of navigation equipment operating systems is missing.	Requires amendments to IMO carriage/maintenance requirements.

Lack of free available electronic charts. Unnecessary complexity introduced by encryption of electronic charts.	To maximize the use of electronic charts. The unity of nations provided by IMO and the e-navigation initiative should be leveraged to encourage nations to remove national laws and policies that require charging for electronic charts. The safety and efficiency benefits of Navigation far outweigh any small revenue streams generated. Further, the complexity introduced by encryption, which is used to protect revenues, adds significantly to the expense, complexity, and undesirability of ECDIS. The pricing of products, etc., is not included in SOLAS. Regarding the cost of ENC's this is, and remains, the responsibility of the Administrations providing them. It is based on national legislation/practice and is not an issue for international organizations.
Operational (Procedural)	
Current design of electronic charts and publications does not provide enough "decisional" support as opposed to "informational" support.	Electronic charts and publications should be redesigned. Electronic charts and publications should not overwhelm mariners with information simply because such information is available. Navigation systems should not be provisioned or used as Geographic Information Systems but as decision support systems. The format and structure of ENCs are considered by the relevant Committees and Working Groups of the IHO. Any requirements for redesign should be raised for consideration within these groups.
Training (Human Element)	
	It has to be ensured that users understand their navigation equipment displays, how all elements of data are displayed (data attributes for example) what they mean, and how to use them efficiently. Users need to be made aware of metadata which may provide better understanding of the data and its accuracy and vintage. Users need to know how to access and assimilate all ancillary data to charts, such as sailing directions, real time water levels bulletins, notices, updates, etc. Users should be versed in how weather patterns and ice conditions affect particular navigable areas, and should have an idea how to read ice charts where necessary.

EFFECTIVE AND ROBUST VOICE COMMUNICATION AND DATA TRANSFER

Effective and Robust Voice Communication and Data Transfer Related User Needs (NAV 56/WP.5/Rev.1, annex 2): – Effective and Robust Communications	**Key Elements** MSC 85/26/Add.1 [1],[2],[3],[5],[7]	**Core Objectives** MSC 85/26/Add.1 [1],[3],[5],[10]
GAP	**COMMENTS**	
Technical (Hardware, Software, Equipment, Links, Data Structure)		
Insufficient reliability of data communications.	- by use of GMDSS equipment, - adaptation of IP technology to GMDSS, - digitization of analogue communication, - application of high speed channels, - by use of SDR (Software Defined Radio)	
Possible lack of bandwidth and unclear assignment of adequate bandwidth for identified e-navigation communication needs.	For identified e-navigation communication needs the provision of adequate bandwidth will be necessary to prevent busy communication channels. Possible lack of bandwidth has to be determined.	
Lack of reliability standards for communication technology.	Means to prevent equipment failure/adequate back-up systems. This may be able to be addressed through revision of relevant IMO standards and a review of the role of type approval activities. Need to define "adequate". The "systems" as indicated in the question is not quite clear. Does this relate to various individual components of e-navigation or is it meant for the ECDIS alone?	
Lack of systems for source and channel management for communication equipment.	Prevention of busy communication channels. Supports the mariner, reduces workload. Easier update of information.	

Lack of technical solutions for processing, filtering of information exchanged via communication equipment.	
Lack of integrated GMDSS equipment.	Integrated GMDSS equipment will result in simplified GMDSS procedures.
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	Description of user need: To clear uncertainty of navigational intension of encountered ships, especially in congested sea area, navigators may need communication means to exchange information between ships with simple and effective way. Pertains hardware and software. AIS Application Specific Messages for ship to ship communication exist. It is enough for simple exchange of navigational intensions between ships. But for more detailed information such as planned route, it is not enough. Seamless and communication mean dependent protocol for exchanging navigation information between ships should be standardized internationally. To use the exchanged information between ships for collision avoidance, some guidelines for the use are needed.
Limited resources for communication infrastructure.	Fully automated data network, where all parties involved in a SAR incident are "connected" is desirable. Consideration should be given to improve communication between assets at sea, air and land and the RCCs. Interoperability and security measures will be very important to make this work.
Absence of structured communication link to notify anomalies and malfunctions of shipboard navigational systems such as ECDIS.	Robust and auditable regulatory framework is needed to communicate anomalies.

Regulations/Standards	
Lack of regulations for communication equipment and systems addressing the identified e-navigation communication needs.	Revision of regulations for communication equipment and systems (incl. GMDSS).
IMO resolutions for navigation and communication are not harmonized.	Comprehensive regulations for navigational equipment are not applicable to communication equipment (related to SOLAS chapter V regulations 15 and 18). Merger and/or transfer of relevant requirements from SOLAS chapter IV to chapter V.
Operational (Procedural)	
Insufficient use of IMO Standard Marine Communication Phrases (SMCP).	Training strategies for increasing the use of IMO Standard Marine Communication Phrases (SMCP) have to be developed. In the absence of an at-sea training regime it is anticipated that a shore based training regime can promote the use of SMCP. If masters are not on the bridge imparting knowledge to the younger seafarers then there are limited remaining mechanisms that can pick up incorrect use of any IMO initiative, be it communications or procedure. There is a wealth of information that is (in the main) largely ignored. Introducing administration staff to some ships would release the master from his administrative responsibilities to the bridge where all these initiatives can be bedded down by the experienced master mariner. This will greatly facilitate greater use of SMCP.
Currently, collecting information pertaining to a distress situation consumes valuable time.	The efficient gathering and exchange of information pertaining to an incident in digital format and on digital displays will allow greater time for essential personal communication with persons in distress. There is a definite need for more accurate and up-to-date digital database information.

Training (Human Element)	
Insufficient training strategies for the use of IMO Standard Marine Communication Phrases (SMCP).	For classroom use. Without an at-sea training regime, classroom activity will only gain a certain amount of traction.
Gaps may appear as new tools and techniques become available for sourcing information.	As e-navigation evolves, and greater amounts of information become available in digital format, SAR training will have to take into account new hardware and software tools.
	Those working with information management systems need to be competent and need to stay current.

NAVIGATIONAL BRIDGE SYSTEMS AND EQUIPMENT

Improved Ergonomics, Standardization and Alert Management
 	
Related User Needs (NAV 56/WP.5/Rev.1, annex 2):
   – Improved Ergonomics
   – Standard Interface
   – Alert Management
	Key Elements
	MSC 85/26/Add.1
	[2],[7],[8]
		Core Objectives
		MSC 85/26/Add.1
		[7],[8],[11]

GAP	COMMENTS	
Technical (Hardware, Software, Equipment, Links, Data Structure)		
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.	Innovations and new technology solutions should concentrate on the needs and capabilities of the users. Application of existing regulations with regard to HMI design for bridge systems.	
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.	Pertains to hardware, software and equipment. Expected technical challenges relating to this gap are mainly about how to establish the consistent and robust methodology of usability evaluation. Ergonomic problems and possible improvements can be found by conducting usability test. Probably, once ergonomic problems are identified, there will not be big technical challenges to improve usability. Mariners must have a say in this.	
Regulations/Standards		
Lack of unified symbology.	MSC.191(79) (Pres. of NAV-related Info on NAV-Displays) and related for Guidelines for the Presentation of Navigation-related Symbols, Terms and Abbreviations (SN/Circ.243) are not applicable for all bridge systems and equipment. Guidelines for unified symbols, terms and abbreviations for all bridge systems should be developed.	

Existing documents (performance standards, guidelines, etc.) with regard to ergonomics are missing harmonization and are seldom applied.	MSC.252(83) (INS), MSC/Circ.982 (Ergonomic Criteria for Bridge Equipment and Layout), SN.1/Circ.288 (Guidelines for bridge equipment and systems, their arrangement and integration (BES), MSC.191(79) (Pres. of NAV-related Info on NAV-Displays), MSC.302(87) (Bridge Alert Management).
Existing documents (performance standards, guidelines, etc.) with regard to ergonomics are not applied for communication equipment and systems (incl. GMDSS).	MSC.252(83) (INS), MSC/Circ.982 (Ergonomic Criteria for Bridge Equipment and Layout), SN.1/Circ.288 (Guidelines for bridge equipment and systems, their arrangement and integration (BES), MSC.191(79) (Pres. of NAV-related Info on NAV-Displays), MSC.302(87) (Bridge Alert Management).
Existing documents (performance standards, guidelines, etc.) for alert management are not applied.	MSC.252(83) (INS), MSC.302(87) (Bridge Alert Management), A.1021(26) (Code on Alerts and Indicators).
Currently, there are no guidelines or guidance for usability evaluation.	For the moment, it might be better to use the usability guidelines, when developed, on a voluntary basis. After accumulating knowledge and experiences, how to use the guidelines in a regulatory context can be considered. In order to improve usability of navigational equipment, consistent and robust usability evaluation is necessary, and therefore, development of the guidelines for usability evaluation of navigational equipment is needed.
Lack of standardization for operation of functions to observe the passage plan.	Most functions to observe the passage plan in cautionary should be operated through the same concept and way even though it can be implemented on e-navigation display for automation. (KOR). This may require a review of the ECDIS performance standard so as to enhance the procedure through which a passage plan is developed and checked.

Operational (Procedural)	
Lack of good human machine interface for the communication means.	The means should be simple, transparent and easy to understand, not to disturb primary look out tasks. Usability test and task analysis is good tool to evaluate the means.
Seafarers sometimes experience difficulties in accessing necessary information because of ergonomic problems.	Onboard users (seafarers) need to obtain necessary navigational information easily. Some of ergonomic problems are caused by design aspects (such as alignment of buttons and how to display information), and some are caused because different products require different operation for the same function (such as choosing a mode and setting alarm conditions). As more information is gathered on board and more integrated equipment is used through implementation of an e-navigation strategy, it is expected that navigational equipment will be more complicated with more information and will be difficult to be used. Thus, ensuring user-friendliness of navigational equipment is one of most important onboard user needs. Seafarers also need to know their equipment be it standardized or otherwise. Standardization is a good idea in itself but not because a seafarer does not know how to use a piece of kit. Manuals must be read and re-read.
Lack in presentation of manoeuvring information/data (engine-room telegraphs) on navigational display.	Manoeuvring information/data should be display effectively and ergonomically on navigational display system. ECDIS or new navigational display system should be developed to provide the function. Training for mariners on use of new navigational display systems necessary. Presentation of manoeuvring information/data is specified in INS performance standards MSC.252(83).

Training (Human Element)	
Bridge layouts, equipment and systems are seldom designed from an ergonomic and user friendly perspective.	Equipment and systems that are self-descriptive, appropriately designed for the task at hand, controllable, compliant with the users' expectations and fault tolerant, reduce the amount of training and familiarization. Training is necessary. However, it can be minimized by using human centred and user-friendly design. Improvement of usability of navigational equipment may reduce workload relating to training of equipment operations. "Design" should be used to minimize the need for training rather than providing more training as a means to overcome poorly designed systems and procedures. e-navigation systems and equipment should be designed so as to require less training in their use rather than improving training to overcome existing difficulty in use.
Difficulties exist for personnel to transfer from ship to ship.	The Human Element is not a stand-alone thing but is, as it should be, embedded in the technical and operational aspects, e.g., alertness, awareness, judgment and decision making. The result of full consideration of Human Element aspects of e-navigation should result in an appropriate level of interesting and meaningful employment for personnel on board and ashore, and the ability for ship based personnel to easily transfer from ship to ship with minimal need for familiarization training. The Human Element aspects could, however, usefully be identified and brought together for training purposes.

Presentation of Information Received via Communication Equipment (e.g., MSI) on the Navigational Displays Related User Needs (NAV 56/WP.5/Rev.1, annex 2): – User-Selectable Presentation of Information Received via Communication Equipment – Maritime Safety Information (MSI)	**Key Elements** MSC 85/26/Add.1 [1],[2],[5],[8]	**Core Objectives** MSC 85/26/Add.1 [1],[7],[8],[11]
GAP	**COMMENTS**	
Technical (Hardware, Software, Equipment, Links, Data Structure)		
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.	NOTMAR and NOTSHIP transmissions could at least flag a position or the relevant affected chart numbers in a vessel's "e-navigation system" and on-board chart catalogue.	
Insufficient network of storage, sharing and distribution of MSI.	- automatic integration and display of NAV Area Warnings, - NAVTEX messages, etc., on the ECDIS display, - using a layering technique.	
Insufficient means for sorting and display of Maritime Safety Information (MSI) such as NAVTEX, SafetyNET.	NAVTEX information is displayed on a separate screen or printed on a scroll of paper.	
Lack of technical solutions for processing, routeing, and filtering of information received via communication equipment to enable transfer of the information to navigational systems.	INS-task concept MSC.252(83) offers flexibility to integrate further information.	
Lack of technical solutions for presenting communication information/Maritime Safety Information (MSI) on navigational displays.	INS-task concept MSC.252(83) offers flexibility to integrate further information.	

Lack of user-selectable and task oriented presentation of information received via communication equipment (including MSI) on navigational systems.	Requirements for task-oriented presentation based on INS-task concept MSC.252(83) should be developed.
Lack of interface messages between sender and receiver for monitoring of local/coastal warning broadcasts/watching GMDSS system (NAVTEX, NAVAREA message).	For monitoring of local/coastal warning broadcasts/watching GMDSS system (NAVTEX, NAVAREA message) new interface message should be defined btw sender and receiver (addition to IEC 61162). Current interface standards should be revised accordingly.
Lack of integrated secondary screen option for digital publications and MSI.	This should be evaluated with minimum cost to shipowners. A layered and user-friendly approach should be taken to cater for the need. The OOW should be able to prioritize information about dangers to the ship.
Regulations/Standards	
IMO resolutions for navigation and communication are not harmonized.	Comprehensive regulations for navigational equipment are not applicable to communication equipment (related to SOLAS chapter V regulations 15 and 18). Merger and/or transfer of relevant requirements from SOLAS chapter IV to chapter V.
Operational (Procedural)	
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.	For example, Navtex broadcast for any submarine exercise area, etc., needs to be displayed on to the ECDIS using "layering technique" and with appropriate display specifications (e.g., colour/shading, etc.) and this should also warn the navigator accordingly so as to avoid the danger.
Unavailability of information in real-time with possible presentation on the navigational display to support bridge operation.	Information overload needs to be prevented. User-selectable presentation of information.
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.	Calling message from pilot should be shown on navigational display. Transmitting ship's information from mariner to pilot should be developed to text message.
Lack of presentation of warning broadcasts on navigation displays.	Monitoring of warning broadcasts/Watching GMDSS system (e.g., Navtex, Navarea message) This procedure can be implemented on e-navigation display together in automatic way.
Lack of information about special berthing requirements on navigation systems.	Information about special berthing requirements available on nav. Systems – Database on ECDIS or New navigational display will be needed to provide berthing requirements. - Port Authority transmits berthing instruction. ECDIS and Digital communication should be developed. Regulation for communication system should be developed.
Lack of real-time environmental information (current, tide, weather) received automatically.	Receiving of environmental information (Current, tide, weather) – Environmental data to be received automatically in realtime on demand is missing. ECDIS and Digital communication should be developed. Regulation for communication system should be developed newly.
Training (Human Element)	
When new means are introduced under the framework of e-navigation adequate training is necessary.	Application of the HEAP process.

Documents in Electronic Form and Automated Updates of Information	Key Elements MSC 85/26/Add.1 [1],[5],[7]	Core Objectives MSC 85/26/Add.1 [3],[7],[8],[10]
Related User Needs (NAV 56/WP.5/Rev.1, annex 2): − Reduction of Administrative Burden and Increase Use of Electronic Documentation − Automated Updating of Base Line Data and Documents − Effective and Robust Communications		

GAP	COMMENTS
Technical (Hardware, Software, Equipment, Links, Data Structure)	
	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 provided in electronic form which was formerly available in printed format should be printable, traceable and auditable.
Information may be difficult to localize in electronic documents.	A search function should be implemented.
Lack of automatic updating of documents.	Automatic updates to support the operator.
Electronic systems can not automatically determine the status of available data and automatically retrieve the most current and comprehensive data.	A standard for a machine-readable electronic catalogue should be developed, adopted, and used by all hydrographic offices.
Regulations/Standards	
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 (Procedural)	
Insufficient indication of information updates.	E.g., indication of information updates with time stamp.
Ineffective access to information.	For operational efficiency information should be accessible from a centralized station.
Lack of automatic update of navigation charts and publications in real-time on demand on ECDIS.	All navigation charts and publications corrected up to date – related data should be received automatically in real-time on demand to the ECDIS.
	ECDIS or new navigational display system should be developed to provide the function. Digital communications should be developed.
	The IHO is already developing appropriate S-100 based standards to achieve this in S-100 based ECDIS equipment.
	This is a good goal, however, as we have seen each ECDIS does things in a different way. Plus, National HOs have the legal liability attached to the products. If this is to be achieved the ECDIS testing and certification must be much more rigorous and include IHO oversight.
	This statement should be clarified. Does this mean sending just data? Or does it mean Auto loading of official ENCs and updating the RENC?
	Notice of available updates should be automatic, but there should be user interaction in loading them to ensure that the update met the advertised intention of the update on the product.
	Many ECDIS providers are uncertain as to the security of linking systems to the outside world.
	The latest chart correction protocol should be immediately apparent to the operator be it OOW, Master or Pilot. Such a protocol would also drive these individual to be cognizant with the change process and where their particular change is up to in relation to that promulgated.

Training (Human Element)	
When new means are introduced under the framework of e-navigation adequate training is necessary.	Application of the HEAP process.

SHIP REPORTING

Ship Reporting	Key Elements	Core Objectives
Related User Needs (NAV 56/WP.5/Rev.1, annex 2): − Standardized and automated reporting	MSC 85/26/Add.1 [1],[2],[3],[5],[7]	MSC 85/26/Add.1 [3],[10]
GAP	**COMMENTS**	
Technical (Hardware, Software, Equipment, Links, Data Structure)		
With the exception of Polling, current system does not provide provision for automatic ship reporting.	The proposed automated ship reporting function, if designed well, will overcome the language difficulty in reporting as well as facilitate navigation by allowing more focus/emphasis for the oncoming traffic and/or abnormal weather condition (e.g., fog). However, the proposed voiceless ship reporting by electronic and information technology, must have provision for error checking by the user. For example, the GPS antenna could be broken, GPS signal could be lost, etc., but the VHF Transceiver or other broadcasting equipment still be getting Fall-back (DR) GPS Input and thus providing erroneous position in the ship reporting. Therefore, before the auto-transmission of the message takes place, the system should alert the watch keeper and also allow to check, verify and enter additional information/comments as appropriate.	
Lack of automated and standardized ship reporting function.	- consider adequate bandwidth, reliability - standards of communication technology	
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).	- Automated communication facilities - Broadband com, possible satellite (GMDSS scooping process)	

Automated entry of internal ship data for reporting (including updates of information) is not available.	System networking for automated entry of internal ship data for reporting (including updates of information).
Communication with pilot could be improved.	Communication with pilot: Ship information should be automatically filled out by digital format and sent before the pilot on board. To fulfil the operational requirement ECDIS or new navigational display system should be developed to provide the function. Digital communications should be developed. Ship's information should be displayed ergonomically on navigational display system.
Insufficient means for ship reporting.	Reporting ship's information to VTS automatically by sending the standard text message. Reporting ship's information to Port Authority automatically without voice. Mariner sends standardized text message, but it is possible to use voice message via VHF. Receiving instruction from P/A or VTS should be provided to text or voice. New s/w implementation on ECDIS or e-navigation display system. When this is done, it is important to ensure through the use of good procedures that there remains no ambiguity about the seafarer's obligations to manually provide reports.
Regulations/Standards	
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).	The IMO reporting instruments, SOLAS regulation V/11, resolution A.851(20), resolution MSC.43(64), as amended. These are partly based on the use of the Morse telegraphy system. - Standardized format, e.g., as FAL forms - Possibility to send reports before departure as an encompassing generic sailing plan - Shore-shore information exchange
Legal aspects regarding access and sharing of reporting information are not solved.	There are also concerns as to how the automatic voiceless electronic information reporting by the ship satisfies the position reporting requirements of the ship for which, in Australia, there can be penal provisions for missing a report.

	The issue here is perhaps not accessing information from ships via INMARSAT-C, AIS or LRIT, it is more a legal protocol that permits a government agency to automatically (and without notice or agreement from the master) pick up the ship in a MDA system and maintain an interest in it beyond sovereign boundaries. This may clash with a commercial interest.
National reporting requirements are not harmonized.	
Lack of standardized reporting formats.	Report format should be standardized. New standard for reporting message and system to operate automatic reporting function.
Operational (Procedural)	
Reporting procedures are not globally standardized.	Example for standardized reporting: Safe Sea Net. Use of AIS and LRIT data should be considered.
The needs to report, for safety, commercial and legislative reasons require time and effort.	Where making reports requires time and effort, then these must be considered in the context of both total and peak workload (applies on board and ashore).
Training (Human Element)	
When new means are introduced under the framework of e-navigation adequate training is necessary.	- Training requirements for new systems - Application of the HEAP process
When standardized reporting formats are introduced adequate training is necessary.	Mariner should be trained on standardized report format and using communication system. There is much guidance already where needed for this. The problem has more to do with English not being the common language despite insistence that English is the language of the sea. Training must be reinforced in the environment for which it was needed – either at sea and/or through the use of simulation.
The design of reporting and administrative activities require too much training in their use.	Reporting and administrative activities should be designed so as to require less training in their use rather than improving training to overcome existing difficulty in use.

TRAINING AND FAMILIARIZATION

Training and Familiarization	**Key Elements**	**Core Objectives**
Related User Needs (NAV 56/WP.5/Rev.1, annex 2): – Familiarization Requirements	MSC 85/26/Add.1 [2],[3],[7]	MSC 85/26/Add.1 [8],[9],[10]

GAP	**COMMENTS**
Technical (Hardware, Software, Equipment, Links, Data Structure)	
Insufficient familiarization material for safety-related equipment.	All safety-related equipment should be provided by manufacturer with familiarization material or tutorials specific to the model and installation. INS performance standards (MSC.252(83)) provides example for specification of familiarization material.
Current training regime does not go far enough to specify type specific training needs for seafarers.	Development of common features for complex navigational system such as ECDIS. Absence of aviation type common operational features for complex systems such as ECDIS. Seafarers would prefer to deal with common operational features for complex navigational systems.
Regulations/Standards	
Lack of specifications of familiarization material for new and existing performance standards.	The IMO guidelines for application of the modular concept to performance standards (SN.1/Circ.274) should be taken into account. INS Performance Standard (MSC.252(83)) provides example for specification of familiarization material. Familiarization material should be required to be provided by the manufacturer.
Current training regime does not go far enough to specify type specific training needs for seafarers.	Establish auditable regulatory framework.

Operational (Procedural)

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 (Human Element)

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.	A "Training-Need-Analysis" must be done to accommodate various types of training need. According to the e-navigation strategy, the service and associated requirements of e-navigation will be differentiated between types of vessel and their operation. This will cause potentially different watch keeping requirement based on ship type (e.g., ferries, cruise ships, fishing vessels, leisure vessels, etc.), voyage length (e.g., coastal, high seas, etc.), location (e.g., port, traffic separation scheme, arctic, etc.) etc. Also the e-navigation system architecture itself needs to fulfil the widely varying requirement to deliver the appropriate level of services.
When new means are introduced under the framework of e-navigation adequate training is necessary.	- Training requirements for new systems - Application of the HEAP process
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.	

General issues to be considered with regard to regulations

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.	A review needs to be undertaken of the effectiveness of existing type approval processes, and in particular whether for some systems there should be a need for revalidation or renewal of type approvals.
Regulations for new navigational display systems should be standardized.	

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ANNEX 2

INITIAL GAP ANALYSIS – shore-based users

STRUCTURE

Information/Data Management

      – Common Data Structure/Harmonized Data Format

      – Improved Reliability

Robust Communication

Systems and Equipment

      – Presentation of Information

Training and Familiarization

Ship Reporting

Traffic Monitoring

INFORMATION/DATA MANAGEMENT

Common Data Structure/Harmonized Data Formats

Related User Needs (NAV 56/WP.5/Rev.1, annex 3):

- – Effective and robust communication
- – Collection of information
- – Provision of information to vessels
- – Shore-to-shore information exchange

GAP	COMMENTS
Technical (Hardware, Software, Equipment, Links, Data Structure)	
Lack of a common maritime information/data structure harmonizing the policies for the security and use of data.	COMSAR 14/WP.6 Policies for the security and use of data in harmonized maritime information/data structures should be developed.
Insufficient identification of harmonization needs for standards, formats and protocols.	Identify the timeline required to do this.
Tools that have the capability to manage increased levels/volumes of information are not in use.	Identify the sources and ownership of information to be managed.
Regulations/Standards	
Lack of protocols, formats and data structure that enable shore based authorities to exchange information with other authorized shore based users.	The outcomes of the recent e-navigation data framework workshop held at the IHB are relevant to this activity.
Inconsistent rules that require some coastal states to maintain domain awareness.	Identify what constitutes "domain awareness". The rules that require some coastal states to maintain Maritime Domain Awareness (MDA) should be identified.

	Different countries will have different perceptions of what is important for them and may not wish to openly share this. In many respects, what a country looks at (or does not look at) in an UNCLOS/RESTRICTED environment does give a suggestion as to what is strategically important (and therefore sensitive) for them.
Operational (Procedural)	
Training (Human Element)	

Improved Reliability

Related User Needs (NAV 56/WP.5/Rev.1, annex 3):

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GAP	COMMENTS
Technical (Hardware, Software, Equipment, Links, Data Structure)	
Regulations/Standards	
Operational (Procedural)	
Training (Human Element)	

ROBUST COMMUNICATION

Robust Communication	
Related User Needs (NAV 56/WP.5/Rev.1, annex 3): – Effective and robust communication	
GAP	**COMMENTS**
Technical (Hardware, Software, Equipment, Links, Data Structure)	
There is a gap between information capability of current information management systems and those that will be required as volumes of information increases.	It is assumed that enhanced Maritime Domain Awareness (MDA) means more contacts to manage in terms of position, course and speed (or dynamic AIS data). Sub menus could capture additional information such as type of vessel, etc., from AIS static data input. As the volumes increase, so too will the need to identify exactly what information is required. Introduction of a mechanism that categorizes information on a priority basis such as: essential, important, routine, etc., should be established.
Regulations/Standards	
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.	Reference is made to communication with other ships by VHF during collision avoidance action – although there are warnings (e.g., from the UK MCA) against this due to the problems of confusion of ship identity, distraction through focusing on radio communications, and the tendency for local agreements outside of the COLREGs. References to operations in Arctic areas should now also refer to Antarctic areas, combining them if appropriate into polar areas. Whilst the role of ship to shore communication as a source of information to enhance safety of the ship is important, the role of shore to ship communication should not be neglected as an equally important source of safety enhancement.
Operational (Procedural)	

Training (Human Element)	

SYSTEMS AND EQUIPMENT

Presentation of Information	
Related User Needs (NAV 56/WP.5/Rev.1, annex 3): − Management of information − Provision of information to vessels	
GAP	**COMMENTS**
Technical (Hardware, Software, Equipment, Links, Data Structure)	
Insufficient delivery and presentation of maritime information that shore based authorities are required to provide to ships.	The commercial imperative also needs to be kept at the forefront of any shore based initiative such that trade is not unnecessarily impeded. Not necessarily improved, but it must meet requirement for content and timeliness.
Insufficient collection of data required to establish accurate marine domain awareness.	IMO Strategy (Section 8.2)
Regulations/Standards	
Operational (Procedural)	
Lack of harmonized presentation of domain awareness to improve situational awareness for allied and other support services.	
Training (Human Element)	

TRAINING AND FAMILIARIZATION

Training and Familiarization
Related User Needs (NAV 56/WP.5/Rev.1, annex 3):

GAP	COMMENTS
Technical (Hardware, Software, Equipment, Links, Data Structure)	
Regulations/Standards	
Operational (Procedural)	
Training (Human Element)	
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.	The shore organizations are not part of SOLAS regulations, hence it is of concern on how the training need for shore based users (e.g., Pilot, VTS operators, etc.) will be implemented and enforced.

SHIP REPORTING

Ship Reporting	

Related User Needs (NAV 56/WP.5/Rev.1, annex 3):
  – Collection of information
  – Management of information
  – Shore-to-shore information exchange	

GAP	**COMMENTS**
Technical (Hardware, Software, Equipment, Links, Data Structure)	
Regulations/Standards	
Operational (Procedural)	
The needs to report, for safety, commercial and legislative reasons require time and effort.	Where making such reports requires time and effort, then these must be considered in the context of both total and peak workload (applies on board and ashore).
Training (Human Element)	

TRAFFIC MONITORING

Traffic Monitoring	
Related User Needs (NAV 56/WP.5/Rev.1, annex 3):	
GAP	**COMMENTS**
Technical (Hardware, Software, Equipment, Links, Data Structure)	
Tools that have the capability to manage increased levels/volumes of information are not in use.	Identify the sources and ownership of information to be managed.
Insufficient delivery and presentation of maritime information that shore based authorities are required to provide to ships.	Please Clarify – which information specific to traffic monitoring. [Delivery and presentation of maritime information that shore based authorities are required to provide to ships must] Not necessarily [be] improved, but it must meet requirement for content and timeliness. In the Initial GAP Analysis Annex (dated 23/8/10) there is frequent mention of communication which is generally described as being from the ship to the shore. This needs to be adjusted so that references to communication captures the need for there to be appropriate shore to ship communication, which is necessary to give the ship the information it needs to operate safely and efficiently.
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.	IEC standards/IMO Performance Standards for onboard equipment. Monitoring of quality of shipboard navigational system should be covered under the existing Flag/Port State Control inspection regime. The need to keep systems up to date and the role of type approval may need revision.

Regulations/Standards	
Lack of protocols, formats and data structure that enable shore based authorities to exchange information with other authorized shore based users.	The outcomes of the recent e-navigation data framework workshop held at the IHB are relevant to this activity.
Operational (Procedural)	
Lack of harmonized presentation of domain awareness to improve situational awareness for allied and other support services.	The outcomes of the recent e-navigation data framework workshop held at the IHB are relevant to this activity.
Training (Human Element)	

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ANNEX 3

INITIAL GAP ANALYSIS – Search and Rescue

SAR
 	
Related User Needs (NAV 56/WP.5/Rev.1, annex 4):
   – 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
	Key Elements
	
	[1],[2],[3],[4],[5],
	[6],[7],[8]
		Core Objectives
		
		[1],[3],[5],[10],[11]

GAP	**COMMENTS**	
Technical (Hardware, Software, Equipment, Links, Data Structure)		
Lack of mechanisms to provide SAR (RCC) function with the full range of relevant e-navigation information in digital format.	In the shift from voice communication towards digital communication needs, the priority for distress communication should be maintained. The continued need for voice and analogue communication for RCCs should be taken into account during the development of e-navigation.	
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.	Issues of interoperability and security will be critical to the functioning of the system.	
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.	There is a danger in constraining RCCs to use only digital data. It must be noted that not all RCC will be capable of handling digital data in the short term.	

Currently, collecting information pertaining to a distress situation consumes valuable time.	The efficient gathering and exchange of information pertaining to an incident in digital format and on digital displays will allow greater time for essential personal communication with persons in distress.
	There is a definite need for more accurate and up-to-date digital database information.
Potential loss of priority for distress communication.	The move to digital communications needs to be managed to ensure that the distress communications continue to receive priority.
	Addressing this issue will require work at forums such as IMO, ITU and IEC.
Regulations/Standards	
Lack of solutions for maintaining priority for distress communication.	Solutions for maintaining priority for distress communication should be worked out with the involvement of IMO, ITU and IEC.
	Solution will require procedure for activation of priority messages.
Insufficient implementation of SAR facilities.	Implementation of SAR facilities should be strengthened through IMO administrative (Voluntary IMO Audit Scheme) VIMSAS scheme.
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".	Consideration ought to be given to strengthening the implementation of SAR facilities through IMO administrative (Voluntary IMO Audit Scheme) VIMSAS scheme.
	Use to be made of best practices and common formats.
Operational (Procedural)	
Insufficient support of the use of LRIT data for SAR.	The increasing use of LRIT data for SAR should be supported.
	AIS data as well as AIS satellite data may be included.
Insufficient access to and quality of information from ships in distress.	Ways should be found to improve access to and quality of information from ships in distress "Less search, more rescue".

Lack of an effective SAR system in some parts of the world.	Many national RCCs in the foreseeable future will need the ability to source information in analogue format.
Lack of adequate number of trained personnel.	In the foreseeable future, information coming in from the On Scene Coordinators will come across on a voice rather than a data link.
	It should be noted during the development of e-navigation that these limitations are to be taken into account so as not to diminish the effectiveness of SAR services.
	The use of LRIT data for SAR purposes is increasing.
	AIS data and AIS data via satellite should not be excluded!
	Access to better information from ships in distress will reduce uncertainly in the rescue phase (i.e. "Less search, more rescue").
Training (Human Element)	
Insufficient training in correct use and activation of priority messages.	Establish procedure for activating priority messages.
	Ensure training is provided for correct use and activation of priority messages.
Lack of access to the details of all relevant onboard communication and capabilities for SAR authorities.	Solutions should be found to give SAR authorities access to the details of all relevant onboard communication and capabilities.
Gaps may appear as new tools and techniques become available for sourcing information.	As e-navigation evolves, and greater amounts of information become available in digital format, SAR training will have to take into account new hardware and software tool.
Ships manning does not take account of the potential of SAR, and also of the practice for SAR.	The stress and confusion of a real SAR, whether assisting or in need of assistance.

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