**DEVELOPMENT OF AN E-NAVIGATION STRATEGY IMPLEMENTATION PLAN**

**Draft report from the Correspondence Group on e-navigation to NAV 57.**

**Version 2: 13.03.2011.**

**Questions to CG marked in red.**

**Background.**

1The Maritime Safety Committee at its 85.session approved the Strategy for the development and implementation of e-navigation, and then at its 86.session approved a proposal for a coordinated approach to the implementation of the e-navigation strategy. The proposal outlines a joint plan of work for the NAV, COMSAR and STW Sub-Committees for the period 2009-2012. According to the plan NAV 56 finalized the user needs, the initial system architecture, and completed an initial gap analysis, initial cost benefit and risk analysis, taking into account the recommendations of COMSAR 14.

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

3 Norway would like to thank the following Member States, intergovernmental organizations, governmental and non-governmental organizations for their participation in the correspondence group: Argentina, Australia, Bahamas, Belgium, Brazil, Bulgaria, Canada, Chile, China, Cote d’Ivoire, Denmark, Finland, France, Germany, Ghana, Greece, India, Ireland, Italy, Japan, Kenya, Republic of Korea, Marshall Islands, The Netherlands, Nigeria, Philippines, Poland, Portugal, 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.

**Terms of reference for the re-established correspondence group**

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

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

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

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

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

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

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

**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.**

5 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 Correspondence Group;

It is an objective of the e-navigation work program to develop an overall conceptual, functional and technical architecture, particularly in terms of process description, data structures, information systems, communication technology and regulations (MSC86/23/4).

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.

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

7 At NAV 56 it was agreed to organize a work shop on these issues. The work shop took place 4-5 November 2010 at the headquarters of the International Hydrographic Organization in Monaco, 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 work shop has been submitted to the CG.

8 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).

9 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.

10 COMSAR 15 (March 7-11, 2011) endorsed that IHO's S-100 data model should be used as a baseline for creating a framework for data access and information services under the scope of SOLAS; and also that IMO, in consultation with other organizations, should consider the establishment of a Harmonization Group on creating a framework for data access and information services under the scope of SOLAS, based on the example of the IMO/IHO Harmonization Group on ECDIS including the draft Terms of Reference for the IMO/IHO Harmonization Group on Data Model (HGDM) (Annex 1 of this document, and COMSAR 15/WP6:Annex 1).

The CG is invited to give its comments on the draft Terms of Reference for the HGDM.

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11 The sending and reception of e-navigation data from ships may have an influence on shore based data and services. Does the CG have any concerns in this regard?

12 In the view of the CG this framework for data access and information services under the scope of SOLAS adds to the various components of the e-navigation architecture previously endorsed by COMSAR 14 and NAV 56, further completing the final conceptual architecture, and adding important principles to the functional and technical architecture.

The CG still takes into account that the outcome of various analyses (gap, cost-benefit and risk) might eventually lead to further development of the proposed architecture for e-navigation.

The architecture elaboration process was illustrated by the following figure in the report from the CG to NAV 56: NAV 56/8, Annex 1, page 9. (Figure 1) The annex also presented the functional decomposition related to defined roles and responsibilities.



**Figure 1: The e-navigation architecture elaboration process**

Figure 1 illustrates the architecture specification process, and the figure is explained in the

following.

**The scope and content of e-navigation (area A and B):**

Area A and B in the figure addresses the premises for the architectural work:

 The scope of e-navigation is defined by means of the responsibilities that

are considered as a part of e-navigation (area A)

 User needs are captured and assessed (area B)

As indicated by the red events in the figure, the specification is an iterative process. New

responsibilities may at any time be defined to be a part of the e-navigation concept (e.g., due to policy decisions or due to a more mature definition of e-navigation) and, in the same way, new user needs may emerge (e.g., needs detected during the work on the architecture or provided by other sources).

**Functions (area 1)**

Area A will as mentioned above define responsibilities, and a role represents a unique and generic set of such responsibilities. A stakeholder (a person or an organization) may have several different responsibilities (roles), and a stakeholder with a role accounts for functions (or activities) contributing to the fulfilment of the responsibilities of the role. In area 1 the functions of the roles related to e-navigation are identified.

**Processes (area 2)**

The functions identified in area 1 may require input and they may also generate output. The input and the output will be provided from or delivered to other functions, functions belonging to other roles included. Thus, the functions belong to processes. Several roles may be involved in a process, and there may be interactions between functions belonging to different roles.

The specifications of the processes are important for more reasons:

 The required interactions are identified.

 Missing functions and insufficient function descriptions can be detected (feedback

must be provided to area 1, as indicated in the figure).

 The process descriptions may expose cumbersome procedures and facilitate

assessments and, if required, reengineering of the processes. New technology

may for example be utilized to simplify procedures.

 In case of reengineering, harmonization of interactions should be considered

(to reduce the number of different interfaces).

**Information elements (area 3)**

The required information elements are identified and specified based on the functions that are to be carried out and the required interactions.

The user needs (from area B) may also address information needs. Note that additional user needs may emerge leading to the identification of new information needs.

The same information elements may be required by many functions and in many

interactions. Thus, the naming of the information elements and the specification of the

information content should be harmonized across the whole e-navigation concept.

**Information exchange interfaces (area 4)**

The interactions between the functions identified in the process descriptions (see area 2) are defined by means of the information elements (see area 3). Information elements are

combined into specifications of the content of the information that is exchanged (i.e. the

information exchange interfaces), e.g., between on-board and on-shore systems. In this way the interactions are defined in a precise, but technology independent way.

**Service requirements (area 5)**

The process description from area 2 (functions and interactions) and the information

exchange interfaces from area 4 (how to interact) are together with user needs from area B the basis for the specification of ICT services (i.e. the functionality of the ICT solutions). This includes both end-user services and services provided to other systems (e.g., single window services). Thus, user interface, Information validation and processing, communication requirements (use of the interfaces from area 4), etc., must be specified.

**Technical architecture (area 6)**

The technical architecture will specify the implementation of the ICT services (see area 5), i.e. the systems, the system components, the communication, etc. Different options could exist for technical realization of interactions and relevant system components. A technical assessment process is necessary to select the best choice of technical realization, e.g., need for redundancy.

How should one proceed to finalize the architecture elaboration process?

**Further analyses for navigation and related shore-based services issues.**

**The gap analysis.**

13 COMSAR 14 and NAV 56 endorsed the proposed methodology for carrying out the gap

analysis.

14 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 Annex 2, 3, 4 and 5 of NAV 56/ WP5/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 p.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;”

15 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. For this reason the CG has proposed that the sequence of the four elements should be: operational, technical, regulatory and training, recognizing that these elements are inter-related and need to be considered in a coordinated manner.

16 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 NAV 56, WP5/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 (Republic of Korea) which was taken into account for the gap analysis.

17 Inputs from the CG 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 was presented in the report of the CG to COMSAR 15. (COMSAR 15/11, Annex 1: Gap analysis, ship board; Annex 2: Gap analysis, shore based; Annex 3: Gap analysis, SAR).

18 These annexes are based on user needs as identified in NAV56/WP.5 REV1: Annex 2:

Ship board 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 NAV56/WP.5REV1:Annex 5 will be further developed, but have to

some extent also been included in the initial gap analysis undertaken for COMSAR

19. The initial gap analysis is presented in seven categories.

.1 Information/Data Management.

.1 Common Data Structure/Harmonized Data Format.

Summarized User needs:

.1 User-selectable presentation of information received via communication equipment.

.2 Marine 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.

.6 Alert management.

.2 Improved reliability and indication of reliability.

Summarized User needs:

.1 Indication of reliability.

.2 Improved reliability.

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

Summarized User needs:

.1 Automated updating of base line data and documents.

.2 Effective and robust communications.

.2 Effective and robust voice communication and data transfer.

Summarized User needs:

.1 Effective and robust communications.

.3 Navigational bridge systems and equipment.

.1 Improved ergonomics, standardization and alert management.

Summarized User needs:

.1 Improved ergonomics.

.2 Standard interface.

.3 Alert management.

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

Summarized User needs:

.1 User-selectable presentation of information received via communication equipment.

.2 Marine safety information (MSI).

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

Summarized User needs:

.1 Reduction of administrative burden and increase use of electronic documentation.

.2 Automated updating of baseline data and documents.

.3 Effective and robust communications.

.4 Ship reporting.

Summarized User needs:

.1 Standardized and automated reporting.

.5 Training and familiarization.

Summarized User needs:

.1 Familiarization requirements.

.6 Traffic monitoring.

Summarized User needs:

.1 Related user needs (NAV 56/WP.5/Rev.1.Annex 3.

.7 SAR.

Summarized 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.

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

For each category the corresponding user needs are given as well as proposals for filling the gaps.

20 At COMSAR 15 the Sub-Committee endorsed that e-navigation could provide the necessary data/information for SAR purposes and keep SAR within the scope of the e-navigation concept

(COMSAR 15/WP.6, Paragraphs 25 and 26 and Annex 3).

The SAR Working Group at COMSAR 15 provided advices to the Working Group on e-navigation. (COMSAR 15/WP.6, Annex 3). This is included in this document as Annex 3.

The CG is invited to give its comments on the issues raised by the SAR Working Group.

21 During the review of annexes 1, 2 and 3 of document COMSAR 15/11 with respect to the initial gap analysis covering shipboard users, shore-based users and SAR, the Sub-Committee identified certain shortcomings, which should be taken into account by the e-navigation Correspondence Group (COMSAR 15/WP6, paragraphs 18 to 24), as follows:

**COMSAR 15/11: Annex 1 – shipboard users**

18 The Working Group was of the view that with respect to common data

structure/harmonized data formats concerning operational (procedural) matters there was a lack of standardized procedure.

19 The Working Group was of the view that with respect to navigational bridge systems and equipment concerning technical issues, there was a need for an "S" mode functionality.

20 With respect to regulations/standards, the delegation of Germany stated that new

graphical symbols to be used within the e-navigation environment should be implemented within or added to the existing list published as SN/Circ.243 (List of Symbols, Navigation-related Terms and Abbreviations). In addition, with respect to existing documents, namely resolution MSC.191(79) on Presentation of Navigation related information on navigation displays, it would also be necessary to develop standardized communication displays.

21 With respect to training, it was stated that training could be made more efficient by using standard human centred and user-friendly design.

22 With respect to documents in electronic form and automated updates of information, the delegation of the United Kingdom was of the view that indication of information updates with time stamp should have an expiry date.

**COMSAR 15/11: Annex 2 – shore-based users**

23 With respect to ship reporting, the Working Group was of the view that reference

should be made to SOLAS regulation V/11, resolution A.851(20) and resolution MSC.43(64), as amended.

**COMSAR 15/11: Annex 3 – search and rescue**

24 With respect to information/data management, the Working Group was of the view that regarding technical (hardware, software, equipment, links, data structure), there should be a facility for the display of an electronic message, e.g., on ECDIS.

22 At COMSAR 15 the Sub-Committee noted that 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, Antarctic and remote areas.

This should be taken into account when further developing the gap analysis. (COMSAR 15/WP.6. Paragraph 6 and 30.2.)

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

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

25 The Working Group considered the template modified by the Republic of Korea based on document NAV 56/INF.10. Accordingly, with the intention of using the template for

identifying practical e-navigation solutions based on operational, technical, regulatory and

training aspects, the Group discussed and developed an example of how to identify practical

e-navigation solutions based on an example of an identified gap relating to lack of

presentation of warning broadcasts on navigation displays. A developed example of gap

analysis and practical e-navigation solutions is attached as Annex 2 of this document, corresponding to COMSAR15/WP6:Annex 2. The example is to be found in the attached electronic version as item number 80 on the list of gap topics of that template. It was agreed that subject to the Sub-Committee's endorsement, the Correspondence Group on e-navigation would endeavour to develop practical e-navigation solutions for other identified gaps taking into account the human element. (COMSAR 15/WP6. Paragraph 15).

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

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

.2 as inputs for identifying new concepts.

This double perspective is also reflected in the mandate for the final Strategy Implementation Plan.

The CG is invited to contribute with further examples on how to fill the gaps and to identify possible e-navigation solutions, based on the list of gaps agreed by COMSAR 15 and using the modified Korean template as endorsed by COMSAR 15.

26 Operational gap analysis.

So far a baseline concept of operations has been defined, that could be used based on the integration of existing technology and systems and the extent to which implementation of e-navigation could enhance operations.

This should result in a plan for fully integrating and standardizing existing technology and systems and using a reduced concept of operations.

Questions for the CG to elaborate on:

How could one obtain early benefits and make the optimum use of existing systems and services in the short term?

Would it be advisable to consider the development of standardized, module-based bridge designadapted to the functions of the individual ship, in order to facilitate the smooth familiarization of ship borne personnel when transferring from one ship to another, noting IMO Guidelines for Bridge Equipment and Systems, their Arrangement and Integration?

Will INS be a dominant factor for the development of e-navigation on board?

At STW 42 the issue was raised whether it would be essential to develop a simulator that gives the possibility to test the output of an IBS main area of a standard bridge, including the interface between INS and engine automation, and commence the testing of regular user friendly and easy communication of data in a common format through the use of simulators.

Does the CG agree that this could assess the simplicity and workability of the system?

27 Technical gap analysis.

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

The type approval is also relevant for the shore based side.

This should result in a program of development work that needs to be done to provide technology solutions to user requirements in their entirety.

Are there any constraints to building upon shore-based existing systems to meet e-navigation shore-based requirements?

28 Regulatory gap analysis.

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

Could INS be recognized as a basis line?

Should the possible approval process for INS be adjusted to make it possible to add and incorporate relevant e-navigation elements?

How should the identified regulatory gaps be analyzed to result in needed institutional reforms to be proposed for implementation?

29 Training gap analysis.

The analysis tries to identify what measures should be taken to ensure that individuals, who are entrusted with its operation, receive an appropriate level of instruction and have the required levels of competences to use any technology or systems introduced as a component of e-navigation.

To that end the CG had identified a number of training-related questions that were presented to the Sub-Committee at STW 42 (January 2011) towards the development of an e-navigation strategy implementation plan.

30 At STW 42 the Sub-Committee recalled that adequate knowledge of the English language was essential to enable the officers to perform their duties. The Sub-Committee recognized that it might be necessary at a later stage for amending the IMO Standard Marine Communication Phrases (SMCP), as appropriate.

According to international surveys on user needs on e-navigation, language skills still is a major challenge.

Should there be considered any improvements in the use of SMCP or any other form of operational English on board and ashore?

31 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 programs. There is, however, also a question of

whether one should emphasize assessment of the de facto skills and competences, or alternatively if assessment should include a more formal documentation of having fulfilled authorized training programs.

.2 The monitoring navigator

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

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

The topic was also discussed at COMSAR 15.

The Sub-Committee noted and endorsed that the navigator's traditional skills would remain essential for the safe navigation of the ship.

The view was also expressed that this was not an either/or scenario, but consideration needed to be given to the development from a purely navigating navigator toward a somewhat more monitoring navigator and that it would not compromise the skills of the navigator.

Several delegations expressed the view that over a period of time, the navigating navigator scenario and the monitoring navigator scenario would complement each other.

It was also important to keep the role of the navigator in mind, and what introduction of new concepts would actually mean for them.

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

Does the CG have any comments on this topic, and should these challenges be addressed as part of the development of the final Strategy Implementation Plan on e-navigation which is currently being undertaken?

33 At STW 42 the view was expressed that there was a serious need to form a group of experts to clarify relevant issues and to provide leadership, direction and advice concerning the development of training strategies in the short, medium and long term and in particular, with regard to:

.1 the development of maritime education and training relevant to the needs of current and future generations of seafarers;

.2 the role of technology in shipboard and maritime operations and associated training requirements; and

.3 the utilization of technology and state-of-the-art methodologies in the delivery of maritime education and training,

These issues might be important in order to assist the Organization in the development of maritime education and training that will meet the needs of an efficient, safe, clean and secure shipping industry in the future.

Could the outcome of such an initiative be of relevance to the further development of e-navigation?

34 Considerations given by individual delegations at STW 42 might be of relevance to the further development of e-navigation:

.1 The view was expressed that the use of S-mode for navigation displays should be considered as an alternative for seafarers that would facilitate the use of the equipment, in particular to assist in the familiarization process. They emphasized that such a development would neither freeze innovation nor prevent the progress of new technologies.

.2 The view was also expressed that the need for an "e-navigation" project should be supported, as a useful and indispensable system for seafarers, which would result in the enhancement of safety, security and protection of the marine ecosystem. Furthermore, it was premature to analyze reliability risks of the project without knowing which equipment would form part of e-navigation, however, in the meantime, the development of S-mode for equipment should be considered. In this respect, it would be essential to:

.1 develop a draft model course on e-navigation;

.2 establish a common S-mode for navigation screens and displays to be

used in an S-mode Integrated Bridge System (IBS);

.3 develop a simulator that gives the possibility to test the output of an IBS

main area of a standard bridge, including at least, at this stage, the interface between Integrated Navigation System (INS) and engine automation; and

.4 commence the testing of regular user friendly and easy communication of

data in a common format through the use of simulators, so as to assess the simplicity and workability of the system.

Does the CG have any further comments to these issues?

35 At STW 42 the issue of standardization of bridge design was discussed.

The following views were expressed:

.1 although the standardization of bridge design was a positive and desirable

step, it was not clear how this could be achieved;

.2 the standardization of bridge design was within the remit of the NAV and

COMSAR Sub-Committees and should be addressed by them;

.3 the development of S-mode and standard operating procedures for

equipment would probably be the way forward; and

.4 training should focus on detecting operational anomalies.

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

36 The Sub-Committee also discussed the issue of S-mode for navigation displays. In the ensuing debate on this topic, there was general support for the development of a common S-mode for navigation displays. However, it was recognized that while this might not necessarily improve the competency of seafarers, it would facilitate training and improve operational safety.

After some discussion, the Sub-Committee agreed that this was a welcome step which could reduce the familiarization time for seafarers.

Does the CG have any inputs or further comments concerning paragraphs 29 and 30?

37 MSC 88 (MSC 88/26, paragraph 11.15) requested the Secretariat to convey the outcome of the Joint IMO/ITU Expert Group on Maritime Radio-communication matters to the Chairman

of the e-navigation correspondence group re-established by NAV 56. The outcome is reflected in document COMSAR 15/4, paragraphs 64 and 65:

“**New abilities to communicate safety and security information for ships and ports**

64 Taking into account the draft CPM report and documents IMO/ITU EG 6/4/2

(United Kingdom), IMO/ITU EG 6/3/1 and IMO/ITU EG 6/3/1/Add.2 (Secretariat) the Group decided to follow the text in the draft CPM report in supporting an exclusive primary allocation to the maritime mobile service in the band 495-505 kHz in all three regions and a co-primary allocation in the band 510-525 kHz in Region 2.

65 The Group had a long debate on the need for making a statement that the existing maritime mobile primary allocation in the band 415 kHz – 526.5 kHz should be maintained. This was to fulfill the possible requirement in future for the promulgation of additional security-related information, the implementation of e-navigation and the implementation of the revised elements and procedures of the GMDSS.”

38 The CG has noted that at FAL 36 e-navigation was discussed. In the Report of the Facilitation Committee on its thirty-sixth session it is however stated that: “The Committee, while noting the discussion of the Group regarding e-navigation nevertheless decided not to establish a separate correspondence group on e-navigation, as it was considered unnecessary and would clearly duplicate the extensive work already being carried out by other IMO committees and sub-committees in this respect.” (FAL 36/17, item 5.39).

Eventual relations between the FAL Committee and the e-navigation development may be re-addressed at a later stage, possibly as a consequence of the outcome of the gap analysis.

**Further procedure for risk and cost-benefit analyses.**

39 NAV 56 endorsed the initial risk and cost-benefit analyses describing the methodology according to IMO’s FSA procedures. The completed gap analysis will serve as a basis for the further development of the risk and cost-benefit analyses.

**Outline of a provisional Strategy Implementation Plan.**

40 A template for the development of the e-navigation concept might be illustrated as follows:

Core strategy objective

Ref.: MSC 85/26/Add.1/Annex 20

Ref.: NAV 56/20, paragraph 8.46

User needs

To be adopted

Outcome of gap analysis for e-navigation solutions

To be adopted

Formal Safety Assessment

To be adopted

Outcome of risk analysis

To be adopted

Outcome of cost-benefit analysis

To be adopted

Implementation schedule

Could the CG apply this structure for its approach for developing the e-navigation concept?

Actions could be requested by the Maritime Safety Committee and of the three Sub-Committees; NAV, COMSAR and STW as follows:

MSC Committee

Action requested

NAV

Sub-Committee

Consideration for eventual adoption

Action requested

COMSAR

Sub-Committee

Action requested

STW

Sub-Committee

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

.1 Identification of responsibilities to appropriate organizations/parties,

.2 Transition arrangements,

.3 A phased implementation schedule along with possible roadmaps,

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

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

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

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

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

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

**Identification of responsibilities to appropriate organizations/parties.**

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

Issues concerning the responsibility for the quality, the liability and legal aspects on the use and the reuse, and the protection, storage, consistency, maintenance and enrichment of data and information are of fundamental importance to make e-navigation possible and operational.

How does the CG think one should deal with these issues to avoid obstruction of further development of innovation?

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

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

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

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

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

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

To which extent does the CG consider that the identification of responsibilities might also imply international organizations, and that there will be a need to identify the responsibilities of the national, eventual local and regional authorities?

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

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

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

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

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

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

How might the development of a road map be helpful to clarify common understandings which are necessary for the implementation of e-navigation strategy?

A methodology for continual assessment of user needs was introduced at NAV 55/11/4, UK: “Development of an e-navigation strategy implementation plan: methodology for developing e-navigation user needs using a task-based approach”.

Does the CG agree that the methodology for continual assessment of user needs as introduced by NAV 55/11/4 might be adequate in this respect?

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

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

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

Does the CG consider such procedures to be important for the implementation of e-navigation?

It will be important to connect these topics to HEAP.

How should this be taken into consideration for the further progress of the plan?

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

Usability is an important e-navigation item, and the CG is invited to give comments on the subject.

46 One important aspect of this challenge will be the integration of test-bed outcomes.

Should there be developed guidelines for test beds in the e-navigation context?

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

Does the CG see the need for such a methodology?

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

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

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

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

.1 technical gap analysis that should result in “a program of development work that needs to be done to provide technology solutions to user requirements in their entirety”.

.2 regulatory gap analysis that should serve as a basis for “any institutional reform that is needed should be proposed for implementation”.

e-navigation should be more easily promoted if the Strategy Implementation Plan meets the expected requirements.

“A stable and realistic implementation plan will create forward enthusiasm and momentum for e-navigation across the maritime sector.” (NAV 54/25, Annex 12.)

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

World Bank and Regional Development Banks could be relevant institutions, provided member countries within the relevant regions are actively cooperating in the process.

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

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

The CG is invited to comment on the issue.

**ANNEX 1**

**DRAFT TERMS OF REFERENCE FOR THE IMO/IHO HARMONIZATION**

**GROUP ON DATA MODEL (HGDM)**

In creating an e-navigation architecture, it is important to identify information and data flows,

and the interaction between applications and user interfaces. Consequently, there needs to

be a common data structure to implement the identified Information, which represents the

maritime domain (and including both ship and shore aspects). It is therefore important to

harmonize efforts in data modelling, with the aim of creating and maintaining a robust and

extendable maritime data structure. This maritime information and data structure will require

some form of overarching coordination to ensure the ongoing management and maintenance

of the structure. There may be several management roles to be performed by such a

coordinating body, (for example, the maintenance of a register). This management role may

be shared between relevant organizations. [The structure is a highly important element by

which e-navigation can modernize the operational environment of the maritime industry and

also fulfil the requirement of document MSC 85/26, annex 20.]

[The IMO Sub-Committee on Safety of Navigation agreed to establish a small group to work

mainly by correspondence and in conjunction with IHO to further develop this common data

structure in conjunction with ongoing efforts in data modelling. This would involve

harmonization and standardization of:

.1 formats for the collection, exchange and distribution of data;

.2 processes and procedures for the collection; and

.3 development of open standard interfaces.]

The HGDM group should be constituted of representatives of IMO and IHO Member States

and Secretariats, and organizations with an official IMO/IHO observer status.

The HGDM group reports to the IMO Sub-Committee on Safety of Navigation (NAV), and to

the IHO through the IHB Directing Committee.

The HGDM group should:

.1 consider matters related to the framework for data access and information

services under the scope of SOLAS, using as a baseline IHO's S-100 data

model, as requested by IMO or IHO, and prepare appropriate

documentation; and

.2 review the results of studies by IMO, IHO and other related organizations

which address aspects of access and information services under the scope

of SOLAS, and advise IMO and IHO as to whether they are compatible with

the e-navigation concept and take into account the identified dynamic user

needs.

**ANNEX 3**

**ADVICE PROVIDED FROM THE SAR WG TO THE E-NAVIGATION WG**

The Group was tasked to comment on document COMSAR 15/11, annex 3 on SAR matters

of the GAP analysis. The Group considered it important for any e-navigation strategy that

such technology should be capable of providing all information relevant for search and

rescue purposes both to and from SAR services. It was further commented by IMRF that the

document did not address sufficiently those SAR capabilities that are not governed by IMO

instruments but play a vital role in SAR activities such as aircrafts and other non-SOLAS

assets.

The group also considered it to be important to further discuss and define how e-navigation

and GMDSS systems should communicate with the purpose to meet the needs of SAR

services. The group supported the approach being proposed to harmonize efforts of

e-navigation with the ongoing scoping exercise to establish the need for a review of the

elements and procedures of the GMDSS to allow for the leveraging of e-navigation

technologies to provide useful information to RCCs, either by GMDSS system or via similar

protocols such as giving information or messages priority handling (i.e. AIS and LRIT

messages). There was agreement, that although not all inclusive annex 3 docs does contain

some items worthy of further exploration to determine its usefulness to SAR providers.

**After e-navigation briefing, the following additions were considered relevant by the**

**Group for SAR-purposes:**

The following points are indicative to the requirements of the Search and Rescue

environment but by no means a full and comprehensive list:

.1 support the effective operation of contingency response, and search and

rescue services;

.2 improved safety, through promotion of standards in safe navigation

supported by:

.1 improved decision support enabling the mariner and competent

authorities ashore to select relevant unambiguous information

pertinent to the prevailing circumstances; and

.2 a reduction in human error through provision of automatic

indicators, warnings and fail-safe methods.

.3 the current functions of the present GMDSS need to be supported and

enhanced:

.1 transmission of ship to shore distress alerts by at least two separate and independent means;

.2 reception of shore to ship distress alert;

.3 transmission and reception of ship-to-ship distress alerts;

.4 transmission and reception of Search and Rescue (SAR) coordinating communications;

.5 transmission and reception of on-scene communications;

.6 transmission and reception of locating signals;

.7 transmission and reception of maritime safety information (MSI);

.8 transmission and reception of general radio communications to

and from shore based radio systems or networks; and

.9 transmission and reception of bridge to bridge communications.

.4 how do we accommodate non-GMDSS alerting and communications

technology, including mobile technology and future developments in maritime communications systems?

.5 how do we accommodate the whole SAR system including non-SOLAS rescue crafts and SAR aircrafts?

.6 other data:

.1 passenger/crew list;

.2 passenger tracking systems data;

.3 hazardous cargo;

.4 evacuation plans;

.5 ships plans;

.6 number of lifeboats/liferafts/life saving appliances (Survival suits);

.7 EPIRB/SART and AIS/SART data;

.8 SAR- co-operation plan data for passenger ships; and

.9 ship's IMO number.

.7 Additional Information – Responder

.1 receive data as a vessel comes into area of SAR operations that

informs shore stations on the ship's communications options available. Not just GMDSS but consider Email/Fax/Broadband;

.2 information on a vessel's capabilities for supporting SAR operations; Fast Rescue Craft/Hospitals/Fire fighting;

.3 identify vessels that provide Met data – direct access to met data on ships;

.4 use vessel data for coverage prediction based on height of eye above sea level; and

.5 understand constraints of ship data for example: type/draught/manoeuvring capabilities.

.8 On-Scene Action

.1 datum markers identifiable by all on-scene assets, for example: for

drift/sea current and weather info;

.2 locating devices;

.3 monitor execution of search coverage plan; and

.4 individual casualty location and tracking.