**Draft report of the**

**IMO Correspondence Group on e-navigation to COMSAR 17**

**Background**

1 The work program 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. MSC 90 extended the join plan of work to 2014.

According to the work program, the next steps (after finalizing the Gap Analysis), are completion of the Risk and Cost Benefit analyses and the final Strategy Implementation Plan (SIP).

MSC 90 in May 2012 approved the:

.1 current overarching e-navigation architecture

.2 proposed way forward for developing a Common Maritime Data Structure

(CMDS);

.3 use of the IHO's S-100 geospatial standard as the baseline for creating a frameworkfor data access and services under the scope of SOLAS; and

.4 proposed joint plan of work on e-navigation for the COMSAR, NAV and

STW Sub-Committees for the period 2012-2014.

MSC 90 also authorized the establishment of an IMO/IHO Harmonization Group on Data modeling and approved its terms of reference.

2 MSC 90 noted that COMSAR 16 in relation to the development of an e-navigation Strategy Implementation Plan endorsed the final draft list of gaps relevant to radio communications and search and rescue and instructed the Secretariat to forward it to both STW 43, for further revision from the training perspective, and NAV 58, for final consideration.

3 STW 43 noted the comments of its Working Group concerning the Gap Analysis and in particular that:

.1 some training elements, especially those that were covered by the STCW Convention and Code, might need to be reviewed in the future in light of the forthcoming developments on e-navigation; and

.2 the revision, updating or development of training elements should only be considered in the future, after having a clear understanding of the potential technical, operational and regulatory e-navigation solutions that would be developed by the Organization.

4 NAV 58 noted that the Gap Analysis had been completed and:

.1 approved the final list of gaps of e-navigation (NAV 58/WP.1,paragraph 6.38.1)

.2 endorsed the preliminary list of potential e-navigation solutions, as work in progress, and agreed that the above list should be used as the basis for the further identification of Risk Control Options, as preparation for the Formal Safety Assessment (NAV 58/WP.1,paragraph 6.38.2); and

.3 endorsed the Methodology of the Human Element Analyzing Process in e-navigation (NAV 58/6, annex 3).

**Terms of Reference**

5 NAV 58re-established the Correspondence Group (CG) on e-navigation under the coordination of Norway and instructed it to take into account the revised joint plan of work for the COMSAR, NAV and STW Sub-Committees for the period 2012-2014, as approved by MSC 90. The Correspondence Group on e-navigation should:

.1 review the preliminary list of potential e-navigation solutions (NAV 58/WP.6, annex 2) and, if necessary, prepare additional potential e-navigation solutions in order to address all gaps identified in annex 2 to NAV 58/WP.6;

.2 finalize the Cost Benefit and Risk Analyses, with a view to final approval by NAV 59, using as input documents namely, the final list of gaps and the preliminary list of potential e-navigation solutions that would cover all the identified gaps and taking into account the Formal Safety Assessment process and the Methodology of the Human Element Analyzing Process (NAV 58/6, annex 3);

.3 further develop:

.1 the detailed ship and shore architecture;

.2 the concept of Maritime Service Portfolios; and

.3 the draft Strategy Implementation Plan;

4 consider documents NAV 58/6/1 and NAV 58/6/3 (Germany) and provide comments and recommendations, as appropriate;

.5 consider the issue of software quality assurance, taking into account document NAV 58/6/4 (Republic of Korea), and provide comments and recommendations, as appropriate;

.6 progress the development of draft Guidelines for usability evaluation of navigational equipment and its harmonization with the HEAP, taking into account documents NAV 58/6/6 and Corr.1, NAV 58/INF.12 and NAV 58/INF.13 and Corr.1 (Japan) and NAV 58/INF.10 (Australia);

.7 progress the development of draft Guidelines for the harmonization of test beds, taking into account document NAV 58/6/8 (Republic of Korea);

.8 submit reports to COMSAR 17 and STW 44 raising specific questions, as required, that should be addressed by the STW and COMSAR Sub-Committees; and

.9 submit a consolidated progress report to NAV 59.

**Finalizing the Risk and Cost Benefit Analyses**

6 NAV 58 noted the completion of the Gap Analysis (NAV 58/WP.1, paragraph 6.38.1).

The next step will be the identification of the Risk Control Options (RCOs) which will be subjected to Formal Safety Assessment (FSA) for Risk and Cost Benefit analyses. The objective of this step is to facilitate the decision-making recommendations.

7 At NAV 58 the chairman of the Working Group on e-navigation, in his capacity as coordinator of the CG, gave a presentation outlining the FSA methodology, the identification of RCOs, and how the Risk and Cost Benefit analyses were intended to be undertaken based on the identified RCOs. (NAV 58/WP.6/Rev.1, paragraph 3.15).

The chairman’s presentation may be found at [*www.e-nav.no*](http://www.e-nav.no)

The use of the FSA methodology was endorsed by the Sub-Committee.

8 The schedule for performing the FSA is provided in **Annex 1** of this document.

**Potential e-navigation solutions**

9 At NAV 58 the Working Group on e-navigation noted that the list of e-navigation solutions (NAV 58/6, Annex 2) was not exhaustive and that further e-navigation solutions should be developed, in particular, those related to the shore side and the relationship between ship and shore. (NAV 58/WP.6/ Rev.1, paragraph 3.8).

The Working Group also was of the opinion that e-navigation solutions should be goal-based and their descriptions should be kept generic, which would then be expanded during the FSA process. (NAV 58/WP.6 /Rev.1,paragraph 3.7.1).

10 The Sub-Committee endorsed the preliminary list of potential e-navigation solutions, as work in progress, and agreed that the list should be used as the basis for the further identification of RCOs, as preparation for the FSA (NAV 58/WP.1, paragraph 6.38.2).

11 A further developed list of e-navigation solutions, including the shore side, is presented in **Annex 2** of this document. New text is marked in red.

12 ***The CG is invited to comment on the description of the potential e-navigation solutions for their development into RCOs as a part of the FSA.***

**A detailed ship and shore architecture**

13 The overarching e-navigation architecture was presented in the report of the Correspondence Group to NAV/57 (NAV57/WP6). Further detailing the architecture one should take into account the use of the IHO's S-100 Standard and Registry.

14 Using the overarching e-navigation architecture as a framework, the further development of the detailed architecture of both the ship and shore sides will have to take into account the outcome of the finalized Gap Analysis. The CG has already considered the development of the on board architecture including communications to be subject to further study and discussions. An example was given in its report to NAV 58, (NAV 58/6, Annex 1: Example of a more detailed onboard architecture). The same example is presented as **Annex 3** of this document.

15 At NAV 58 the Working Group on e-navigation considered the comments and observations of the CG concerning the development of the detailed e-navigation architecture for both the ship and shore sides (NAV 58/6, paragraphs 5 to 10 and Annex 1). The Group was of the view that inputs from different experts from the industry, other organizations and stakeholders, in particular, ship borne and shore-based users should be taken into consideration during the further development of the detailed e-navigation architecture. (NAV 58/WP.6/Rev.1, paragraph 3.2).

16 The Sub-Committee noted the progress made with regard to the development of the detailed on-board e-navigation architecture and invited IALA, IHO and other relevant organizations to contribute to its further development. (NAV 58/WP.1, paragraph 6.37).

17 ***Noting the discussion at NAV 58 and in accordance with the Terms of Reference the CG is invited to comment on and further develop the detailed architecture both on board and on shore, as appropriate, taking into consideration the example given in Annex 3.***

**Maritime Service Portfolios (MSP)**

18 Maritime Service Portfolios (MSP) are presented in the report of the Correspondence

Group to NAV 57 (NAV57/6, paragraphs 23-26).

According to the report of the Correspondence Group to NAV 58 (NAV 58/6, paragraphs 22 to 23) a Maritime Service Portfolio defines and describes the set of operational and technical services and their level of service provided by a stakeholder in a given sea area, waterway, or port, as appropriate. MSP should be developed to achieve harmonization, modernization, integration and simplification on board and ashore, taking into account the use of the IHO’s S-100 standard.

19 The objective of the MSP concept is to align global maritime service with the need for information and communication services in a clearly defined operational area. To achieve such, the first step should be to identify the need for information services and communication infrastructure in the different geographical areas. A set of services will require a certain communication infrastructure capacity and information management, varying from area to area. The user needs with regard to the e-navigation concept identified and adopted different MSPs corresponding to the needs for services and communication in different areas and for different operations. It has been agreed that the MSP areas are divided into:

1. Harbor operations;

2. Operations in coastal and confined or restricted waters;

3. Transocean voyages;

4. Offshore operations; and

5. Operations in Arctic, Antarctic and remote areas.

20 At NAV 58 the Working Group on e-navigation considered the information provided by the CG related to the development of MSPs (NAV 58/6, paragraphs 22 to 24), including document NAV 58/INF.4, and recommended it for further development. (NAV 58/WP.6/ Rev. 1, paragraph 3.17). This was endorsed by the Sub-Committee. (NAV 58/WP.1, paragraph 6.39.2).

21 To visualize the MSP concept a comprehensible matrix has been established, presenting some examples of e-navigation services, which have been mapped towards the identified MSP’s geographical areas to form Maritime Service Portfolios. The examples have been collected from functions found in NAV 56/WP.5/Rev.1 - Annex 1 (paragraph 3 - Functions), and examples on e-navigation solutions found in NAV 58/WP.6 - Annex 2.

The matrix is presented in **Annex 4** of this document.

22 NAV 56/WP.5/Rev.1 - Annex 1 (paragraph 3 - Functions) states that in e-navigation the level of automation will increase. Some functions may be automated, while others will continue to be carried out through interactions between people and systems. Seamless information flows and improved access to electronic information will arrange for automated processing and assessments across different information sources.

Information should be made useful in a context of decision support by increasing situation awareness and should lead the decision maker to rational decisions and actions.

23 ***The CG is invited to comment on the MSP as presented in the paragraphs 18 to 22 and Annex 4 of this document, and eventually to propose further detailing, possible modifications or additional topics in Annex 4.***

**Considering documents NAV 58/6/1 and NAV 58/6/3**

24 At NAV 58 the Working Group on e-navigation recommended the documents NAV/58/6/1 and NAV 58/6/3 to be further considered for comments and recommendations by the CG when conducting the Risk and Cost Benefit Analyses (NAV/WP.6/Rev. 1, paragraph 3.14).

This was endorsed by the Sub-Committee (NAV/WP.1, paragraph 6.41.4).

25 NAV 58/6/1 provides information on a resilient Integrated Position, Navigation (PNT), and Timing System as part of INS, which intends to support meeting e-navigation user needs such as improvement and indication of reliability. This concept takes into account the enhancement of radio navigation equipment and meets the modular structure of INS.

26 NAV 58/6/3 provides information on a procedure to determine Risk Control Options for the Risk and Cost Benefit Analyses on the basis of goal based solutions determined with the Gap Analysis.

27 ***The CG is invited to consider the documents NAV 58/6/1 and NAV 58/6/3 for comments, and recommendations, as appropriate.***

28 Regarding terms of reference for the CG (NAV58/WP6 paragraphs 5.5, 5.6, and 5.7), the Coordinator will come back to these issues on the later stage. The Coordinator will also come back at a later stage with more information concerning the deadlines for raising specific questions and submitting reports to COMSAR 17 and STW 44.

**Annex 1**

Ref. NAV 58/WP.6 Annex 3

**How to identify Risk Control Options (RCOs) - Roadmap for CG**

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| **Posting to CG** | **Approved user needs** | **Deadline for CG** |
|  | Finalized 2010 |

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| **Posting to CG** | **Gap analysis** | **Deadline for CG** |
|  | a. List of gaps | Finalized 2012 |
| 05.09.2012 | b. List of potential e-navigation solutions including hazards | 03.10.2012 |

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| **Posting to CG** | **Requirements identification** | **Deadline for CG** |
| 12.11.2012 | a. Perform Risk Assessment taking into account the hazard  description | 03.12.2012 |
| b. Development of RCOs, to include infrastructural, usability  and regulatory requirements |

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| **Posting to CG** | **Feasibility evaluation** | **Deadline for CG** |
| 21.01.2013 | a. Evaluate the feasibility of the suggested solutions with  regard to regulatory and infrastructural requirements | 08.02.2013 |
| **Risk reduction effectiveness evaluation** |
| b. Evaluate suggested solutions or RCOs regarding their  risk reduction effectiveness – disqualifying solutions with  low effectiveness |
| **Identification of RCOs** |
| a. List of identified RCOs |

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**Undertake a Cost Benefit Analysis based on identified RCOs**

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| **Posting to CG** |  | **Deadline for CG** |
| 19.02.2013 | a. Consider all identified RCOs | 27.03.2013 |
| b. Identify the type of cost and benefits involved for each  RCO |
| c. Estimate or quantify the pertinent costs and benefits of  each RCO |

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| **Posting to CG** |  | **Deadline for CG** |
| 16.04.2013 | a. Compare the cost effectiveness of each RCO in term of the  cost per unit risk reduction | 30.04.2013 |
| b. Rank the RCOs from the cost benefit perspective in order  to facilitate the decision-making recommendations |

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| **Posting to CG** |  | **Deadline for CG** |
| 14.05.2013 | a. Check the quality assurance of the FSA | 31.05.2013 |
| b. Discuss how recommendations will be implemented by  decision makers |
| c. Rank list of final recommendations for decision making |

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**Annex 2**

NAV 58/WP.6 Annex 2

**PRELIMINARY LIST OF POTENTIAL E-NAVIGATION SOLUTIONS**

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| **No.** | **Short description** | **Primary user need** | **User type** | **Other user needs** | **Hazard description** | **Origin** |
| **S1** | **Improved, harmonized and**  **user-friendly bridge design** | | | | | |
| S1.1 | Ergonomically improved and harmonized bridge and workstation layout. | Improved ergonomics | Shipboard user | Familiarization requirements | Suboptimal performance or accident due to lack of familiarity with bridge equipment / slow response due to not finding the correct information / control / alarm, inefficient operation due to poor bridge / workstation design. | 134-Gte01  134-Gre01  134-Gre03  134-Gre04 |
| S1.2 | Extended use of standardized and unified symbology for relevant bridge equipment. | Standard interface | Shipboard user | Improved ergonomics | Suboptimal performance or accident due to non-standards symbology, resulting in misinterpretation of operator controls, information or problem locating correct information. | 113-Gre01  134-Gte01  134-Gte03 |
| S1.3 | Standardized operations and training manuals to be provided in electronic format for relevant equipment | Familiarization requirements | Shipboard user | Standard interface | Suboptimal performance or accident due to lack of familiarity with bridge equipment. | 150-Gte01  113-Gtr01 |
| S1.4 | Standard default settings, save / recall settings, and S-mode functionalities on relevant equipment. | Standard interface | Shipboard user | Familiarization requirements, Improved ergonomics | Suboptimal performance or collision and grounding due to lack of familiarity with bridge equipment or using settings not appropriate to task. | [NAV 56/WP.5/Rev. 1 Annex 2] |
| S1.5 | All bridge equipment to follow IMO BAM (Bridge Alert Management) performance standard | Alert management, ? | Shipboard user | Functionality - security | Suboptimal performance or accident due to not responding to relevant alert. | 134-Gre03  134-Gre04  134-Gre06 |
| S1.6 | Information accuracy / reliability indication functionality for relevant equipment | Indication of reliability | Shipboard user | Reliability – fault tolerance | Suboptimal performance or accident due to actions taken based on inaccurate information. | 112-Gte01  132-Gte03 |
| S1.6.1 | Graphical or numerical presentation of levels of confidence for the provided information | Indication of reliability | Shipboard user | Functionality – suitability. | Suboptimal performance or accident due to miscalculation, misinterpretation or lack of presented information. | 112-Gte01  134-Gte04 |

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| **No.** | **Short description** | **Primary user need** | **User type** | **Other user needs** | **Hazard description** | **Origin** |
| S1.7 | Integrated Navigation System (INS) that centralises navigational displays for improved access to navigational information | Effective and robust communications | Shipboard user | Improved ergonomics | Suboptimal performance or accident due to not applying available information/ overburdening. | 134-Gop02 |
| S1.8 | GMDSS equipment integration - one common interface | Effective and robust communications | Shipboard user | Efficiency, usability | Suboptimal performance or failure to mitigate accident due to poor communication. | 120-Gte05 |
| **S2** | **Means for standardized and**  **automated reporting for shipboard users** | | | | | |
| S2.1 | Single-entry of reportable information in single-window solution | Standardized and automated reporting | Shipboard user | Correctness, efficiency | Suboptimal performance or accident caused by distraction / high workload. | 140-Gte02  140-Gte03  140-Gop01 |
| S2.2 | Automated collection of internal ship data to fulfil ship reporting requirements | Standardized and automated reporting, reliability | Shipboard user | Correctness, efficiency | Suboptimal performance or accident due to distraction / high workload. | 140-Gte04  140-Gre05 |
| S2.3 | Automated or semi-automated digital distribution / communication of required reportable information, including both "static" ?and dynamic information | Standardized and automated reporting, reliability | Shipboard user | Correctness, efficiency | Suboptimal performance or accident due to distraction / high workload. | 140-Gte01  140-Gte02  140-Gte03  140-Gre04  140-Gre05  140-Gop01 |
| S2.4 | All national reporting requirements to apply standardized digital reporting formats based on IMO FAL forms and SN.1/Circ.289 | Standardized and automated reporting, usability | Shipboard user | Correctness, reliability | Suboptimal performance or accident due to distraction / high workload. | 111-Gte02  140-Gre04  140-Gre05  140-Gop01 |

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| **No.** | **Short description** | **Primary user need** | **User type** | **Other user needs** | **Hazard description** | **Origin** |
| **S3** | **Improved reliability, resilience**  **and integrity of bridge equipment**  **and navigation information** | | | | | |
| S3.1 | Harmonised self-check/built-in integrity test (BIIT) indications with interface for relevant equipment  ? | Improved reliability, fault tolerance, recoverability, accuracy | Shipboard user | Improved consistency, simplicity | Suboptimal performance or accident caused by bridge equipment failure. | 132-Gte02  132-Gte02-Sop01  132-Gte02-Sop02  132-Gte02-Ste01  132-Gte02-Ste02  132-Gte02-Sre01 |
| S3.2 | Uniform high quality, ~~and~~ integrity, verification testing and validation for relevant bridge equipment, including software | Improved reliability, efficiency, maintainability | Shipboard user | Improved correctness, flexibility | Suboptimal performance or accident caused by bridge equipment failure. | 134-Gre02  120-Gte01  112-Gre01 |
| S3.3 | Perform information integrity tests based on integration of navigational equipment – application of INS integrity monitoring concept | Improved reliability, fault tolerance, recoverability, accuracy | Shipboard user | Improved correctness, flexibility | Suboptimal performance or accident due to actions taken based on inaccurate information. | 112-Gte01-Ste01  112-Gte01-Sre01  112-Gte01-Sre03  112-Gte01-Sre04  112-Gte01-Sre05 |
| S3.4 | Improved reliability and resilience of on-board PNT systems by robust integration with alternative systems | Improved reliability, interoperability, efficiency, adaptability | Shipboard user | Improved, reusability, flexibility | Suboptimal performance or accident due to poor information from PNT systems. | 132-Gte01  132-Gre01 |

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| **No.** | **Short description** | **Primary user need** | **User type** | **Other user needs** | **Hazard description** | **Origin** |
| **S4** | **Integration and presentation**  **of available information in**  **graphical displays received via**  **communication equipment** | | | | | |
| S4.1 | Integration and presentation of available information in graphical, numerical and textual displays (including MSI, AIS, charts, radar, etc.) received via communication equipment | User-selectable information received via communication equipment | Shipboard user | Maritime Safety Information (MSI), Improved target detection, Guard zones, real time information | Suboptimal performance or accident due to misinterpretation of information or problem locating correct information, information overload and poor situational awareness | 111-Gte06  134-Gte04  135-Gte01  135-Gte02 |
| S4.1.1 | Implement a Common Maritime Data Structure and include parameters for priority, source, and ownership of information | Improved communicativeness, Storage efficiency | Shipboard user | Access audit, traceability, consistency | Suboptimal performance or accident caused by poor decision making resulting from error in dealing with unstructured of data, lack of harmonized data format, and lack of priority in transfer of information. | 111-Gte01-Ste03  111-Gte01-Sre03  135-Gte01-Ste09  ~~211-Gte01-Ste01~~  ~~211-Gte01-Sre01~~  ~~211-Gte01-Sre02~~  ~~211-Gte02-Ste02~~ |
| S4.1.2 | Standardized interfaces for data exchange should be developed to support transfer of information from communication equipment to navigational systems (INS) | Improved conciseness, Interoperability - data and communication commonality | Shipboard user | Use of standard protocols and interfaces, use of standard data representation | Suboptimal performance or accident caused by poor system integration, poor modularity and poor execution efficiency. | 111-Gte01-Ste01  111-Gte01-Ste02  111-Gte01-Sre01  111-Gte01-Sre02  135-Gte01-Ste03  135-Gte01-Sre07 |
| ~~S4.1.3~~ Ref: S12.1.2 | ~~Provide mapping of specific services (information available) to specific regions (e.g. maritime service portfolios) with status and access requirements.~~ | ~~Improved ship safety and operability~~ | ~~Shipboard user~~ | ~~Improved availability of information and usability~~ | ~~Suboptimal performance or accident due to lack of understandability and self-descriptiveness of provided services.~~ | ~~260-Gtr02-Sop01~~  ~~260-Gtr02-Ste01~~ |
| S4.1.4 | Provision of a system for the selection of the most appropriate communication means (automatic source and channel management) based on criteria such as, band width, message format, integrity and cost . | Improved integrity, storage and execution efficiency | Shipboard user | Improve operability, and interoperability | Suboptimal performance or accident due to lack of seamless communication means, insufficient data storage or protocols to support the exchange of information. Interferences and bandwidth limitation for ship – shore communication. | 120-Gte03-Sop01  120-Gte03-Sop02  120-Gte03-Ste01  120-Gte03-Ste02  120-Gte03-Sre02  120-Gte03-Sre03  120-Gte03-Sre04 |

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| **No.** | **Short description** | **Primary user need** | **User type** | **Other user needs** | **Hazard description** | **Origin** |
| S4.1.5 | Routing and filtering of information onboard (weather, intended route etc.):   1. Development of software / hardware (modules for processing, filtering, transfer and routing of information exchanged via communication equipment to the appropriate applications on-board e.g. navigation, other bridge applications (safety, security) and other onboard applications. 2. Provide functionality as part of INS to process and filter exchanged information received via communication equipment for relevance to vessel, route, and conditions, ensuring delivery (routing) and presentation of safety relevant information on INS tasks (displays). 3. Provide an administrative Human Machine Interface (HMI) using the INS task concept for identifying updates and setting of presentation rules based on route plan, vessel characteristics, INS tasks supported and other user-selected priorities. | Improved operability, interoperability, integrity, storage and real-time execution efficiency | Shipboard user | Improved completeness, consistency, security and international standardization of data and its sharing | Suboptimal performance or accident due poor decision making resulting from lack of harmonized data and technical solutions for processing, filtering and transfer of information via communication equipment.  There is a gap between information capability of current information management systems and those that will be required as volumes of information increases | 111-Gte01-Sop01  135-Gte01-Sop04  111-Gte05-Sop01  111-Gte05-Ste01  111-Gte05-Ste02  111-Gte05-Sre01  135-Gte01-Sop02  135-Gte01-Ste07  135-Gte01-Ste12  135-Gte01-Ste11 |
| S4.1.6 | Provide quality assurance to ensure that all data is reliable and is based on a consistent common reference system (CCRS) or converted to such before integration and display. | Improved system update, data validity and integrity | Shipboard user | Improved interoperability and usability | Suboptimal performance or accident due to problem of interoperability between application and use of deprecate operating systems. | See solutions S1.6 and S3.3 |

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| **No.** | **Short description** | **Primary user need** | **User type** | **Other user needs** | **Hazard description** | **Origin** |
| S4.1.7 | Implement harmonized presentation concept of information exchanged via communication equipment including standard symbology and text support taking into account human factors and ergonomics design principles to ensure useful presentation and prevent overload. | Improved graphical display of information including prioritized alarm display, usability and self-descriptiveness | Shipboard user | Improved standardized symbology, human interface design and communica-tiveness. | Suboptimal performance or accident caused by decision making error resulting from un-prioritized alarm system, uncommunicativeness of information displayed or poor ergonomics design. | 113-Gre01-Ste01  113-Gre01-Ste02  113-Gre01-Sre01  135-Gte01-Sop01  135-Gte01-Sop03  135-Gte01-Sop05  135-Gte01-Sop07  135-Gte01-Ste04  135-Gte01-Ste05  135-Gte01-Ste08  135-Gte01-Ste10  135-Gte01-Ste11  135-Gte01-Sre01  135-Gte01-Sre06  135-Gte01-Sre09 |
| S4.1.8 | Develop a presentation library as required to support accurate presentation across displays. | Improved information retrieval, efficiency and usability | Shipboard user | Improved standardized presentation of data and simplicity | Suboptimal performance or accident due to inaccessibility or unavailability of information support. | 135-Gte01-Ste01  135-Gte01-Ste02  135-Gte02-Ste01  135-Gte03-Ste02  135-Gte01-Sre10 |
| S4.1.9 | Provide alert functionality of INS concepts to information received via communication equipment and integrated into INS | Improved situation awareness and presentation of prioritized alarm notification | Shipboard user | Improved reliability, integrity and usability | Suboptimal performance or accident due to lack of solution maintaining priority of alarm display. Critical alarms are often bypassed or ignored because of their uncommunicativeness nature. | 111-Gte01  135-Gte016 |
| S4.1.10 | Harmonization of performance standards and regulations for navigation and communication equipment | Improved harmonization, usability, portability and communicativeness | Shipboard user | Improved simplicity, understand-bility, and reusability | Suboptimal performance or accident due to unfamiliarity with communication equipment or lack of familiarity with procedures and displayed navigational information | 120-Gre02  135-Gte01 |

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| **No.** | **Short description** | **Primary user need** | **User type** | **Other user needs** | **Hazard description** | **Origin** |
| **S5** | **Information Management** | | | | | |
| S5.1 | Accurate status display of available data and availability indication of updates. | Automated updating of baseline data and documents | Shipboard user | Improved correctness and reliability | Suboptimal performance or accident due to overburdening / out of date navigational documentation | 136-Gte01  136-Gop01 |
| S5.2 | Automated and timely updating of Electronic Navigational Charts (ENCs), nautical publications and other documentation | Automated updating of baseline data and documents | Shipboard user | Provision of information to vessels | Suboptimal performance or accident due to overburdening/out of date navigational documentation. | 136-Gte01 |
| S5.3 | Electronic information to be searchable by the appropriate shipboard user | Effective and robust communications | Shipboard user | Improved ~~ergonomics~~, access to relevant information | Suboptimal performance or accident due to not applying or providing available information / overburdening. | 136-Gte01 |
| S5.4 | Task-based information management | Effective and robust communications | Shipboard user | Improved ~~ergonomics~~ information reliability | Suboptimal performance or accident due to not applying available information. | 136-Gte01  150-Gop01 |
| S5.5 | Integrated system for improved and harmonized presentation of ship domain awareness | Improved visualization of target detection, danger zone and risk estimation level | Shipboard user | Improved efficient and homogenous decision making | Suboptimal performance or accident caused by poor situation awareness or lack of effective / early safe evasive manoeuvre. Mariners do not know the danger index value and the size of the ring remains the same regardless of the danger degree value. | 111-Gte01  112-Gte01  135-Gte01 |

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| **No.** | **Short description** | **Primary user need** | **User type** | **Other user needs** | **Hazard description** | **Origin** |
| **S6** | **Improved access to relevant**  **information for Search and Rescue (SAR)** | | | | | |
| S6.1 | Automated network for communication and data coordination / distribution among SAR stakeholders | Effective communication and information sharing | SAR user | Ensure interoperability and data integrity | Failure to mitigate SAR incident due to poor operation coordination. | 320-Gte01 |
| S6.2 | Automated SAR information collection | Effective communication and information sharing | SAR user | Access to relevant information within the e-nav domain | Failure to mitigate SAR incident due to poor situation awareness / lack of information. | 310-Gte01  310-Gop01  310-Gop02 |
| S6.3 | Electronic information to be searchable to the appropriate SAR user. | Effective and robust communications | SAR user | Improved access to relevant information | Suboptimal performance or SAR incident due to not applying or providing available information / overburdening. | 310-Gop01 |
| S6.4 | Automated collection of internal ship data for SAR incident reporting. | Standardized and automated reporting, reliability | SAR user | Improved efficiency | Suboptimal performance or SAR incident due to distraction / high workload. Lack of automated data network connecting all stakeholders in SAR intervention. | 320-Gte01 |

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| **No.** | **Short description** | **Primary user need** | **User type** | **Other user needs** | **Hazard description** | **Origin** |
| **S7** | **Improved reliability, resilience and**  **integrity of bridge equipment and**  **navigation information provided to shore-based users** | | | | | |
| S7.1 | Shore monitoring of quality / integrity of navigation systems, quality of onboard information and effectiveness of communications. | Quality assurance | Shore-based user | Improved reliability | Suboptimal performance or accident due to navigation or communication equipment failure/poor onboard navigation documentation. | 260-Gte03  260-Gte07 |
| S7.2 | Perform system integrity tests of integrated equipment. | Improved reliability,  access audit | Shore-based user | Improved correctness, accuracy | Suboptimal performance or accident due to actions taken based on inaccurate / insufficient information. | 260-Gte02  260-Gte04 |
| S7.3 | Improved reliability and resilience of shore-based PNT systems to support ship-based PNT systems. | Improved reliability, Interoperability, efficiency, | Shore-based user | Improved robustness, operability | Suboptimal performance or accident due to poor information from PNT systems. | 260-Gte05  132-Gte01  132-Gre01 |
| **S8** | **Improved and harmonized**  **shore-based systems and services** | | | | | |
| S8.1 | Integrated system for improved and harmonized presentation of domain awareness | ~~Management of information~~  Improved visualization of target detection, danger zone and risk estimation level | Shore-based user | ~~Improved target detection~~  Improved Management of information | Suboptimal performance or accident caused by poor situation awareness or lack of effective indication of collision avoidance manoeuvre. | 235-Gop01 |
| S8.2 | Standardized and unified symbology for relevant shore equipment | Management of information | Shore-based user | Improved usability | Suboptimal performance or accident due to equipment symbol misinterpretation. | 235-Gop01 |
| **S9** | **Improved communication of**  **VTS service portfolio** | | | | | |
| S9.1 | Improved communication of VTS service portfolio | Provision of information to vessels | Shore-based user | Improved completeness of information | Suboptimal performance or accident due to not applying available information. | 260-Gtr02  260-Gtr01  260-Gte04  235-Gte01 |

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| **No.** | **Short description** | **Primary user need** | **User type** | **Other user needs** | **Hazard description** | **Origin** |
| **S10** | **Improved, harmonized and**  **user-friendly shore-based design** | | | | | |
| S10.1 | Standardized reference material for relevant equipment to be provided in electronic format.. | Familiarization requirements | Shore-based user | Standard interface | Suboptimal performance or accident due to lack of familiarity with shore-based equipment. | 250-Gtr02 |
| S10.2 | Information accuracy / reliability indication functionality for relevant equipment. | Indication of reliability | Shore-based user | Fault tolerance, completeness | Suboptimal performance or accident due to actions taken based on inaccurate / insufficient information. | 211-Gre01 |
| S10.3 | Graphical or numerical presentation of levels of reliability together with the provided information. | Indication of reliability | Shore-based user | Functionality – suitability. | Suboptimal performance or accident due to miscalculation, misinterpretation or action based on inaccurate / insufficient information. | 211-Gre01  235-Gte01  260-Gte07 |
| **S11** | **Means for standardized and**  **automated reporting for shore-based users** | | | | | |
| S11.1 | All national reporting requirements to apply standardized digital reporting formats based on IMO FAL forms and SN.1/Circ.289. | Standardized and automated reporting, reliability | Shore-based user | Correctness, usability | Suboptimal performance or accident due to insufficient provision of information exchanged with shipboard user. Both ship and shore systems will need to support the agreed common data structure and format for the exchange of e-navigation information. | 235-Gte01 |
| **S12** | **Integration and presentation**  **of available information in**  **graphical displays received via**  **communication equipment for shore-based users** | | | | | |
| S12.1 | Integration and presentation of available information in graphical, numerical and textual displays received via communication equipment | Improved safety and vessel monitoring | Shore-based user | Improved visualization and prioritization of information. | Suboptimal performance or accident due to misinterpretation of information or problem locating correct information, information overload and poor situational awareness | 211-Gte02  211-Gre01 |

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| **No.** | **Short description** | **Primary user need** | **User type** | **Other user needs** | **Hazard description** | **Origin** |
| S12.1.1 | Implement a Common Maritime Data Structure and include parameters for priority, source, and ownership of information. | Improved safety, communicativeness, storage efficiency | Shore-based user | Access audit, traceability, consistency | Suboptimal performance or accident caused by poor decision making resulting from error in dealing with unstructured of data, lack of harmonized data format, and lack of priority in information transfer. | 211-Gte01  211-Gte02 |
| S12.1.2 | Provide mapping of specific services (information available) to specific regions (e.g. maritime service portfolios) with status and access requirements. | Improved services delivery access control | Shore-based user | Improved availability of information and usability | Suboptimal performance or accident due to lack of clarity and harmonization of provided services. | 260-Gtr02 |
| S12.1.3 | Provision of a system for the selection of the most appropriate communication means (automatic source and channel management) based on criteria such as, band width, message format, integrity and cost . | Improved integrity, storage and execution efficiency | Shore-based user | Improve operability, and interoperability | Suboptimal performance or accident due to insufficient data storage or protocols to support the exchange of information. Interferences and bandwidth limitation for ship – shore communication. | 260-Gte06  260-Gte02 |
| S12.1.4 | Routing and filtering of information ashore (weather, intended route etc.) | Improved operability, interoperability, storage and real-time execution efficiency | Shore-based user | Improved accuracy, consistency, security and international standardization of data and its sharing | Suboptimal performance or accident due poor decision making ashore resulting from lack of harmonized data and technical solutions for processing, filtering and transferring reliable information to ship-based systems.  There is a gap between information capability of current information management systems and those that will be required as volumes of information increases. | 211-Gte02  220-Gtr01 |
| S12.1.5 | Provide quality assurance process to ensure that all data is reliable. | Improved correctness, reliability integrity and data validity | Shore-based user | Improved efficiency and usability | Suboptimal performance or accident due to problem of interoperability between application and use of deprecate operating systems. | See solutions S10.2 and S7.2  260-Gte05 |

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| **No.** | **Short description** | **Primary user need** | **User type** | **Other user needs** | **Hazard description** | **Origin** |
| S12.1.7 | Provide procedures that enable shore-based authorities to monitor the quality of information received from ship-based navigation systems. | Improved situation awareness and presentation of prioritized alarm visualization | Shore-based user | Improved reliability, Traceability | Suboptimal performance or accident due to lack of solution maintaining priority of alarm display. Critical alarms are often not tracked, bypassed or ignored because of their uncommunicativeness nature. | 260-Gte03 |
| **S13** | **Information Management for shore-based users** | | | | | |
| S13.1 | Improved display of status of available data and indication of available updates. | Automated updating of baseline data and documents | Shore-based user | Improved correctness and reliability | Suboptimal performance or accident due to use of out of date navigational documentation or wrong indication display. | 260-Gte05 |
| S13.2 | Automated and timely updating of Electronic Navigational Charts (ENCs), nautical publications and other documentation. | Automated updating of baseline data and documents | Shore-based user | Provision of relevant and necessary information to vessels | Suboptimal performance or accident due to use of out of date navigational documentation. | 260-Gte05  211-Gte02 |
| S13.3 | Task-based information management. | Effective and reliable information flow | Shore-based user | Improved communication | Suboptimal performance or accident due to not applying available information. | 260-Gte01 |

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**Annex 3**

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**Figure 1: Example of a more detailed onboard architecture**

**Annex 4**

**Table 1: Maritime Service Portfolios**

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| **No.** | **Identified Services** | **Identified Responsible Service Provider** | **Short Description** | **Geographical Areas**  NAV 58/6, paragraph 23 | | | | | **Solution References** | **Gap Origin** |
| **1** | **2** | **3** | **4** | **5** | **Functions** NAV 56/WP.5/ Rev.1 - Annex 1 | **Identifier**  NAV 58/WP.6 Annex 1 and paragraph 3.9 |
| MSP1 | VTS Information Service (INS) | National Competent VTS Authority / Coastal or Port Authority | The VTS INS is defined by IMO as **“**a service to ensure that essential information becomes available in time for on-board navigational decision making**”**. IMO Resolution A.857(20) states that: **“**A VTS should at all times be capable of generating a comprehensive overview of the traffic in its service area combined with all traffic influencing factors.**”**  The VTS INS is designed to improve the safety and efficiency of vessel traffic and to protect the environment. Among other, such services include catalogue such as: Routing, Channel info, Security level, Berthing, Anchorage, Time slot, Traffic monitoring and assessment, Waterway conditions, Weather, Navigational hazards, any other factors that may influence the vessel’s transit, Reports on the position, Identity and intentions of other traffic. | x | x | x | x | x | A33  A34  A2.4  A22  A25  A5 | 260-Gtr01  260-Gtr02  260-Gte04  235-Gte01 |
| MSP2 | Navigation Assistance Service (NAS) | National Competent VTS Authority / Coastal or Port Authority | The NAS is defined by IMO as **“**a service to assist on-board navigational decision-making and to monitor its effects, especially in difficult navigational or meteorological circumstance or in case of defect or deficiencies**”**. This service is normally rendered at the specific request of a vessel or when deemed necessary by the VTS.  NAS may be provided on request by a vessel in circumstances such as equipment failure or navigational unfamiliarity.  Specific examples of developing situations where NAS may be provided by the VTS include:  Risk of grounding; Vessel deviating from the recommended track or sailing plan; Vessel unsure of its position or unable to determine its position; Vessel unsure of the route to its destination; Assistance to a vessel to an anchoring position; Vessel navigational or maneuvering equipment casualty; Inclement conditions (e.g. low visibility, high winds); Potential collision between vessels; Potential collision with a fixed object or hazard; Assistance to a vessel to support the unexpected incapacity of a key member of the bridge team, on the request of the master. | x | x |  | x | x | A36  A6.1  A10  A7 | 132-Gte01  132-Gre01  260-Gte03  260-Gte04 |

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| **1** | **2** | **3** | **4** | **5** | **Functions** NAV 56/WP.5/ Rev.1 - Annex 1 | **Identifier**  NAV 58/WP.6 Annex 1 and paragraph 3.9 |
| MSP3 | Traffic Organization Service (TOS) | National Competent VTS Authority / Coastal or Port Authority | The TOS is defined by IMO as **“**a service to prevent the development of dangerous maritime traffic situations and to provide for the safe and efficient movement of vessel traffic within the VTS Area**”**.  The purpose of the TOS is to prevent hazardous situations from developing and to ensure safe and efficient navigation through the VTS area. The traffic control centre provides information, advice and instructions to vessels. Vessels report before sailing into the VTS area, or when leaving an anchorage site or dock in order to avoid traffic congestion that can create critical situations.  Instructions given as part of a TOS shall be result orientated, leaving the details of the execution to the vessel. | x | x |  | x | x | A35  A7  A22  A33  A34.3  A34.2 | 235-Gte01  260-Gte04  260-Gtr01  260-Gtr02 |
| MSP4 | Local Port Service (LPS) | Local Competent Port / Harbour Operator | Some ports will identify from their risk assessment the need to provide a VTS as specified in the IMO and IALA documentation. To accommodate all other ports, the government may chose to introduce LPS. This service is applicable to those ports where it has been assessed that a VTS, as described above, is excessive or inappropriate and does not imply a lower standard, or a poorer service to customers  Examples of LPS may include:   * berthing information; * availability of port services; * details of shipping movements; * meteorological and hydrological data;   The main difference arising from the provision of LPS is that it does not interact with traffic, nor is it required to have the ability and / or the resources to respond to developing traffic situations and there is no requirement for a vessel traffic image to be maintained.  Provision of LPS is designed to improve port safety and co-ordination of port services within the port community by dissemination of port information to vessels and berth or terminal operators. It is mainly concerned with the management of the port, by the supply of information on berth and port conditions. Provision of LPS can also act as a medium for liaison between vessels and allied services, as well as providing a basis for implementing port emergency plans. | x | x |  |  |  | A30  A31  A32 | 260-Gtr01  235-Gte01  260-Gte04 |

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| **1** | **2** | **3** | **4** | **5** | **Functions** NAV 56/WP.5/ Rev.1 - Annex 1 | **Identifier**  NAV 58/WP.6 Annex 1 and paragraph 3.9 |
| MSP5 | Maritime Safety Information (MSI) service | National Competent Authority | The Global Maritime Distress and Safety System (GMDSS) as described in SOLAS Chapter IV defines the seventh functional requirement as:  "Every ship, while at sea, shall be capable of transmitting and receiving maritime safety information".  The MSI service is an internationally co-ordinated network of broadcasts of Maritime Safety Information from official information providers, such as:   * National Hydrographic Offices, for navigational warnings and chart correction data; * National Meteorological Offices, for weather warnings and forecasts; * Rescue Co-ordination Centres (RCCs), for shore-to-ship SAR information including distress relays; * The International Ice Patrol, for oceanic ice hazards. | x | x | x | x | x | A2.3  A24 | 111-Gte06  134-Gte04  135-Gte01  135-Gte03  260-Gtr02  136-Gte01  135-Gte01-Str01  211-Gte02-Ste03  211-Gre01-Ste01  260-Gte04  135-Gte01-Sre07 |
| MSP6 | Pilotage service | Pilot Authority / Pilot Organization | The aim of the pilotage service is to safeguard traffic at sea and protect the environment by ensuring that vessels operating in pilotage area have navigators with adequate qualifications for safe navigation. Each pilotage area needs highly specialized experience and local knowledge on the part of the pilot.  Efficient pilotage depends, among other things, upon the effectiveness of the communications and information exchanges between the pilot, the master and the bridge personnel and upon the mutual understanding each has for the functions and duties of the other.  Establishment of effective co-ordination between the pilot, the master and the bridge personnel, taking due account of the ship’s systems and equipment available to the pilot, will aid a safe and expeditious passage. | x | x |  |  | x | A26  A4  A5 | 260-Gtr02  235-Gte01  260-Gte04 |
| MSP7 | Tugs service | Port / Commercial Tug Organization | The aim of the tugs services is to safeguard traffic at sea and protect the environment by conducting operations such as:   * Transportation (Personnel and staff from port to anchorage) operations. * Ship assistance (ex: Mooring) operations * Salvage (grounded ships or structures) operations * Shore Operations * Towage (Harbour / Ocean) Operations * Escort Operations * Oil Spill response Operations | x | x | x | x | x | A5 | 260-Gtr02  260-Gte04 |

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| **1** | **2** | **3** | **4** | **5** | **Functions** NAV 56/WP.5/ Rev.1 - Annex 1 | **Identifier**  NAV 58/WP.6 Annex 1 and paragraph 3.9 |
| MSP8 | Digital information exchange with Pilot’s portable unit -PPU. | Pilot Authority / Pilot Organization / VTS Authority | The aim of digital information exchange with PPU is to safeguard traffic and operation at sea, thus protect the environment.  When pilots guide vessels into busy tide-bound ports, or dock alongside quay walls, extremely precise navigation and automatic transfer of information received via communication equipment into the navigational systems for presentation becomes essential.  The PPU is an essential tool for pilotage . It provides:   * Accurate and reliable dynamic real time UKC measurements * Vessel position status with accurate no-go areas * Real time safety limits * Real time emergency options * Differential GPS, real time tidal inputs * Wi-Fi (wireless) connection to the same data that is provided via the AIS pilot plug * Berthing operations   Removal of difficult operations from the pilots workload will increase safety. | x | x |  |  | x | A11.1  A26.2 | 111-Gte01-Ste01  111-Gte01  111-Gte01-Sre01  135-Gte01-Ste03  135-Gte01-Sre07  111-Gte01-Sop01  235-Gte01  260-Gte04  135-Gte01-Ste11  135-Gte01-Ste10  135-Gte02  211-Gte02 |
| MSP9 | Vessel shore reporting | National Competent Authority, Shipowner / Operator / Master | The aim of vessel shore reporting is to safeguard traffic at sea, ensure personnel safety and security, ensure environmental protection and increase the efficiency of maritime operations.  **Single-Window** is one of the most important solutions to reduce the Mariners workload (amount of time spent on preparing and submitting reports to shore-based authorities). To achieve this, reports should be automatically generated as much as possible from on board systems. Some other important possibilities for vessel shore reporting system may include:   * Single-entry of reportable information in single-window solution * Automated collection of internal ship data for reporting * All national reporting requirements to apply standardized digital reporting formats based on IMO FAL forms * Automated or semi-automated digital distribution / communication of required reportable information | x | x | x | x | x | A38  A16  A25  A11  A17 | 140-Gte02  140-Gte03  140-Gre04  140-Gre05  140-Gop01  111-Gte01-Ste01  111-Gte02  260-Gte03  150-Gop01  211-Gte01  235-Gte01  320-Gte01 |

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| **No.** | **Identified Services** | **Identified Responsible Service Provider** | **Short Description** | **Geographical Areas**  NAV 58/6, paragraph 23 | | | | | **Solution References** | **Gap Origin** |
| **1** | **2** | **3** | **4** | **5** | **Functions** NAV 56/WP.5/ Rev.1 - Annex 1 | **Identifier**  NAV 58/WP.6 Annex 1 and paragraph 3.9 |
| MSP10 | Remote monitoring of ships systems | VTS Authority, Shipowner | The objective of the service for remote monitoring of vessel systems is to promote the safety of the vessel and personnel, protect the environment and improve and maintain the ships efficiency.  The remote monitoring system can be combined with automated operation and control features as part of a fully integrated systems covering many aspects of the ship operation such as:   * Propulsion (Main Engine) and Power Monitoring & Control * Auxiliary Machinery Monitoring and Control * Cargo & Ballast Monitoring & Control * Navigation equipment monitoring * Condition based monitoring * Mitigation of potential of fire and flood outbreaks and malfunctioning of necessary auxiliary systems and their supplies. * Managing critical vessels pares parts * Flood Prevention Systems * Fire Detection and Alarm System   temperatures, pressure, level, viscosity, flow control, position of vessel, speed, torque control, voltage, current, machinery status (on/ off), and equipment status (open/ closed). | x | x | x | x | x | A1 | 132-Gte03  120-Gte01-Sop04  120-Gre03  140-Gop02-Ste02 260-Gte03  112-Gte01-Ste01  112-Gte01  136-Gop02  132-Gte01  132-Gte02 |
| MSP11 | Telemedical Assistance Service (TMAS) | National health organization / dedicated health organization | According to the IMO/ILO solution 164 the TMAS centre should provide medical advice for seafarers 24 h/day, 365 days/year. TMAS should be permanently staffed by physicians qualified in conducting remote consultations and who are well versed in the particular nature of treatment onboard ship.  Within the maritime medicine the prevailing view has for a long time been that a standardization of the TMAS services is both necessary and wanted. This would firstly enhance the quality of the medical practice, and secondly, a standardization of reporting and registering of medical events will make a much better basis for advancement. |  |  | x | x | x | A37 | 330-Gte01 |

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| **1** | **2** | **3** | **4** | **5** | **Functions** NAV 56/WP.5/ Rev.1 - Annex 1 | **Identifier**  NAV 58/WP.6 Annex 1 and paragraph 3.9 |
| MSP12 | Maritime Assistance Service (MAS) | Coastal / Port Authority / Organizations | The primary mission of MAS is to handle communication between the coastal State, ship’s officers requiring assistance, and other players in maritime community. These can be fleet owners, salvage companies, port authorities, brokers etc.  The MAS is on 24-hour alert to deploy rapid assistance and professional support for shipsinvolved in combating pollution, fire and explosions on board, collision, grounding, maritime security, terror mitigation, etc.  The Ship Security Alert System enables a vessel to send a distress call if it is attacked by pirates etc. On receiving such a call, the MAS is responsible for alerting the relevant authorities responsible for a response.  The MAS is responsible only for receiving and transmitting communications and monitoring the situation. It serves as **a point of contact** between the master and the coastal State concerned if the ship’s situation requires exchanges of information between the ship and the coastal State.  Situations where the MAS apply are as follow:   * Ship involved in an incident (loss of cargo, discharge of oil, etc) that does impair its seakeeping ability but nevertheless has to be reported. * Ship in need of assistance according to the master’s assessment, but not in distress situation that requires the evacuation of personnel on board. * Ship in distress situation and those on board have already been rescued, with the possible exception of those who have remained aboard or have been placed on board to attempt to deal with the ship’s situation.   The MAS entails the implementation of procedures and instructions enabling the forward of any given information to the competent organization and requiring the organizations concerned to go through the MAS in order to make contact with the ship. | x | x | x | x | x | A19  A20  A23  A22  A37  A34.1 | 111-Gte01-Sop02  135-Gte01-Sop06  260-Gte02 |

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| **No.** | **Identified Services** | **Identified Responsible Service Provider** | **Short Description** | **Geographical Areas**  NAV 58/6, paragraph 23 | | | | | **Solution References** | **Gap Origin** |
| **1** | **2** | **3** | **4** | **5** | **Functions** NAV 56/WP.5/ Rev.1 - Annex 1 | **Identifier**  NAV 58/WP.6 Annex 1 and paragraph 3.9 |
| MSP13 | Nautical Chart Service | National Hydrographic Authority / Organization | The aim of the nautical chart service is to safeguard navigation at sea by providing information such as nature and form of the coast, water depth, obstructions and other dangers to navigation, location and type of aids to navigation.  The Nautical Chart service also ensure the distribution, update and licensing of electronic chart to vessels and other maritime parties. | x | x | x | x | x | A2.1 | 136-Gte01  113-Gre01  113-Gtr01 |
| MSP14 | Nautical publications service | National Hydrographic Authority / Governmental Agencies | The aim of the nautical publication service is to promote navigation awareness and safe navigation of ships. The nature of waterways described by any given nautical publication changes regularly, and a mariner navigating by use of an old or uncorrected publication is courting disaster. Nautical publications includes:  Tidal currents, aids to navigation system, buoys and fog signals, radio aids to marine navigation, chart symbols, terms and abbreviations, sailing directions.  A Chart and Publication Correction Record Card system can be used to ensure that every publication is properly corrected prior use by mariners. | x | x | x | x | x | A2.2 | 136-Gte01  260-Gte04  113-Gre01  113-Gtr01 |
| MSP15 | Ice navigation service | National Competent Authority / Organisation | The ice navigation service is critical to safeguard the ship navigation in ice-infested waters, given how quickly the ice maps become outdated in the rapid changing conditions of the ice-covered navigational regions. Such services include:   * Ice condition information and operational recommendations / advise * Ice condition around a vessel * Vessel routing * Vessel escort and ice breaking * Ice drift load and momentum, * Ice patrol | x | x | x | x | x | A2.8  A6.2 | 235-Gte01  260-Gte04 |
| MSP16 | Meteorological information service | National Meteorological Authority / WMO / Public Institutions | The meteorological service is essential to safeguard the traffic at sea by providing weather, climate digital forecasts and related information to mariners who will use these types of information to support their decision making. Such information include:   * Weather routing, Solar radiation, Precipitation, * Cold / hot durations, Warnings * Air temperature, Wind speed & Direction * Cloud cover, Barometric pressure | x | x | x | x | x | A2.6  A26.2  A34.7  A34.8  A6.1 | 111-Gte01-Sop01  111-Gte05  135-Gte01  135-Gte01-Ste10  211-Gte02  220-Gtr01  235-Gte01  260-Gte04 |

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| **No.** | **Identified Services** | **Identified Responsible Service Provider** | **Short Description** | **Geographical Areas**  NAV 58/6, paragraph 23 | | | | | **Solution References** | **Gap Origin** |
| **1** | **2** | **3** | **4** | **5** | **Functions** NAV 56/WP.5/ Rev.1 - Annex 1 | **Identifier**  NAV 58/WP.6 Annex 1 and paragraph 3.9 |
| MSP17 | Hydrographic information service | National Hydrographic and meteorological Authorities | The hydrographic information service is essential to safeguard navigation at sea and protect the environment. The service provided are such as:   * Current speed and direction * Wave height * Marine habitat and bathymetry * Sailing Directions (or pilots): detailed descriptions of areas of the sea, shipping routes, harbours, aids to navigation, regulations etc. * Lists of lights: descriptions of lighthouses and lightbouys * Tide surge prediction tables and tidal stream atlases * Ephemerides and nautical almanacs for celestial navigation * Notice to Mariners: periodical (often weekly) updates and corrections for nautical charts and publications | x | x | x | x | x | A2.7  A34.5  A6.1 | 136-Gte01  211-Gte02  220-Gtr01  235-Gte01  260-Gte04  111-Gte01-Sop01  111-Gte05 |
| MSP18 | Search and Rescue (SAR) Service | Search and Rescue Authorities | The SAR service is responsible for assisting and coordinating search and rescue operations at sea. In maintaining a state of full readiness the MRCC may perform the following rescue functions:   * Survivors of any aircraft (not in an act of war) crashes or forced landings at sea; * The crew and passengers of vessels in distress; * Survivors of maritime accidents or incidents; * The SAR services must also coordinate the evacuation of seriously injured or ill person from a craft or platform at sea when the person requires medical treatment sooner than the craft or platform would be able to transfer the person to a suitable medical facility.   MRCC may also be pro-actively involved in maritime assistance activities such as:   * Information collection, distribution, and coordination, * Monitoring towing operations, * Monitors and evaluates levels of risk from Maritime Safety Information (MSI) broadcasts to ensure an immediate response in case of life threatening situations developing; * Monitoring vessels not under command, * Pollution reports and vessels aground. | x | x | x | x | x | A39  A18 | 112-Gte01  132-Gte03  320-Gre01  211-Gre01  310-Gte01  310-Gop01  310-Gop02  330-Gte01  320-Gte01 |

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