

IMO/IHO HARMONIZATION GROUP ON
DATA MODELLING
Agenda item 5

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**DEVELOPMENT OF A DEFINITION FOR MSPs AND CONSIDERATION FOR
THE HARMONIZATION OF THE FORMAT AND STRUCTURE OF MSPs**

**References developed by the International Hydrographic Organization (IHO)
and the International Association of Marine Aids to Navigation
and Lighthouse Authorities (IALA)**

Submitted by IHO and IALA

SUMMARY

**Executive
summary:**

This document provides references, an overview of the issues to be considered, potential interactions/dependencies between individual Maritime Service Portfolios (MSPs), and a draft of an IALA Guideline on MSPs.

The co-sponsors have provided this information to facilitate the development and consideration of MSPs by the HGDM.

Action to be taken: Paragraph 9

Related documents: MSC 90/10, MSC 90/28, MSC 94/21, MSC 96/23/7, MSC 96/25; NAV 57/15, NAV 57/WP.6, NCSR 1/28 (annex 7) and NCSR 4/29

INTRODUCTION

1 The term "Maritime Service Portfolio" (MSP) was introduced in the report of the Correspondence Group (CG) on e-navigation to the 56th session of the then Sub-Committee on Safety of Navigation (NAV) in 2010 (NAV 56/8, paragraphs 39 to 42). The term was defined as follows in the report of the same CG to the 57th session of the NAV Sub-Committee (NAV 57/6, paragraph 23):

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

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

2 The concept of MSP was included in the e-navigation architecture endorsed by the 90th session of the Maritime Safety Committee (MSC) in 2012 (MSC 90/28, paragraph 10.10; MSC 90/10, paragraph 2.3; NAV 57/15, paragraph 6.32.1; and NAV 57/WP.6, paragraphs 3.4 to 3.8 and figure 1).

3 The e-navigation Strategy Implementation Plan (SIP) developed by the Sub-Committee on Navigation, Communications and Search and Rescue (NCSR) and adopted by the MSC in 2014 (MSC 94/21, paragraph 9.15; and NCSR 1/28, annex 7) identified MSPs as the means of providing electronic information in a harmonized way and proposed a provisional list of MSPs. The further development of the MSPs is one of the eighteen tasks of the SIP.

4 A related task included in the SIP addresses the development of a Common Maritime Data Structure (CMDS) that includes parameters for priority, source and ownership of information. As agreed by MSC 90 (MSC 90/28, paragraph 10.10), the IHO S-100 data model is the baseline for the CMDS. Harmonization is required for both use on shore and on board ships; and the two must be coordinated.

5 In 2016, the IHO and IALA co-sponsored with others a submission to MSC 96 coordinated by Norway (MSC 96/23/7) proposing, in accordance with the SIP, a new output on e-navigation to define and harmonize the format and structure of MSPs and to provide guidance on the appropriate communication channels to be used for the electronic exchange of information between shore and ship, including any necessary coordination mechanisms and transitional arrangements that may be required. MSC agreed to include in the post-biennial agenda of the Committee (2018-2019) an output on "*Develop guidance on definition and harmonization of the format and structure of Maritime Service Portfolios (MSPs)*", with two sessions needed to complete the item, assigning the NCSR Sub-Committee as the coordinating organ (MSC 96/25, paragraph 23.14).

DISCUSSION

6 The IHO and IALA have individually carried out research and development related to CMDS and MSPs under their remits and had frequent liaisons and meetings between them. During this process, several issues were raised on the development of MSPs. In particular the IHO pointed out the issues related to the general structure of the MSPs, the provision of hydrographic services and coordination across services. These issues are outlined in annex 1.

7 In order to facilitate the understanding of the issue across and between individual services, the IHO developed the diagram "Potential interactions between MSPs". The diagram is at annex 2, and discussed in annex 1.

8 IALA is developing a new Guideline on MSPs to assist IALA members and other service providers to integrate new digital services and to migrate from conventional to digital services. During the development of this Guideline, IALA noted that MSPs would fall within the remit of a number of authorities and organizations including IALA and IHO. IALA is seeking comment from other organizations on the content of this Guideline. The development of this Guideline is still in progress and the current draft is provided at annex 3.

ACTION REQUESTED OF THE HGDM

- 9 The HGDM is invited to:
- .1 consider the need to refine the definition of MSPs (see annex 1, paragraph 1);
 - .2 consider the principles of the governance and architecture of the MSPs (see annex 1, paragraph 1);
 - .3 consider the set of characteristics that are required to describe and implement the MSPs (see annex 1, paragraph 2);
 - .4 consider whether a single MSP named "Nautical Information Service" addresses the provision of all relevant nautical information as required for the implementation of SOLAS Regulation V/9 and Hydrographic information should be promulgated in combination with oceanographic information by means of an MSP named "Hydrographic and Oceanographic Information Service" (see annex 1, paragraph 11);
 - .5 monitor the progress of related NCSR outputs and consider their impact on the implementation of MSPs (see annex 1, paragraph 12):
 - Guidelines for the harmonized display of navigation information received via communications equipment,
 - Additional modules to the Revised performance standards for integrated navigation systems (INS) (resolution MSC.252(83)) relating to the harmonization of bridge design and display of information;
 - .6 monitor the progress in developing the S-100 Interoperability Specification and consider its impact on the implementation of MSPs (see annex 1, paragraph 13);
 - .7 consider issues related to the management of interdependent layers of information (see annex 1, paragraph 14);
 - .8 identify and monitor projects related to the development and implementation of e-navigation that have an impact on the implementation of MSPs (see annex 1, paragraph 15); and
 - .9 note that IALA invites comment from other organizations on the content of its draft Guideline (see annex 3).

ANNEX 1

OVERVIEW OF THE ISSUES TO BE CONSIDERED

General structure

1 The general structure of the MSPs that are required to support e-navigation will have to be developed and agreed with all interested parties. It is suggested that the following aspects be considered by the HGDM:

- Possible need to refine the definition of MSPs recalled in the introduction of this document (see paragraph 1): it is suggested to adopt the concept of 'operational services' implemented through one or more 'technical services' that are described through 'product specifications or other adequate documents'.
- Principles of the governance and architecture of the MSPs: it is suggested to consider a four-level structure:
 - Level 1: MSP governing body: refers to the authority/organization that defines and maintains the overall architecture of the MSPs, endorses the definition and scope of individual MSPs, ensures interoperability and consistency, etc. The HGDM could be the initial forum for defining the structure further.
 - Level 2: Service definition owner: refers to the authority/organization that proposes the definition of a specific MSP to the MSP governing body and then implements the agreed definition through technical specifications.
 - Level 3: Service provider: refers to the authority/organization responsible for delivering a specific operational MSP in a given area according to the relevant specifications. In some cases (i.e. Maritime Safety Information service), there may be a need to distinguish between the provider of the information content (i.e. a NAVAREA coordinator) and the provider of the communication infrastructure/service (i.e. SafetyNET).
 - Level 4:
 - End-user: refers to the organization/individual that makes use of the information provided by a specific MSP; and
 - Stakeholder: refers to the organization/individual other than an end-user that contributes to the implementation and provision of a specific MSP. The stakeholders include the originators of the data/information relevant to the specific MSP, the providers of the end-user equipment, etc.

2 The set of characteristics that are required to describe and implement the MSPs should be agreed by the MSP governing body. The following characteristics are proposed as a starting point:

- Designation;
- Objective;
- Definition/Description/Scope;
- Service definition owner;
- Service provider(s);
- End-users;
- Stakeholders;
- Area(s) of operation;
- Maintenance;
- Interaction(s) with other MSPs if any;
- Regulations and Standards applicable;
- Current status (technical services and related product specifications); and
- Intended evolution (timeline, management procedure which include technical services needed).

Issues related to the provision of hydrographic services

3 The scope of the hydrographic services under the remit of the IHO is defined by SOLAS regulation V/9:

1. *Contracting Governments undertake to arrange for the collection and compilation of hydrographic data and the publication, dissemination and keeping up to date of all nautical information necessary for safe navigation.*
2. *In particular, Contracting Governments undertake to co-operate in carrying out, as far as possible, the following nautical and hydrographic services, in the manner most suitable for the purpose of aiding navigation:*
 - 2.1 *to ensure that hydrographic surveying is carried out, as far as possible, adequate to the requirements of safe navigation;*
 - 2.2 *to prepare and issue nautical charts, sailing directions, lists of lights, tide tables and other nautical publications, where applicable, satisfying the needs of safe navigation;*
 - 2.3 *to promulgate notices to mariners in order that nautical charts and publications are kept, as far as possible, up to date; and*
 - 2.4 *to provide data management arrangements to support these services.*

4 The definition of nautical charts and publications is provided in article 2 of SOLAS regulation V/2:

"Nautical chart" or "nautical publication" is a special-purpose map or book, or a specially compiled database from which such a map or book is derived, that is issued officially by

*or on the authority of a Government, authorized Hydrographic Office or other relevant government institution and is designed to meet the requirements of marine navigation.**

**Refer to appropriate resolutions and recommendations of the International Hydrographic Organization concerning the authority and responsibilities of coastal States in the provision of charting in accordance with regulation 9.*

5 In addition, the provision of navigational warnings is governed by SOLAS Regulation V/4:

*Each Contracting Government shall take all steps necessary to ensure that, when intelligence of any dangers is received from whatever reliable source, it shall be promptly brought to the knowledge of those concerned and communicated to other interested Governments.**

**Refer to the Guidance on the IMO/IHO World-Wide Navigational Warning Service adopted by the Organization by resolution A.706(17), as amended.*

6 Within the framework defined by IMO resolution A.705(17) as amended - *Promulgation of maritime safety information*, navigation warnings are identified as part of maritime safety information (MSI), that, in accordance with the definition provided by SOLAS regulation IV/9 includes:

- navigational warnings,
- meteorological information, and
- other urgent safety-related information.

7 The subjects suitable for navigational warnings are identified in the revised *Joint IMO/IHO/WMO Manual on Maritime Safety Information (MSI)* (MSC.1/Circ.1310/Rev.1, paragraphs 4.2.3.1 to 4.2.3.18). They include position-based subjects that may be relevant to nautical charts or publications (for example: "*the presence of newly discovered rocks, shoals, reefs and wrecks likely to constitute a danger to shipping, and, if relevant, their marking*"), transient position-based subjects that may be displayed on a GIS-based system (for example: "*areas where search and rescue (SAR) and anti-pollution operations are being carried out (for avoidance of such areas)*") and transient general subjects that may affect the destination of the ship (for example: "*World Health Organization (WHO) health advisory information*").

8 The provisions of SOLAS regulation V/9 reflect the paper product era: two sets of documents were developed to support safe navigation: the nautical chart that is a simplified portrayal of the real world adapted to the needs of the mariner and nautical publications that contain all additional information which are deemed useful but less essential and would clutter the paper chart. Charts and publications are kept up-to-date through Notices to Mariners (NtMs) that are generally issued weekly and were originally distributed by post. With the advent of radio-communications, NtMs were supplemented by radio navigational warnings in order to promulgate without delay urgent safety related information.

9 With the implementation of ECDIS, we are today in an intermediate situation. Charts are available in digital form (Electronic Navigational Charts - ENC) with digital updates (ER-profiles) but their content is very similar to the content of the paper charts (both continue to be produced and used concurrently). More and more nautical publications are turned into e-books ('NP2' according to the classification defined in IHO Resolution 5/2002). NtMs are more and more made

available on the web and other digital media but navigational warnings continue to be pushed to the mariner through Navtex and SafetyNET services. The IMO is developing provisions to address the 'harmonized' display of navigation information (NCSR 4/29, paragraph 8) but NP2 publications are not meant to be 'integrated' with ENC's.

10 The IHO S-100 framework provides the foundation for the next phase. The current architecture combines a 'base product' (S-101 ENC's) and 'add-ons' that could provide either more detailed information on a specific ENC theme (for example: detailed bathymetry - S-102), or additional layers that are meant to be used in conjunction with the ENC (for example: weather overlay - S-412). A number of S-100 based product specifications are being developed to address themes related to nautical publications (for example: radio services - S-123). An S-100-based product specification is being developed for navigational warnings (S-124). It is assumed that the S-100 environment will be implemented progressively and that S-52/S-57-based ECDIS and paper products will continue to be used in parallel for some time.

11 It is proposed that a single MSP named "Nautical Information Service" addresses the provision of all relevant nautical information as required for the implementation of SOLAS regulation V/9, i.e. the content of nautical charts and nautical publications. Hydrographic information such as nature of the seabed, tidal and current information (real time or modelled) should be promulgated in combination with oceanographic information by means of an MSP named "Hydrographic and Oceanographic Information Service".

Coordination and cross-services issues

12 The on-going development of "Guidelines for the harmonized display of navigation information received via communications equipment" led by NCSR and any further work on "Additional modules to the Revised performance standards for integrated navigation systems (INS) (resolution MSC.252(83)) relating to the harmonization of bridge design and display of information" may contribute to the harmonization of the display of MSP's in their current status. Therefore, the HGDM is invited to monitor the progress of this output.

13 Ensuring the harmonized display of the information related to more than one service is part of the broader issue of interoperability between the relevant services. In the future CMDS/S-100-based environment, compliance with S-100 based data models and the S-100 Registry structure will enable the provision of consistent products and services. In addition, it appeared necessary to develop an S-100 Interoperability Specification to ensure that S-100 product specifications intended for concurrent use within the same systems are able to interoperate correctly and safely. This development was initiated in 2015 as a high priority work item of the IHO S-100 Working Group (S-100WG), with a target completion year of 2017.

14 Beyond the on-going development of the S-100 Interoperability Specification to support the harmonized display and interaction of the information related to more than one navigational data product, a number of issues related to the management of interdependent layers of information will need to be considered in relation with the implementation of MSP's. Examples of potential issues are:

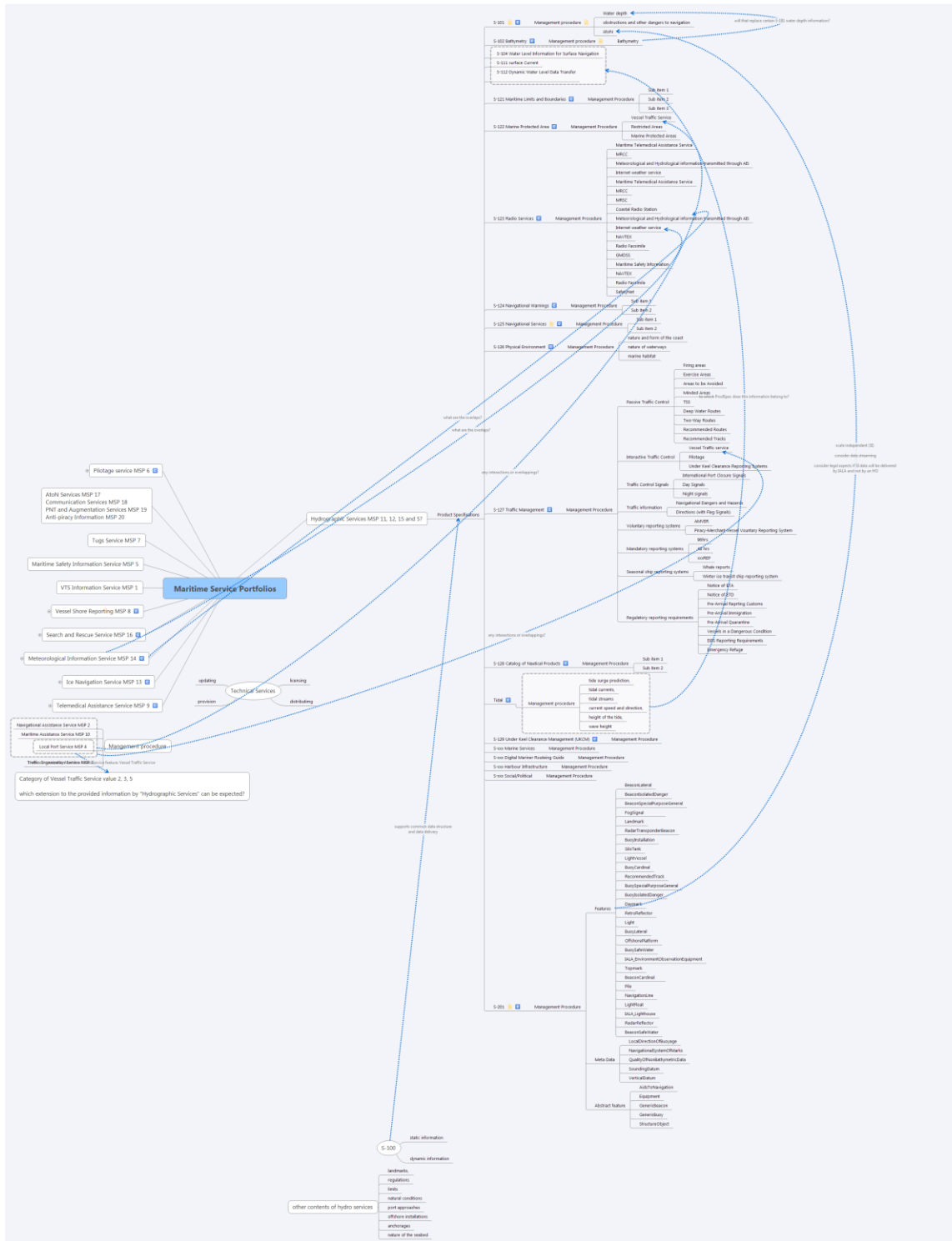
- Role of 'composite' products (such as the ENC) versus separate individual 'layers' for the different themes (for example: bathymetry, topography, aids to navigation, marine protected areas, routeing measures, port infrastructures, etc.).

- Management of data/information shown on different generations of products that may be used in parallel by different users (for example paper charts, S-57 ENC's and S-100-based products).
- Management of data/information affecting more than one MSP to ensure consistency (for example information on aids to navigation [AtoN]: malfunctioning/unserviceability of an AtoN, establishment of a new AtoN or changes to an existing one generate MSI messages and/or ENC updates). The diagram at annex 2 illustrates potential interactions to be considered.
- Provisions related to categorizing, filtering, routing, displaying of received data according to the urgency and the area (including standard versus user settings, preventing risk of information overload, impact on display equipment, impact on the bridge alert management system, etc.).
- Use of the pull mode (for example via the 'maritime connectivity platform', versus the push mode (for example via SafetyNET) for the provision of updates to the end-user and impact on maintaining or not an MSP on the current perimeter of MSI (see paragraph 11 above).
- Combination of static and dynamic information (for example tidal height and depths referred to chart datum).
- Additional standardization required beyond the S-100 framework related to the data structure.
- Organizational and liability aspects, noting that arrangements may vary from country to country: in one country, the same organization may be responsible for hydrographic services, aids to navigation and maritime safety information while in another three different organizations may be involved.

15 A number of recent or on-going projects related to the development and implementation of e-navigation or e-navigation components are already testing options relevant to future services. These projects, in particular those undertaken by the European Union and the Republic of Korea, need to be identified and their objectives and results monitored in order to anticipate and assess their impact on the implementation of MSPs. A list of known test beds can be found on the IALA website at <http://www.iala-aism.org/products-projects/e-navigation/test-bedsprojects/>

ANNEX 2

POTENTIAL INTERACTIONS BETWEEN MSPs



ANNEX 3

**DRAFT IALA GUIDELINE ON MARITIME SERVICE PORTFOLIOS:
DIGITISING MARITIME SERVICES**



IALA GUIDELINE

**MARITIME SERVICE PORTFOLIOS:
DIGITISING MARITIME SERVICES**

Edition 1.0

Document date



DOCUMENT REVISION

Revisions to this IALA Document are to be noted in the table prior to the issue of a revised document.

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1. INTRODUCTION

1.1. General Description

When developing the IMO e-Navigation strategy to improve safety and efficiency of sea transport it became clear that digital services provided to ships are an essential part of this initiative. In order to best describe, structure and implement those services, IMO introduced the concept of "Marine Service Portfolios" (MSPs).

A "Maritime Service Portfolio (MSP)" defines and describes the set of operational and technical services and their level of service provided by a stakeholder in a given sea area, waterways or ports, as appropriate. (NAV 57/6 para 23)

IMO has identified a preliminary list of 16 MSPs. Under its remit, IALA recognised that additional MSPs were needed for items such as AtoNs and PNT, which have been added to these guidelines.

1.2. Purpose

This guideline is mainly for providers of services defined in MSPs to understand what is expected by the maritime community if a dedicated provider of such services is declaring the availability of an MSP in their jurisdiction. It provides the basic information on the defined MSPs. It describes the objectives to be achieved with the MSP as well as a short explanation of the MSP. It also includes references to other MSPs, which may be associated to the specific MSP in question.

This guideline helps providers to integrate new digital services and to migrate from conventional to digital services but does not include technical specifications necessary for the implementation of those MSPs. Those will be defined elsewhere through the respective competent bodies, but are referenced in this document for easy access. It rather provides the guidance on the overarching expectations for a service provider of a given MSP.

The services described in this guideline are intended for IALA guidance, but can also be used for other organisations and authorities planning to implement a set of services as a portfolio.

1.3. Implementation

The services described within this guideline can be implemented in full or in part, based on individual service providers local circumstances.

1.3.1. Change process

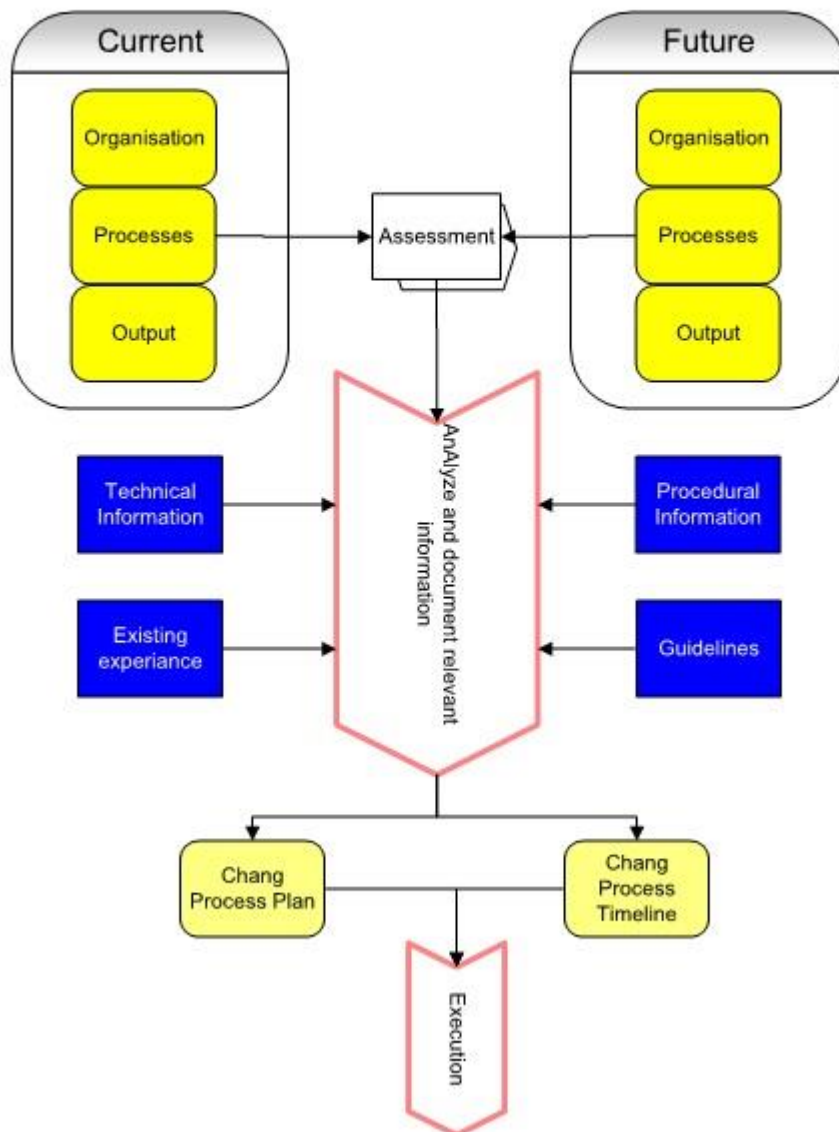
The transformation of existing services into digital services needs to follow a defined process to be successful. See Figure below:

In the beginning there needs to be an assessment of the current situation as well as a clear definition of the intended future situation. This assessment includes review of the organization, the processes and the outputs of the two states: Current and Future.

The result of this assessment will be the input to further analysis. During the analysis phase all relevant information need to be taken into consideration. The categories of information to be analysed are

technical and procedural information as well as existing experience and guidelines. The analysis phase will document all information classes of relevant and the expected outcomes in accordance with the initial assessment of the intended end state. Both a Change Process Plan as well as a Change Process Timeline will have to be created. Once those two plans are available, the execution can start in accordance to those plans.

Conventional to Digital Transformation Process Overview



2. Governing body, SERVICE PROVIDERS & STAKEHOLDERS

2.1. Definitions

- **MSP governing body** which defines and maintains the overall architecture of the MSPs, endorses the definition and scope of individual MSPs, ensures interoperability and consistency, etc. (the IMO/IHO HGDM could be the initial basis for defining further that structure;
- **Service definition owner** which proposes the definition to the governing body and then implement the agreed definition through technical specifications
- **Service provider** responsible for delivering an operational service according to the relevant specifications;
- Service producer refers to a national authority responsible of the collection or creation of an information or data.
- **User** which makes use of the information provided by the service. In some cases (i.e. MSI service), there may be a need to distinguish between the provider of the information content (i.e. a NAVAREA coordinator) and the provider of the communication infrastructure/service (i.e. SafetyNET).
- **Technical service specification owner** refers to the body responsible for developing and maintaining the technical specification(s) of a service, based on the corresponding service definitions [by way of example: for VTS Information Service, technical service specification owners could be the IALA ENAV Committee and the IHO]

2.2. Responsible service providers

[To be decided later]

In each country there will be authorities responsible for providing information services. The table below offers examples of authorities responsible in each case, which can be different between countries.

Responsible authorities may require service providers to deliver the operational service.

The worldwide harmonised provision of Maritime Service Portfolios, their procedures and usage of technologies shall be the ultimate aim, but two basic principles should be taken into account:

- The recognition that on a worldwide, regional, national or local level circumstances may differ due to geographical characteristics, traffic density and diversity, accessibility, environmental conditions and the need to increase the safety of navigation and the efficiency of shipping in a certain area;
- The determination and decision of which services, and on what level they shall be provided to shipping and other stakeholders in their areas of responsibility, will remain assigned to the relevant national, regional or local authorities and service providers.

Table 1 Responsible Authorities (use table derived from NCSR1/28, annex 7?)

Service No	Identified Services	Identified Responsible Service Provider
1	VTS Information Service (INS)	VTS Authority
2	Navigational Assistance Service (NAS)	VTS Authority
3	Traffic Organisation Service (TOS)	VTS Authority
4	Local port Service (LPS)	Local Port/Harbour Authority
5	Maritime Safety Information (MSI) Service	National Competent Authority
6	Pilotage service	Pilotage Authority/Pilot Organization
7	Tug Service	National Competent Authority; Local Port/Harbour Authority; private tug service company
8	Vessel Shore Reporting	National Competent Authority and appointed service providers
9	Telemedical Assistance Service (TMAS)	National health organization / dedicated health organization
10	Maritime Assistance Service (MAS)	Coastal/Port Authority / Organization
11	Nautical Chart Service	National Hydrographic Authority / Organization
12	Nautical Publications service	National Hydrographic Authority / Organization
13	Ice navigation Service	National Competent Authority Organization
14	Meteorological information service	National Meteorological Authority Public Institutions
15	Real time hydrographic and environmental information service	National Hydrographic and Meteorological Authorities
16	Search and Rescue Service	SAR Authorities

3. Defined sea areas for MSP's

The following six areas have been identified for the delivery of MSPs: (See NCSR 1/28 Annex 7)

- 1 port areas and approaches.
- 2 coastal waters and confined or restricted areas.
- 3 open sea and open areas.
- 4 areas with offshore and/or infrastructure developments.
- 5 Polar areas.
- 6 other remote areas.

4. MARITIME SERVICES

4.1. MSP1 VTS Information Service (INS)

4.1.1. Definition

Information Service is defined by IMO as "a service to ensure that essential information becomes available in time for on-board navigational decision-making" (Res. A857(20)). Information is broadcasted at fixed times and intervals or when deemed necessary by the VTS centre, or upon a request from a vessel. It may include but is not limited to¹:

- The position, identity, intention and destination of vessels;
- Amendments and changes in promulgated information concerning the VTS area such as boundaries, procedures, radio frequencies, reporting points;
- The mandatory reporting of vessel traffic movements;
- Meteorological and hydrological conditions, notices to mariners, status of aids to navigation, and waterways conditions;
- Maneuverability limitations of vessels in the VTS area that may impose restrictions on the navigation of other vessels, or any other potential hindrances: or

Any information concerning the safe navigation of the vessel.

The role of VTS in the provision of information service may differ from countries to countries. Table x provides a general overview of information service that can be provided by VTS.

Table x – VTS Information Service

Information related to:	Examples:
Navigational situations (including traffic and route information)	<ul style="list-style-type: none"> • Position, identity, destination of vessels and the intention of other traffic; • Amendments and changes in promulgated information concerning the VTS area such as boundaries, procedures, radio frequencies, reporting points; the mandatory reporting of movements; • Limited maneuverability that may impose restrictions on the navigation of other vessels, or any other potential hindrances; • Suspension or change of routes; etc.
Navigational warnings	<ul style="list-style-type: none"> • Dangerous wrecks, obstacles not otherwise promulgated, diving operations, vessels not under command, etc.

¹ IALA Guideline No. 1089 On Provision of Vessel traffic Services (INS, TOS, NAS), Edition 1, December 2012.

Information related to:	Examples:
Meteorology	<ul style="list-style-type: none"> Information that will include the speed and direction of the prevailing wind, direction and height of the waves, visibility, atmospheric pressure, the formation of ice, etc.
Meteorological warnings	<ul style="list-style-type: none"> Gale, storm, tsunami, restricted visibility, etc.
Hydrography	<ul style="list-style-type: none"> Information that will include factors such as the stability of the seabed, sea depth, the accuracy of surveys, tidal ranges, tidal streams, prevailing currents and swell, etc.
Electronic navigational aids	<ul style="list-style-type: none"> The availability of electronic navigational aids such as: GNSS, Loran, LRIT, DGPS, AIS, RACON etc.
Other information	<ul style="list-style-type: none"> Port information, pilot or tug request, cargo information, health condition, PSC, ISPS, etc.

4.1.2. **Scope**

MSP1 can be delivered in all sea areas (1-6).

4.1.3. **Objective**

IALA guideline 1089 provides guidance on the delivery of the three different types of services provided by a VTS; Information Service (INS), Traffic Organization Service (TOS) and Navigational Assistance Service (NAS).

The categories of services and the associated details are listed in annex 1, MSP1 Information Service template.

4.1.4. **User requirements**

According to the situation, information provided electronically (digital format) could complement and/or replace radio communication. However, critical and urgent situations will most likely be better addressed through radio voice communication, which ensures that the distress call has reached out a VTS centre and proper response is triggered. For non-critical situations, information can be provided in a digital format but care should be taken to ensure that all ships have the capacity to receive and display properly the information.

Given that neither shore-based authorities nor all ships will have modernized their equipment to the digital format level at the same time, a transition period from the current provision of VTS Information Service to the Digital Service format must be envisaged. This transition period will also allow to both ship and shore authorities to get familiar with the new technology and have confidence in it.

It is also important to consider that the provision of VTS Information Service in many VTS areas is not limited to SOLAS vessels but includes as well other type of vessels (domestic, fishing, pleasure craft, etc.). These vessels will need a similar period of transition, which can be longer according to the financial investment that might be required. Thus, the transition period will require that both ways of communication, radio and digital, be maintained in parallel to ensure safety of navigation, and until the Digital format proves to be as efficient and reliable for all situations (figure x).

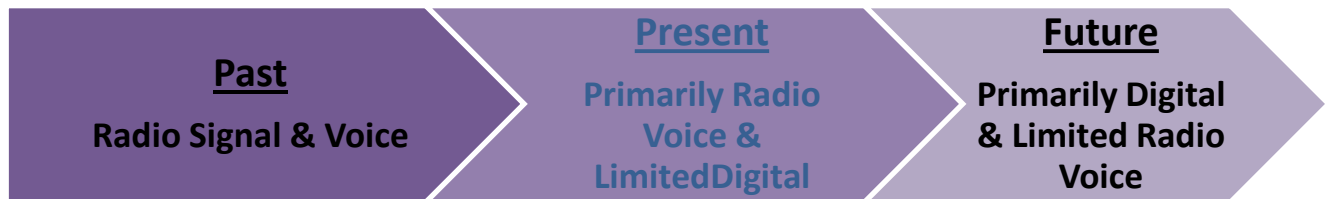


Figure x – Illustration of the provision of VTS information service over time.

Also, many VTS Information Services are produced by other national authorities (see 4.1.5 below) and the conversion of information such as ice, meteorological and hydrographic data to the digital format will gradually change the role of VTS centres with respect to these data. In some cases, the digitalization process will allow to transmit directly the information to mariners without necessarily passing through a VTS centre. However, these situations will require that VTS centres have a constant access to these data in order to monitor its status and to provide the information to ships experiencing electronic problems.

Currently, there are situations where the exchange of information between shore authorities and ships is done electronically.

For example:

- Provision of VTS services such as INS can be done electronically without radio voice communication;
- Meteorological, hydrographic and other type of environmental data can be broadcasted directly to ships through AIS Application Specific Message (AIS ASM), without passing by a VTS centre; and
- The content of the VHF communication can be transmitted electronically and be displayed as a text in parallel to voice communication.

4.1.5. Relationship to other MSPs

As illustrated in figure x, digitalization of information will change the communication procedure between shore authorities and ships and consequently, the role of VTS. Historically, VTS used to communicate to ships most of the information services (MSPs) produced by other recognized organizations (figure xx).

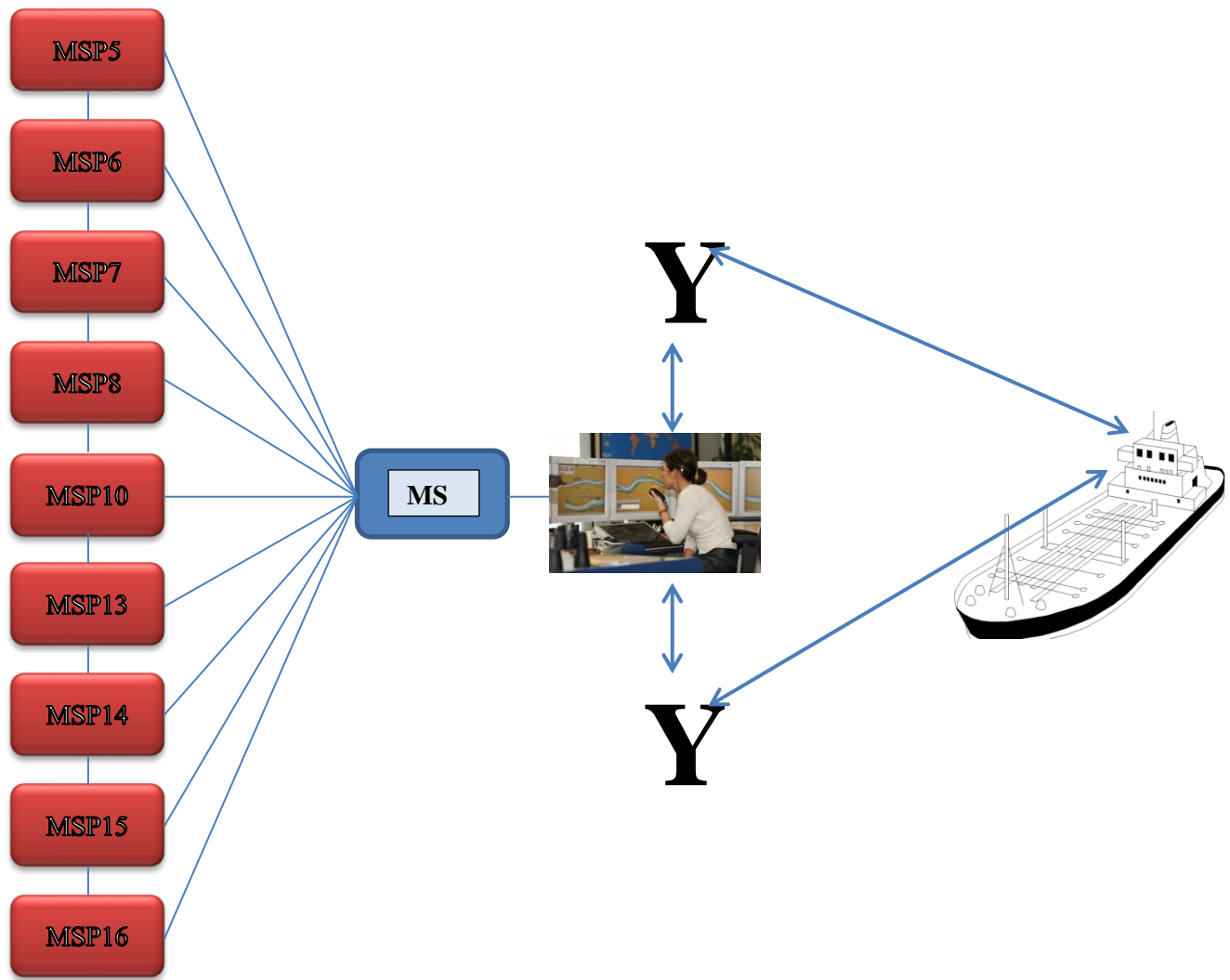


Figure xx: Illustration of the historical communication process between shore and ship.

Over the last decades, the common practice was to "push" information to ships. This allowed VTS to have a knowledge of the status of this information and to trigger a notification procedure whenever a problem was noted. Digitalization of information introduces new ways to communicate with ships and although it will still be possible to push it through communication systems such as AIS and VDES, the capacity of ships to "pull" it directly from internet through Web services will also exist. In both cases, the assistance of VTS may not be required. This new situation may decrease the situational information awareness of VTS as they won't know whether or not information has been received by ships. In order to keep pace with the digital transformation of information service, VTS will need to have access and monitor the status of information transmitted directly to ships. Hence, if ever there is a technological failure and information service cannot be communicated to ships, VTS will be in a position to notify as well mariners as the service producer, or to provide the information to the ship.

Even though information in the near future could be made accessible directly to ships, VTS will remain the primary contact with ships for urgent and important messages, including as a back-up for electronic failure. The figure xxx illustrates some of the current and future possibilities with respect to shore ↔ ship communication.

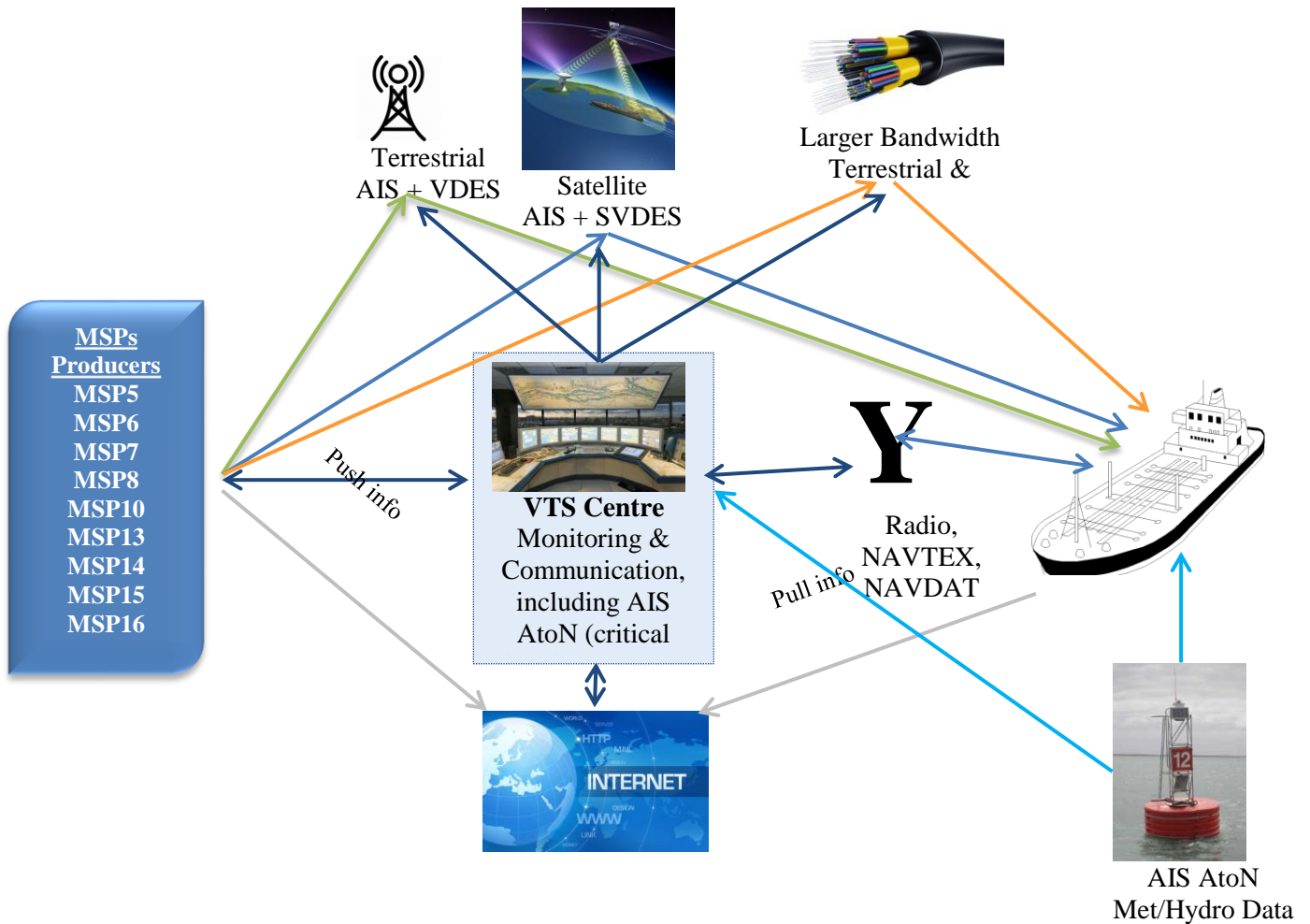


Figure xxx: Illustration of some current and future communication processes between shore and ship.

Implementation of MSP1 by a national authority will require a strong coordination with all other MSP producers to clarify the mean of communication that will be used to transmit their own service information to mariners, and to determine how the VTS will be kept informed. Development of national procedures detailing how shore ↔ ship communication will proceed will be essential to maintain safety to navigation.

In parallel to the development of MSPs' content, the IMO is working on *Guidelines for harmonized display of navigation information received via communication equipment*. These Guidelines aim to develop standards and specifications which will automatically display on equipment onboard MSPs' information received from a recognized an official mean of communication. This interoperability will allow a national authority to select, among e-Navigation recognized means of communication, those adapted to its own situation and capacity.

There are currently some e-Navigation means of communication already implemented or available but several are still in a development phase. Also, there are still works to do on the ships' side to ensure harmonization of display. The Table xx below summarizes the status of these means of communication. This Table will be amended whenever the status of a mean of communication changes.

Mean of communication (e-Navigation)	Status	Standards	Area(s) of application
AIS Application Specific message (ASM)	In force	IMO SN. 1/Circ.289 Rec. ITU-R M.1371-5	Terrestrial: 1, 2 Satellite: all areas
AIS Addressed Safety Related Message	In force	Rec. ITU-R M.1371-5	Terrestrial: 1, 2 Satellite: all areas
VDES (terrestrial & satellite)	In development	ITU-R-M.2092	Terrestrial: 1, 2 Satellite: all areas
NAVDAT	In development	ITU-R M.2010 (03/2012)	1, 2, 4, 5
Web service	In force	XML Conforming to ISO 8879)	Cellular: 1, 2 Satellite: all areas
...			

Table xx: Current status of e-Navigation means.

4.2. MSP2 Navigational Assistance Service (NAS)

4.2.1. Definition

Navigational Assistance Service is defined by IMO as "a service to assist on-board navigational decision-making and to monitor its effects". NAS is especially important in difficult navigational or meteorological circumstances or in case of defects or deficiencies. This service is normally rendered at the request of a vessel or by the VTS when deemed necessary. (IMO Res.A857(20)).

4.2.2. Scope

MSP2 can be delivered in sea areas 1-4.

4.2.3. Objective

IALA guideline 1089 gives guidance on the delivery of the three different types of services provided by a VTS; Information Service (INS), Traffic Organization Service (TOS) and Navigational Assistance Service (NAS).

MSP2 is defining the categories of information that could be exchanged electronically in respect of Navigational Assistance Service (NAS).

4.2.4. User requirements

"Where possible and desired the information related to this service should be displayed in real time, mainly on the ship's ECDIS or in combination with other presentation instruments. An overload of information on one instrument however should be avoided". Information provided electronically could complement VHF communication in time critical situations and in addition partly replace VHF communication in non-time critical situations.

Example of time critical situation:

- Risk of grounding; In addition to VHF communication, vessel can be provided with an electronic route recommendation.

Example of non-time critical situation:

- Assist a vessel to an anchoring position; provide the vessel with an electronic route recommendation without VHF communication.

The categories of service should include the following:

- Navigational Information;
- Advice – to keep clear of danger and avoid hampering the movement of deep draft vessels;
- Warning – alert vessels to the risk of collision or grounding; and
- Manoeuvrability limitations of vessels in the VTS area that may impose restrictions on the navigation of other vessels, or any other potential hindrances; any information concerning the safe navigation of the vessel (ad-hoc type of hazards).

The categories of services and the associated details are listed in annex 2, MSP2 Navigational Assistance Service template.

Those categories may include for example: Navigational information, advice, instruction or warning.

4.3. MSP3 Traffic Organization Service (TOS)

4.3.1. Definition

Traffic Organization Service (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" (IMO Res.A857(20)).

TOS concerns the operational management of traffic and the forward planning of vessels movements to prevent congestion and dangerous situations, and is particularly relevant in times of high traffic density or when the movement of special transports may affect the flow of other traffic. This service may also include establishing and operating a system of traffic clearances or VTS sailing plans or both in relation to priority of movements, allocation of space, mandatory reporting of movements in the VTS area, routes to be followed, speed limits to be observed or other appropriate measures which are considered necessary by the VTS authority. (IMO Res. A.857(20))

4.3.2. Scope

MSP3 can be delivered in sea areas 1-4.

4.3.3. Objective

IALA guideline 1089 gives guidance on the delivery of the three different types of services provided by a VTS; Information Service (INS), Traffic Organization Service (TOS) and Navigational Assistance Service (NAS).

MSP3 is defining the categories of information that could be exchanged electronically in respect of Traffic Organization Service (TOS)

The categories of services and the associated details are listed in annex 3, MSP3 Traffic Organization Service template.

Those categories may include for example: Waterway management, Traffic clearance.

4.3.4. User requirements

All information provided electronically should be displayed in real time on the ship.

Information provided electronically could complement and/or replace VHF communication.

Examples:

- Slot management; provide vessels electronically with timestamp, priority of arrival and distance between two vessels
- Traffic clearance; provide vessels permission to proceed, impose conditions or deny entry electronically

The categories of service should include the following:

- Traffic clearance;
- Anchorage assignment; and
- Routes to be used.

4.4. MSP4 Local Port Service (LPS)

4.4.1. Definition

[More input needed]

LPS is applicable to those ports where it has been assessed that a VTS, as described above, is excessive or inappropriate.

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. Examples of LPS may include:

- berthing information;
- availability of port services;
- shipping schedules;
- meteorological and hydrological data.

4.4.2. Scope

4.4.3. Objective

4.4.4. User requirements

4.5. MSP5 Maritime Safety Information service (MSI)

4.5.1. Definition

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 Coastal administration or shipping authority, for navigational warnings;
- National Meteorological Offices, for marine weather warnings and forecasts;
- Rescue Co-ordination Centres (RCCs), for shore-to-ship distress alerts;
- The International Ice Patrol, for Oceanic ice hazards.

SOLAS Chapter V, regulations 4 through 7 governs the contracting governments' responsibilities with regards to providing MSI information.

Examples of Maritime Safety Information Service are listed in Table x.

Table x – Maritime Safety Information Service

Information related to:	Examples:
Impediments to shipping and areas to avoid	<ul style="list-style-type: none"> • Dangerous wrecks, obstacles not otherwise promulgated, diving operations, cable laying operations, vessels not under command, etc. • The routes of large unwieldy tows; • Drifting hazards (including derelict vessels, ice, mines, containers, other large items, etc.); • The establishment of offshore structures in or near shipping lanes and the positioning of rigs; • Areas where search and rescue (SAR) and anti-pollution operations are being carried out (for avoidance of such areas) • Military practice areas.
Status of navigation aids	<ul style="list-style-type: none"> • Casualties to lights, fog signals, buoys and other aids to navigation affecting main shipping lanes; • Establishment of major new aids to navigation or significant changes to existing ones.

Other urgent safety-related information	<ul style="list-style-type: none"> • unexpected alteration or suspension of established routes; • acts of piracy and armed robbery against ships; • tsunamis and other natural phenomena, such as abnormal changes to sea level; • New or amended mandatory ship reporting systems or maritime regulations affecting ships at sea; • Significant malfunctions or changes to maritime communications systems. • World Health Organization (WHO) health advisory information; • security-related requirements.
Marine weather warnings and forecasts	<ul style="list-style-type: none"> • Information that will include the speed and direction of the prevailing wind, direction and height of the waves, visibility, atmospheric pressure, the formation of ice, etc. • Gale, storm, tsunami, restricted visibility, etc.

4.5.2. **Scope**

MSP5 can be delivered in all sea areas (1-6).

4.5.3. **Objective**

The joint IHO/IMO/WMO Publication S-53 states that the Maritime Safety Information Service of the GMDSS is the internationally and nationally coordinated network of broadcasts containing information which is necessary for safe navigation, received on ships by equipment which automatically monitors the appropriate transmissions, displays information which is relevant to the ship and provides a print capability. This concept is illustrated in figure 4.5-1.

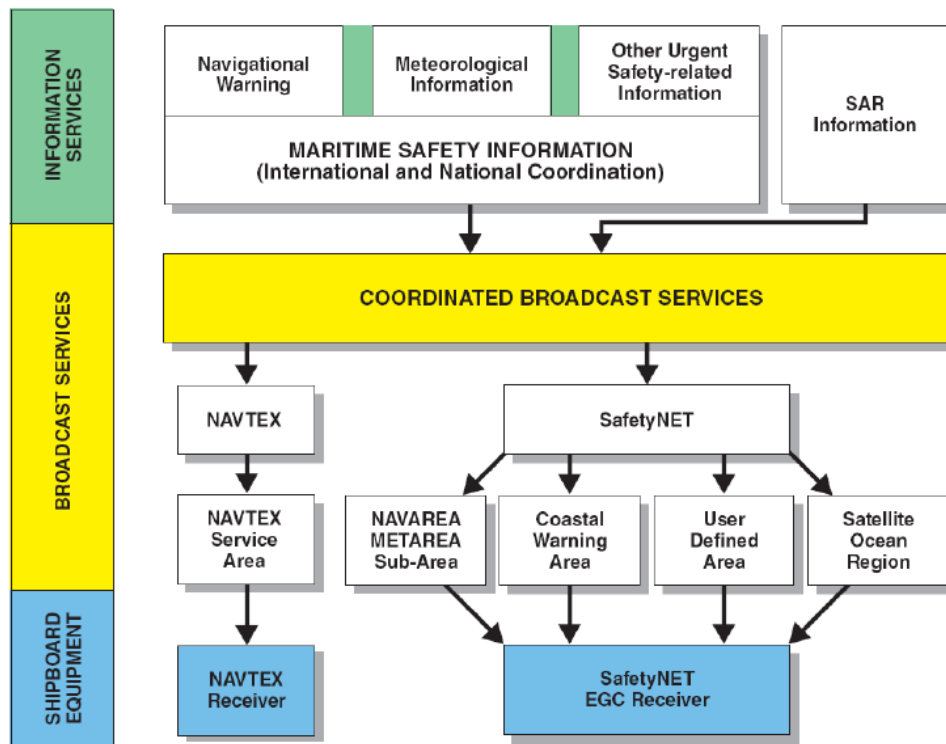


Figure 4.5-1 The maritime safety information service of the Global Maritime Distress and Safety System (Source: S-53)

*Note that search and rescue information is outside of scope for this MSP.

Additionally, local and regional governments may provide MSI information in other formats such as through a website, push e-mail service and social media.

Within GMDSS, navigational warnings promulgation is done in defined areas that are managed by area coordinators as illustrated on figure 4.5-2.

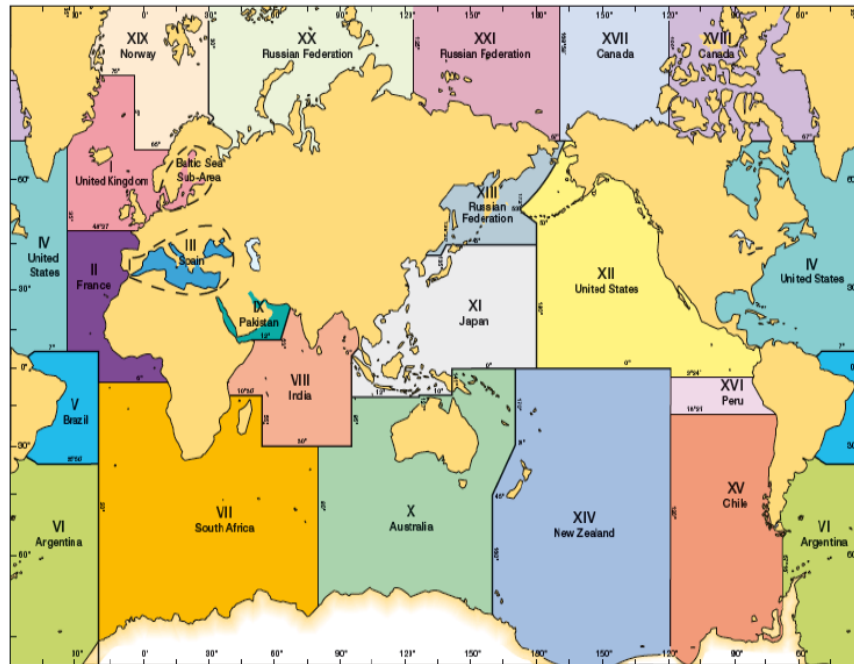


Figure 4.5-2 NAVAREAs for coordinating and promulgating navigational warnings under the World-Wide Navigational Warning Service (Source: S-53)

Marine meteorological warnings are, within GMDSS, promulgated in defined areas which are under the coordination of defined area coordinators. Within other distribution channels, other areas and operators are possible.

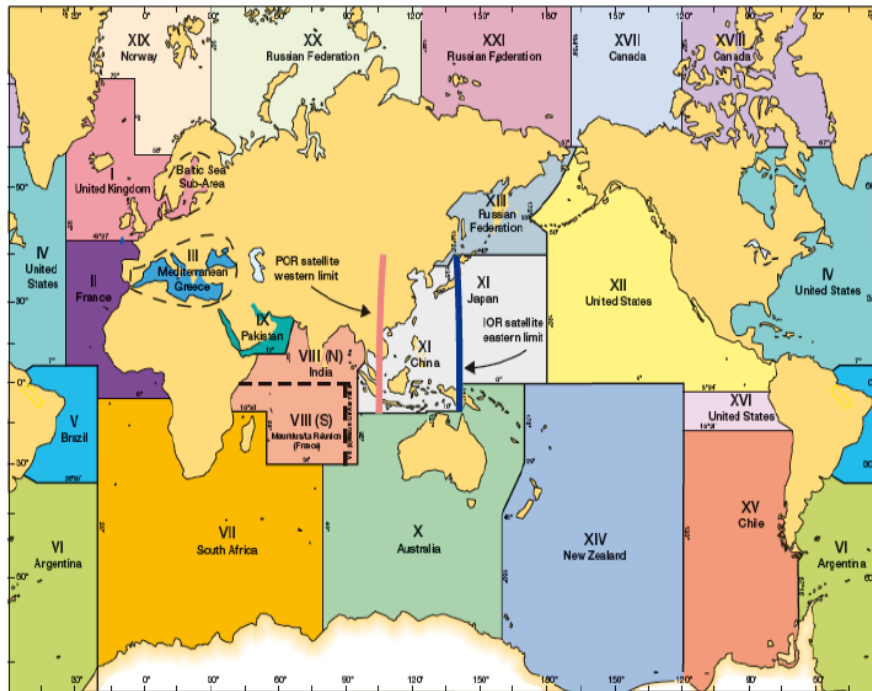


Figure 4.5-3 METAREAs for coordinating and promulgating meteorological warnings and forecasts within the GMDSS (Source: S-53)

4.5.4. User requirements

Two principal methods are used for broadcasting maritime safety information in accordance with the provisions of the International Convention for the Safety of Life at Sea, 1974, as amended, in the areas covered by these methods, as follows:

1. NAVTEX: broadcasts to coastal waters; and
2. SafetyNET: broadcasts which cover all the waters of the globe except for Sea Area A4, as defined by IMO resolution A.801(19), annex 3, as amended.

Additionally, HF NBDP may be used to promulgate maritime safety information in areas outside Inmarsat or NAVTEX coverage (SOLAS regulation IV/7.1.5).

Ships are required to be capable of receiving maritime safety information broadcasts for the area in which they operate in accordance with the provisions of the International Convention for the Safety of Life at Sea, 1974, as amended. The NAVTEX receiver should operate in accordance with the technical specifications set out in Recommendation ITU-R M.540, as amended. The SafetyNET receiver should conform to the Maritime Design and Installation Guidelines (DIGs), annex B, issue 6 of April 2008 published by Inmarsat. In Sea Area A4, outside of the coverage of NAVTEX, where MSI is received using HF NBDP, the HF NBDP receiver should operate in accordance with the technical specifications set out in Recommendation ITU-R M.688, as amended, and should meet the performance standards adopted by IMO resolution A.700(17), as amended.

Future MSI services should provide information in formats and by means that allow it to be better integrated with other systems on board, especially ECDIS. IHO is developing the S-124 standard which is

expected to be the next generation MSI exchange standard. It is envisioned that these will interact in various forms with the ENC within the ECDIS.

4.5.5. Relationship to other MSPs

Information related to ENC data such as updates to the status of navigation aids will supplement information that is part of MSP11 and MSP 17. Anti-piracy warnings transmitted as MSI will overlap with MSP 20 and will probably be summary information that is expanded on in MSP20 services. Meteorological information such as forecasts will overlap information that is part of MSP 14 and MSP 15, and again will potentially be extracts or summaries of information that is provided in more detail as part of those services.

4.6. MSP6 Pilotage service

4.6.1. Definition

[More information needed]

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 exchange on one hand between the pilot, the master and the bridge personnel, and on the other hand between the persons on the bridge and shore based organizations such as VTS. 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.

4.6.2. Scope

Contact info?

4.6.3. Objective

4.6.4. User requirements

4.7. MSP7 Tugs service

4.7.1. Definition

[More information needed]

Efficient tug operations depend on, among other things, the effectiveness of the communications and information exchanges between relevant stakeholders. The primary aim of the tugs services is to assist in the manoeuvring of ships in narrow waterways and when berthing. The tugs service may also be used for:

- 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.

4.7.2. Scope

4.7.3. Objective

4.7.4. User requirements

4.8. MSP8 Vessel shore reporting

4.8.1. Definition

[More information being prepared in Korea]

The aim of Vessel Shore Reporting as a digitalized service is to ensure that reliable and in-time information can be provided by the ship to shore-based authorities and organisations in order to increase the efficiency of maritime operations and to decrease the workload aboard and ashore, and consequently to safeguard traffic at sea, ensure personnel safety and security, and to protect the environment. Automated ship reporting is one of the most important solutions to reduce the Mariner's 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 of the ways the administrative burden of vessel shore reporting can be reduced are:

- single-entry of reporting information into ICT collection tools that store it in a repository and ICT tools that assists with the generation all required reports from this repository;
- automated collection of information from ship-board systems that is required for reporting (for example Ballast Management System, Emissions Control System, Waste Management System, Navigation System, etc., etc.);
- ICT tools that allow mariners to delegate to shore-based personnel (at the discretion of the ship's owner/operator) the tasks of information collection, generation and submittal of required reports;
- reduce the administrative burden by encouraging all national reporting requirements to use standardized digital reporting formats based on the S-200 Product Specification of the Common Maritime Data Structure;
- automated or semi-automated digital distribution/communication of required reports via available networks.

4.8.2. Scope

Submission and distribution of all reports required by all shore-based authorities in the required format and in the required timeframe.

4.8.3. Objective

Reduce the burden of submittal and distribution of required reports

4.8.4. User requirements

Provide ICT tools for shipboard and shore-based personnel to streamline the processes and procedures associated with submittal, generation and distribution of required reports, including retrieval of information from other ship systems (Ballast Management, Waste Management System, Emission Control System, Navigation System, etc., etc.) and from shore-based sources (cargo and passenger booking offices, crewing agents, stevedores, etc., etc.).

Such tools should alert the user what information is missing in the repository that prevents generation of the required reports for an upcoming port call, which reports will need to be submitted when, to whom in what format and via which communications network.

The repository structure shall comply with the latest version of the S-200 Product Specification for the Common Maritime Data Structure.

The reports shall fulfil the exact requirements of each and every shore-based authority. This means adhering to the requirements for report format (hard copy, fax, MS Word, PDF, RTF, XML, Excel, CSV, etc.), its graphical layout, its language(s), the specification of its fields, its units of measure, allowed abbreviations, its deadline (relative to the arrival at the next port), how it is authenticated, how it is to be submitted, who it should be addressed to, etc., etc.

The reports should be created in the proper time and time period to report before her arrival at ports or sea area automatically and authorised by master before submission.

The information related to ship operation should not be revised intentionally by mariner and should be collected directly from ship's automatic monitoring system.

To fulfil the above user requirements an eco-system shall be established in which developers of such ICT Tools can thrive and provide shipping lines with a number of alternative solutions.

This, in turn, requires building and maintaining a library of required reports that are uniquely identified and characterized by their requirements for format, deadline, content, etc., etc. (FONASBA, which is an association of shipping agents that has 'Observer' status at IMO may be enticed to build and maintain the report library). The eco-system also requires developing and maintaining an S-200 Product Specification for CMDS that can be used to generate all required reports in the library. Lastly it requires that ships' systems that generate reporting information be certified to be compliant with an international machine-to-machine interface standard or ship network standards such as IEC 61162 series. A prime candidate for such standards are those developed by the Open Connectivity Foundation for the Internet of Things (IoT).

4.9. MSP9 Telemedical Assistance Service (TMAS)

4.9.1. Definition

[More information needed]

According to the IMO/ILO resolution 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 on board 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. MSC.1/Circ.1218 MSC/Circ.960

4.9.2. Scope

4.9.3. Objective

4.9.4. User requirements

4.10. MSP10 Maritime Assistance Service (MAS)

4.10.1. Definition

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 ships in connection with:

Combating pollution, fire and explosions on board, collision, grounding, 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. [is this right]

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:

- A ship involve in an incident (loss of cargo, accidental discharge of oil, etc.) that does impair its sea keeping ability but nevertheless has to be reported;
- a ship in need of assistance according to the master's assessment, but not in distress situation that requires the rescue of personnel on board;
- a ship in distress when 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 forwarding 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.

4.10.2. Scope

4.10.3. Objective

4.10.4. User requirements

4.11. MSP11 Nautical Chart Service

4.11.1. Definition

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, tides table, obstructions and other dangers to navigation, location and type of aids to navigation and is most often signatories to IMO SOLAS where the responsibilities of a hydrographic service is defined as follows

Contracting Governments to SOLAS V undertake to arrange for the collection and compilation of hydrographic data and the publication, dissemination and keeping up to date of all nautical information necessary for safe navigation. In particular, Contracting Governments undertake to co-operate in carrying out, as far as possible, the following nautical and hydrographic services, in

the manner most suitable for the purpose of aiding navigation:

- to ensure that hydrographic surveying is carried out, as far as possible, adequate to the requirements of safe navigation;
- to prepare and issue nautical charts, sailing directions, lists of lights, tide tables and other nautical publications, where applicable, satisfying the needs of safe navigation;
- to promulgate notices to mariners in order that nautical charts and publications are kept, as far as possible, up to date; and
- to provide data management arrangements to support these services.

Contracting Governments undertake to ensure the greatest possible uniformity in charts and nautical publications and to take into account, whenever possible, relevant international resolutions and recommendations, which means the appropriate resolutions and recommendations adopted by the International Hydrographic Organization (IHO).

IHO facilitate co-ordination of the hydrographic office activities to the greatest possible degree in order to ensure that hydrographic and nautical information is made available on a world-wide scale as timely, reliably, and unambiguously as possible.

In nearly all countries, chart data is currently available to end-users only on a commercial basis, either directly from the hydrographic office, via commercial data vendors, or chart agents. This model is expected to continue for the foreseeable future. Updates are available by both physical media (CD/DVD) and online, over the Internet or by e-mail. Online update services are accessible either directly via off-the-shelf tools (e.g., Web browsers) or via custom applications or software modules in applications.

Vendors supply value-added data (VAD) supplied by vendors (this means VAD that is intrinsically chart data, not an overlay of other information). Such information is considered unofficial data.

Raster charts services also continue to be available and there is expected to be a continued demand during the transition period at least.

Examples of Nautical Chart Service is listed in Table x.

Table x – Nautical Chart Service

Information related to:	Examples:
Navigational charts	<ul style="list-style-type: none"> • Paper charts • Raster Navigational Charts (RNC) • Electronic Navigation Charts (ENC)
Chart catalogue	<ul style="list-style-type: none"> • Catalogue of available products
Bathymetric charts	<ul style="list-style-type: none"> • Bathymetric Information with greater details than normally given in a navigational chart
Notice to Mariners	<ul style="list-style-type: none"> • Regular updating service for products issued by the individual Nautical Chart Service.
Hydrography	<ul style="list-style-type: none"> • Information that will include factors such as the stability of the seabed, sea depth, the accuracy of surveys, tidal ranges, tidal streams, prevailing currents and swell, etc.

4.11.2. **Scope**

MSP11 can be delivered in all sea areas (1-6).

4.11.3. **Objective**

A hydrographic service produces and distribute paper charts, ENCs and other products to safeguard navigation at sea. These services are carried out as defined in the IHO publications M-3 and for ENCs the WEND (Worldwide Electronic Navigational Chart Database) principles (M-3, Resolutions of the IHO – Resolution 1/1997 (as amended)) which note that:

"The purpose of WEND is to ensure a world-wide consistent level of high-quality, updated official ENCs through integrated services that support chart carriage requirements of SOLAS Chapter V, and the requirements of the IMO Performance Standards for ECDIS."

The IHO S-65 standard note that hydrographic offices are responsible for:

- The preparation and provision of digital data and its subsequent updating for waters of national jurisdiction.
- Ensuring that, mariners, anywhere in the world, can obtain fully updated ENCs for all shipping routes and ports across the world and that their ENC data are available to users through integrated services.
- Assuring the high quality of its ENC services through the use of a Quality Management System that is certified by a relevant body as conforming to a suitable recognised standard; typically this will be ISO 9001.
- Ensuring compliance with all relevant IHO and IMO standards and criteria (including IHO S-57, IHO S-52, or their replacements).

- Providing timely updates to the ENC for the mariner; these should be at least as frequent and timely as those provided by the Contracting Government for the correction of paper charts.

Similar arrangements and principles apply to nautical charts and other nautical products (e.g. S-102 high definition bathymetry) made available by hydrographic offices.

[This section reuses material from S-65. S-65 contains this copyright statement: In the event that this document [S-65] or partial material from this document [S-65] is reproduced, translated or distributed under the terms described above, the following statements are to be included:

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4.11.4. User requirements

Nautical chart service should offer both paper charts as well as digital charts in raster and vector formats for use in ECDIS or ECS, depending on vessel classification. Nautical charts should be made available as widely as possible utilizing various distribution channels, including direct distribution, agents and other service providers. ENC may be distributed via a RENC, which distribute them onward with the distributor network.

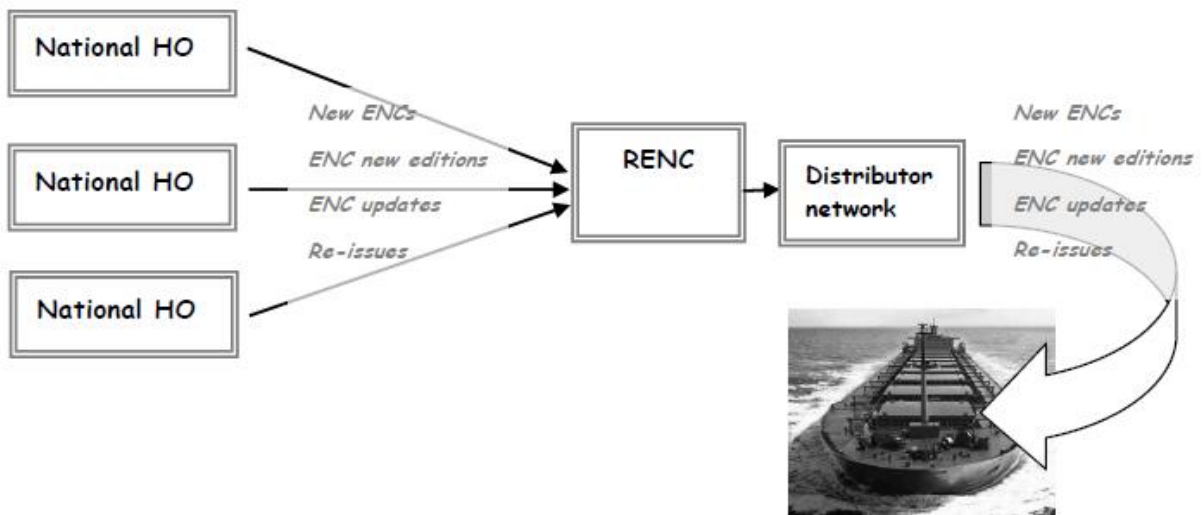


Figure 4.11-1 - General principle of ENC distribution (Source: S-65)

A chart catalogue service should be included as a part of a Nautical Chart service to give service users a quick reference guide to products offered by the nautical chart service.

IHO is developing the next version of ENC, called S-101. It should be expected that a new ECDIS or ECS system may be needed to utilize these next generation ENC. For future nautical chart services, the commercial model of distribution is expected to continue. Chart vendors provide for licensing and payment on a when-needed basis even now, and this will continue to be a requirement. The technical

specifications of this service must support licensing, payment (both subscription-based and spot payments), and data protection.

Requirements for future services in this portfolio include faster turnaround for the process between mariner reports to agencies to the issuance of chart updates, making it easier to include more types of relevant information with reports such as information in mixed media, and reporting methods that are better integrated with ENCs. For example, initial generation of a hydrographic report on an ECDIS followed by automatic transfer of the initial report to a back-of-bridge system and thence to the appropriate hydrographic office.

Provision should be made for value-added data (VAD) and value-added services (VAS) supplied by vendors (this means VAD that is intrinsically chart data, not an overlay of other information), including SENC distribution.

Raster charts services also continue to be available and there is expected to be a continued demand during the transition period at least.

4.11.5. Relationship to other services

MSP 12 and MSP 13 will supplement MSP 11 data for navigation purposes. MSP5 will supplement it with up-to-date information on the status of navigation aids, obstructions to shipping and other events that impact navigational safety.

4.12. MSP12 Nautical publications service

4.12.1. Definition

The aim of the nautical publication service is to promote navigation awareness and safe navigation of ships. Nautical publications include, tidal currents, aids to navigation system, buoys and fog signals, radio aids to marine navigation, chart symbols, terms and abbreviations, sailing directions and notices to mariners and local notices. Nautical publications information often includes information necessary for navigation that cannot be included in a chart service, for example because it consists of blocks of text, or information of use to the mariner but not essential to route monitoring. When the S-100 based product specifications are in full use, the line between ENC and many nautical publications will be based on content rather than format, since both will be available as feature-based datasets.

A nautical publication service is normally provided by a hydrographic service by a nation that is most often a signatory to IMO SOLAS where the responsibilities of a hydrographic service is defined as follows

Contracting Governments to SOLAS V undertake to arrange for the collection and compilation of hydrographic data and the publication, dissemination and keeping up to date of all nautical information necessary for safe navigation. In particular, Contracting Governments undertake to co-operate in carrying out, as far as possible, the following nautical and hydrographic services, in the manner most suitable for the purpose of aiding navigation:

- to ensure that hydrographic surveying is carried out, as far as possible, adequate to the requirements of safe navigation;
- to prepare and issue nautical charts, sailing directions, lists of lights, tide tables and other nautical publications, where applicable, satisfying the needs of safe navigation;
- to promulgate notices to mariners in order that nautical charts and publications are kept, as far as possible, up to date; and
- to provide data management arrangements to support these services.

Contracting Governments undertake to ensure the greatest possible uniformity in charts and nautical publications and to take into account, whenever possible, relevant international resolutions and recommendations, which means the appropriate resolutions and recommendations adopted by the International Hydrographic Organization (IHO).

IHO facilitate co-ordination of the hydrographic office activities to the greatest possible degree in order to ensure that hydrographic and nautical information is made available on a world-wide scale as timely, reliably, and unambiguously as possible. Moreover, the IHO publication M-3 contains technical resolutions and recommendations that define how nautical publications shall be produced to be compliant with SOLAS (NAUTICAL PUBLICATIONS AND THE SOLAS CONVENTION, 3/2002 as amended).

While they have been largely book-based until now, IHO is actively working on making several of them more ECDIS-friendly in the sense of turning them into feature-based datasets.

Nautical publications are currently nearly always provided as printed and digital paper publications that are nearly always distributed via commercial channels. Updates and corrections especially to the status of navigation aids and lights are often distributed via agency web sites as well as the distribution channels for the originals.

Examples of Nautical Publications Service are listed in Table x.

Table x – Nautical Publications Service

Information related to:	Examples:
Transits and routeing	<ul style="list-style-type: none"> • Routes in constricted shipping lanes or • Routeing measures, traffic separation schemes, and shipping lanes
Summary information about port facilities	<ul style="list-style-type: none"> • Depth alongside berths, and quay lengths • Cargo handling facilities at specified terminals and berths
Variations from charted information	<ul style="list-style-type: none"> • Tendencies toward silting at river mouths, shifting sandbanks, etc., that may degrade the accuracy of charted information
Marine radio services	<ul style="list-style-type: none"> • Geographic availability of services • Frequencies and channels used and broadcast schedules • Type of traffic supported – Weather forecasts, radiofax, telemedical assistance, etc.
Protected area information	<ul style="list-style-type: none"> • Locations of marine protected areas • Restrictions and regulations applicable within specific areas
Prevailing natural conditions	<ul style="list-style-type: none"> • Seasonal hazardous conditions • Periodic (e.g., tide-related) or irregular hazardous conditions
Regulatory information	<ul style="list-style-type: none"> • Laws and regulations applicable in specific locations. • Laws and regulations applying to vessels of specific dimensions or carrying specified cargo • Local rules regarding use of specific pilot boarding places by vessels exceeding specified dimensions or carrying hazardous cargo
Services	<ul style="list-style-type: none"> • Waste disposal, repair, bunkering, collection of ship pollutants such as oily wastes • Pilot services contact information and notice times
Navigation aids	<ul style="list-style-type: none"> • List of Lights
Tide information and forecasts	<ul style="list-style-type: none"> • Tide tables, tide stream atlases
Planning	<ul style="list-style-type: none"> • Routeing guides
Controlled areas	<ul style="list-style-type: none"> • VTS contact information

4.12.2. Scope

MSP12 can be delivered in all sea areas (1-6).

4.12.3. Objective

A hydrographic service produces and distribute nautical publications to promote navigation awareness and safe navigation of ships. These services are carried out as defined in the IHO publication M-3. Technical resolution 1/2002 gives the following exhaustive list of nautical publications, but note that other publications may also be added.

Distance Tables

List of Buoys and Beacons

List of Lights

List of Radio Signals

List of Symbols, Abbreviations and Terms used on Charts

Mariners' Handbooks

Notices to Mariners

Routeing Guides

Sailing Directions

Tidal Stream Atlases

Tide Tables

Moreover, M 3 states that nautical publications may be in printed form or digital form (Technical resolution 2/2002 as amended). The digital form may be a digital representation of the printed version, such as is often the case with PDF files, and it may be in other forms such as XML. M-3 classifies the different types of nautical publications in the following manner;

- a) NP1 – Printed paper publications
- b) NP2 – Digital publications based upon existing paper publications
- c) NP3 – Digital dataset(s) fully compatible with ECDIS that serve the purpose otherwise provided by NP1 or NP2.

It should be noted that Data Specifications for NP3 have yet to be finalised and IHO is working on developing S-100 based product specifications that are functionally equivalent to the paper chart versions. These are often referred to as the S-12x series of standards.

4.12.4. User requirements

Users should be trained in understanding the use of nautical publications.

SOLAS V, Regulation 27 require that nautical publications must be adequate for the intended journey, and always be kept up to date. Keeping the nautical publications updated should be done using the means provided by the issuing hydrographic office or approved service provider. A shore-based Internet service that is kept up-to-date with carriage requirements and information about publication updates would help masters and navigation officers in ensuring that digital publications on board are adequate and up-to-date for an intended voyage. Such a service might accept ports of call for a voyage, vessel and cargo

characteristics, and return a catalogue of required publications and their latest revision information, to be compared by on-board software aid to digital publications currently installed, resulting in generation of a compliance report for review and action by the navigation officer.

NP2 nautical publications may be used back of bridge or even on a tablet computer. NP3 is expected to interact in various degrees with the next generation ENC within the ECDIS or ECS system, though some will not be included in an ECDIS at all – e.g., routeing guides.

Short update cycles are preferable – but must be consistent with the nature of the content and the needs of the vessel. For example, port information for a destination on the current voyage is higher priority than Chart No. 1 or the List of lights – and information about changes to the status of a navigational aid are higher priority than most other information.

Updates should be in a form that can be applied automatically to on-board datasets.

Automated aids for reporting discrepancies should be provided.

Consumers of the service should have the ability to obtain up-to-date information pertaining to planned voyage, not just in the present area.

The services should be capable of working within multiple levels of bandwidth limitations, which will vary depending on whether the vessel is on the high seas, approaching a harbour, engaged in loading/unloading operations in port, etc. Performance should degrade gracefully with reductions in bandwidth, e.g., for low-bandwidth channels transfer of large graphics files may be deferred or replaced with lower-quality files.

Pictorial information needs to be transferred, but consistent with bandwidth limitations, if any, e.g., deferred updates for non-essential graphics, or transmission of lower-quality graphics.

Services should be compatible with WFS and WCS (Web Coverage Service) standards for providing up-to-date information about individual features, features within specified spatial constraints, and coverage data within specified spatial constraints. This will need to be integrated with licensing and subscription-based access at least, probably data protection as well.

In cases where information exists in narrative form, the information will need to be summarized or condensed by a producer before it is disseminated.

Some information (such as text from sailing directions) will have to be converted from narrative to geographic form.

4.12.5. Relationship to other MSPs

May give overviews and summarize information in several other MSPs, for example MSP1, MSP13, climatological information from MSP14, MSP6, MSP3, etc. Information in this MSP supplements charted data in MSP 11. Ice navigation (MSP 13) will reuse certain information such as radio services information. The advent of S-100 and creation of S-100-based products including data traditionally in nautical publications will blur the line between MSP11 and MSP 12.

4.13. MSP13 Ice navigation service

4.13.1. Definition

The ice navigation service is critical to safeguard the ship navigation in ice-conditions. Ice navigational services use observational material from all relevant sources, which are combined into an ice chart which represents existing Conditions. The ice centre then has the task of relaying the chart to users while it is still timely. The ice data may also, be combined with meteorological and oceanographic parameters in a prediction model to provide further guidance to vessels in or near the ice. Services provided by an ice navigational service typically include:

- ice condition information and operational recommendations/advice;
- ice condition around a vessel;
- vessel routing;
- vessel escort and ice breaking;
- ice drift load and momentum;
- ice patrol.

Usually, ice forecasts are prepared once a day, or once or twice a week during the ice season, and cover periods of 24 hours to a few days, because they are tied to the frequency of the data input from sensors, stations, and satellites. Long-range predictions e.g., 30 day predictions and seasonal predictions may be shipped by ground or electronic mail to shipping companies and agents rather than ships.

WMO publication 574 (Sea Ice Information Services of the world) has comprehensive information on ice services but dates to 2010.

Examples of Ice Navigation Service is listed in Table x.

Table x – Ice Navigation Service

Information related to:	Examples:
Ice conditions	<ul style="list-style-type: none">• Sea ice concentrations• Type of sea ice• Berg location and drift
Ice reports and bulletins	<ul style="list-style-type: none">• Text or voice summaries of ice conditions
Ice forecasts	<ul style="list-style-type: none">• Near-term or long range forecasts
Routeing aid	<ul style="list-style-type: none">• Recommended routes• Icebreaker assistance

4.13.2. Scope

MSP13 can be delivered in all sea areas (1-6) but delivery makes sense only in areas where ice is encountered and during seasons when ice is encountered.

4.13.3. Objective

4.13.3.1. Ice Patrol

SOLAS V, regulation 6 governs the ice patrol service in the North Atlantic stating that "Ice Patrol contributes to safety of life at sea, safety and efficiency of navigation and protection of the marine environment in the North Atlantic. Ships transiting the region of icebergs guarded by the Ice Patrol during the ice season are required to make use of the services provided by the Ice Patrol." This service is currently carried out jointly by USA and Canada.

4.13.3.2. Ice charting

Some 20 nations around the world offer an ice information service, and these organisations relay charts of existing ice conditions mostly by radio facsimile and via a digital network link. Time slots and schedules usually dictate the scale and number of charts provided by the broadcast station in the area of concern. Direct broadcast by the ice centre is obviously ideal but not always feasible. Services typically provide ice forecasts once a day for a period of 24 to 144 hours because they are tied to the frequency of the data input. These are tactical forecasts, for scheduled radio broadcast to ships which may provide advice on difficult ice conditions forming or dissipating, the general motion of the pack, opening and closing of leads, etc. They are strongly influenced by meteorological prediction and should always be used in concert with the weather forecast.

Other longer-range predictions – those covering periods from 7–10 days to 30 days and seasonal predictions – are usually based on climatological and analogue methods. They are more commonly distributed by ground or electronic mail to shipping companies and agents rather than to individual ships.

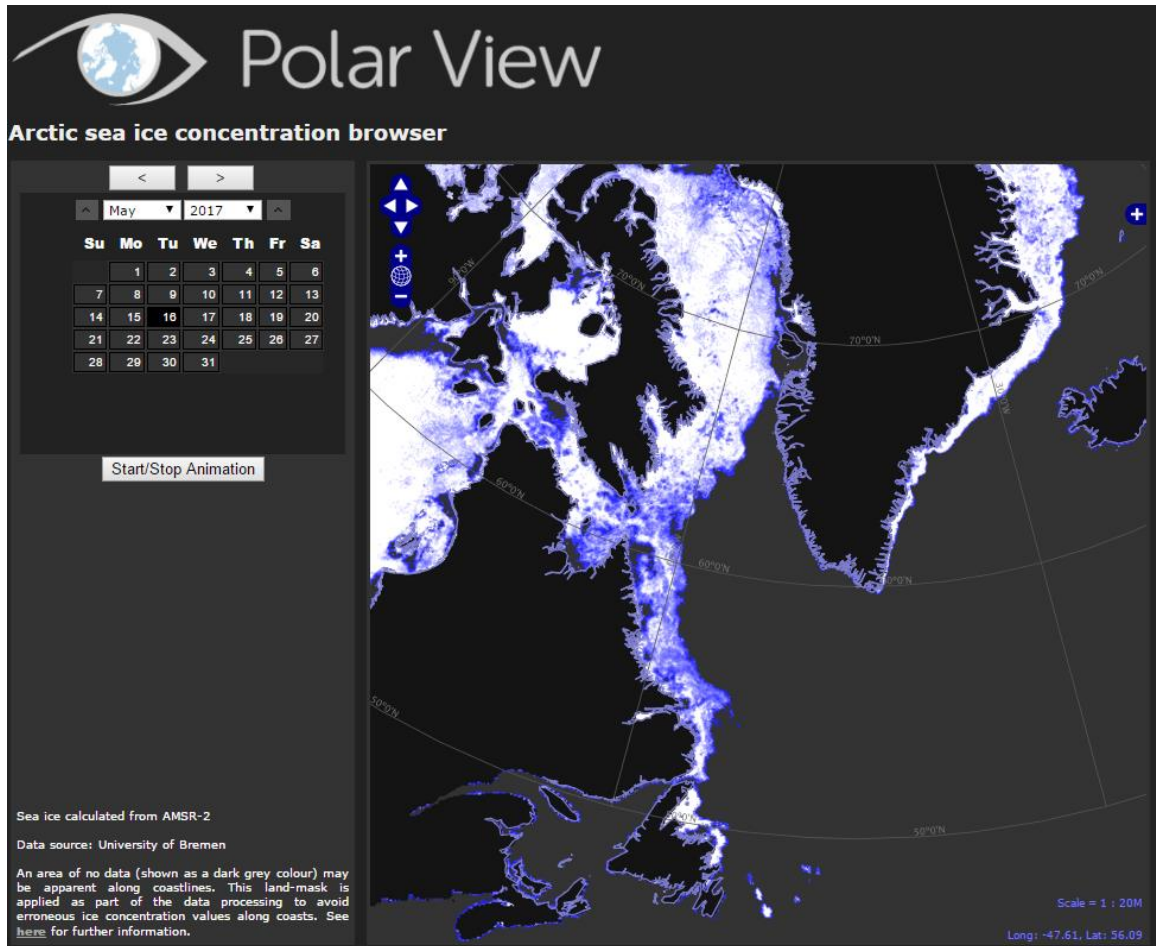


Figure 4.13-1 - Example of Sea Ice satellite service (www.polarview.aq)

4.13.3.3. Vessel Escort and Ice breaking

Icebreaking and support services may be available to ships transiting ice-covered waters. Coast Guards or other national agencies may operate Ice Operations Centres are in operation seasonally as ice conditions dictate. These Centres generally provide up-to-date ice information, suggest routes for ships to follow through or around ice, and co-ordinate icebreaker assistance to shipping. Ice Operations Centres are generally contact with icebreakers at all times and monitor progress of shipping within their area of responsibility. Ice Operations Centres may also provide Recommended Ice Routing services, such as routing maps.

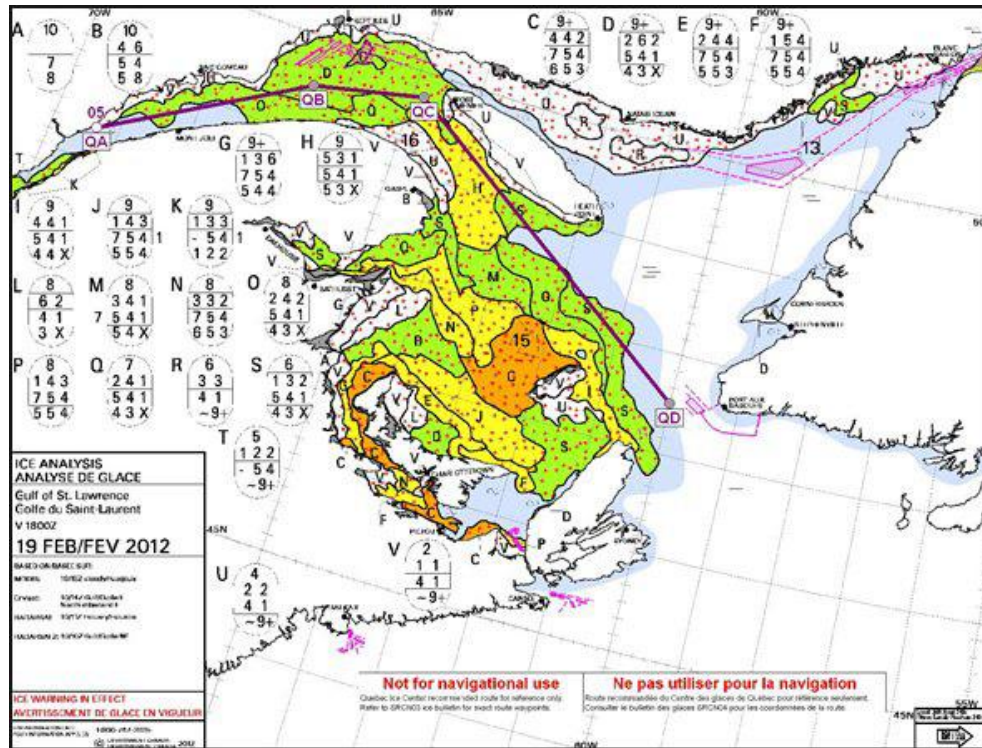


Figure 4.13-2 Example of a Recommended Ice Route in the Gulf of St. Lawrence (source "Ice Navigation in Canadian Waters" – Canadian Coast Guard)

4.13.4. User requirements

Communications play a key role in successful ice navigation. The Master relies upon the receipt of accurate ice information and advice upon which decisions can be based for their future course and progress. Effective icebreaker support, assistance to shipping or up-to-date ice information also requires reliable communications. This portfolio needs a digital service for receiving ice reports from vessels in addition to digital services for communicating ice navigation information, ice charts and forecasts.

Data communication that is compatible with relevant OGC specifications – WFS (Web feature Service), WMS (Web Map Service), and possibly also WCS (Web Coverage Service), will also give benefits in terms of enabling services with more detailed information than traditional radio services currently provide. Moreover, future service will provide vector ice charts in the S-411 format. Navigation systems with a capability to utilize S-411 data will be required to fully utilize this service.

4.13.5. Relationship to other MSPs

MSP 11, MSP 14: MSP 14 information in particular sea temperature charts and meteorological information are essential for mariners to make informed use of ice charts. MSP 13 data will be overlays to MSP 11 (chart data) in navigation systems.

4.14. MSP14 Meteorological information service

4.14.1. Definition

The meteorological service is essential to safeguard the traffic at sea by providing real-time and forecast weather conditions, forecasts, warnings, and weather routing to mariners who will use these types of information to support their decision-making. Such information includes:

- weather routing, solar radiation;
- precipitation, visibility;
- cold/hot periods, warnings;
- air temperature, wind speed & direction;
- cloud cover, barometric pressure;
- wind speed and direction, wave height;
- water level surges due to any cause – storm surges accompanying severe weather, unusual tidal or water flow conditions, etc.

There are three types of marine meteorological information: forecasts and warnings for the High Seas, forecasts and warnings for coastal and offshore areas and services for ports and harbour areas.

SOLAS V Regulation 5 obligates contracting parties to produce and distribute to shipping warnings about severe weather such as gales, storms and tropical cyclones, and to produce and provide other weather information suitable for shipping consisting of data, analyses, warnings and forecasts of weather, waves and ice. Information is supposed to be distributed in text and graphic form (the latter only to the extent practicable) via appropriate radiocommunications services. The regulation also requires signatories to facilitate the collection of meteorological reports from ships at sea, and to arrange for the review and transmission of this collected information to shipping.

Information is distributed via GMDSS, which provides dissemination of warnings and weather and sea bulletins according to a broadcast schedule, via Inmarsat-C SafetyNET, public and commercial radio, specialized weather radio services, and the Internet.

Commercial and public radio and television may also disseminate meteorological information. Such third-party disseminators may not reproduce the information provided to them verbatim, but re-package or re-style the information, for example in the course of delivering weather forecasts by radio or television.

Examples of products include surface analysis, wind and wave forecasts and analyses.

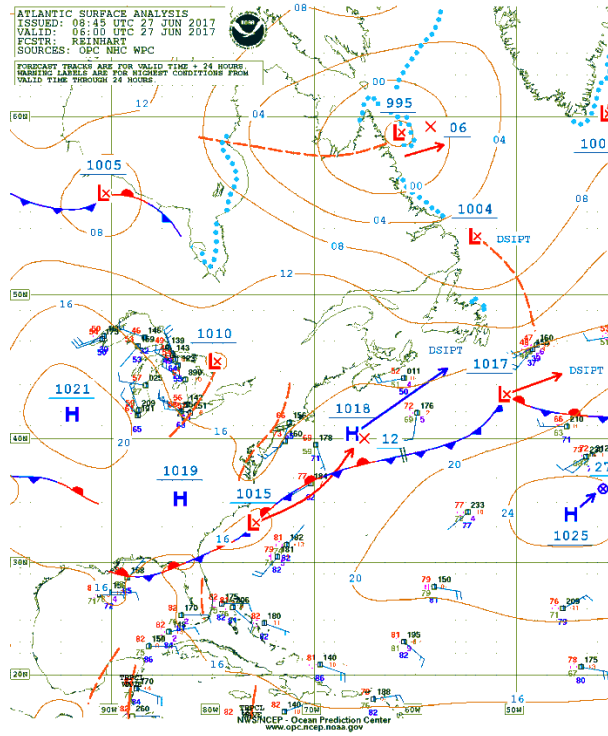


Figure 4.14-1. Surface analysis, West Atlantic. (NOAA)

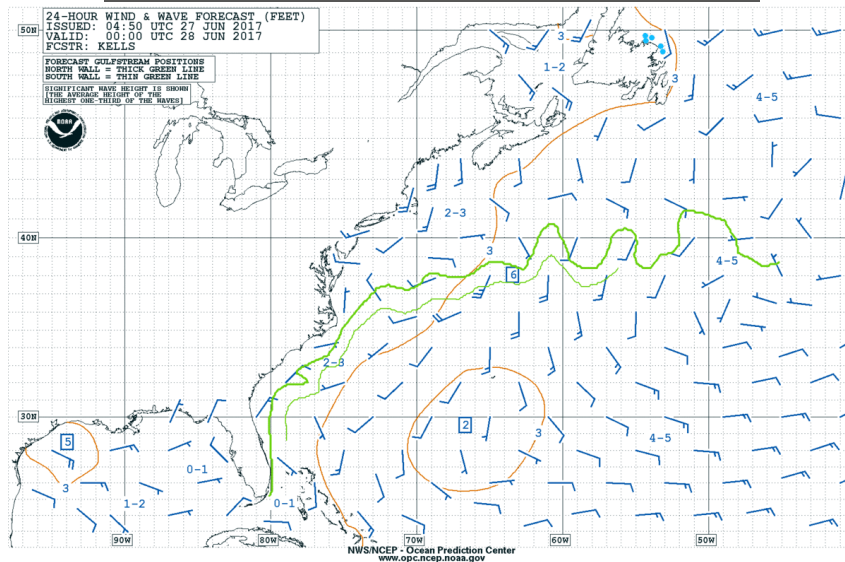


Figure 4.14-2. Wind and wave forecast. (NOAA)

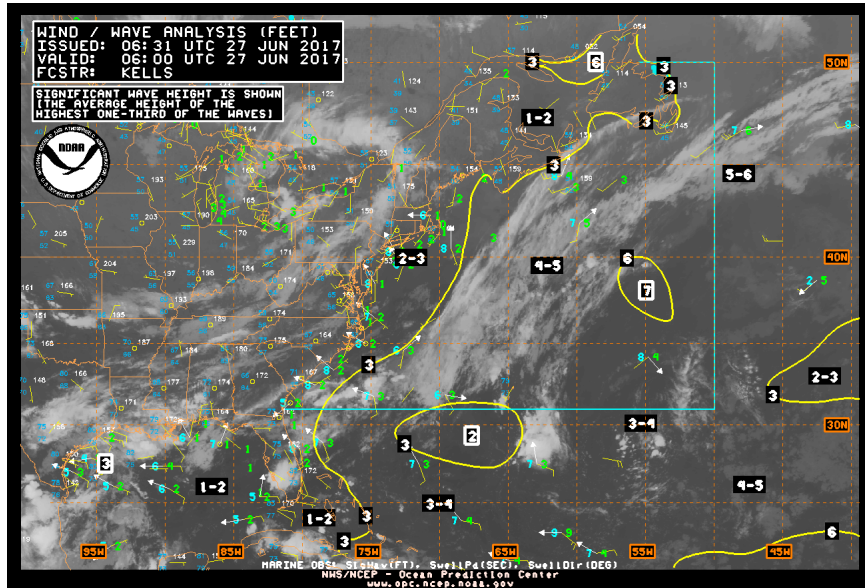


Figure 4.14-3. Wind and wave analysis (NOAA)

Examples of Meteorological Information Service is listed in Table x.

Table x – Meteorological Information Service

Information related to:	Examples:
Wind and wave analysis	<ul style="list-style-type: none"> • Wind speed, direction, gust information • Wave height, swell period, direction • Graphics depicting analysis
Weather conditions	<ul style="list-style-type: none"> • Current conditions • Graphics depicting current conditions and tendencies
Severe weather information	<ul style="list-style-type: none"> • Warnings about location, strength, and movement of storms • Information about areas under severe weather warnings and watches
Bulletins and forecasts	<ul style="list-style-type: none"> • Surface weather analysis, synoptic information • Weather forecasts • Temperature, barometric pressure, tendencies
Ship observations	<ul style="list-style-type: none"> • Receipt of reports from ships in the Voluntary Observation System • Transmission of information extracted from received ship reports to shipping

4.14.2. Scope

MSP14 can be delivered in all sea areas (1-6) but content will depend on location, e.g., ocean meteorological information will be different from near-shore and off-shore marine weather broadcasts.

4.14.3. Objective

SOLAS V Regulation 5 describes the underlying obligations for weather services, i.e., conveying warnings about severe weather and other weather information useful for shipping, and facilitating weather reports by ships and their distribution as needed for the safety of navigation.

The primary objective of this service portfolio is conveying the severe weather warnings and other weather information described in a manner that is highly accessible to shipping even in the middle of ocean voyages, immune to disruptions especially in severe weather, timely, and in a form that is of maximum practicable utility to mariners and conveys the maximum appropriate information. Information must be conveyed by means and formats that are easy for ships to receive.

A second objective, also contained in SOLAS Regulation 5, is to facilitate the transmission of weather reports by ships and the distribution of information gathered from weather reports to shipping.

Since weather information is often re-broadcast by other entities than official national meteorological services, such as public and commercial radio and television, providing warnings and forecasts to such non-official services is a third, secondary objective.

Severe weather warnings increasingly tend to include impacts of the weather, not just the weather data elements. This implies enhanced content like color-coded areas for different severity. For example, the US National Hurricane Centre's hurricane warnings system also includes the production of graphics depicting the probable path of tropical storms and hurricanes, with color-coding of coastal areas where hurricane watches and warnings are in effect. Further, JCOMM is working on an S-100-based product specification for Met-Ocean forecasts (S-412) that will include isobar graphics and WMO symbology for weather information. This portfolio must therefore support a spectrum of information types and formats especially graphical and feature-based information.

4.14.4. User requirements

The basic requirements deriving from SOLAS V regulation 5 must continue to be supported:

- Communication of severe weather warnings;
- Communication of weather forecasts, synopses, and analysis for conditions relevant to shipping – wind, waves, storms, temperatures, precipitation, ice, restricted visibility, etc;
- Communication of warnings and other weather information as appropriate to shipping in ocean areas, in coastal and offshore waters, and in/near port.
- Receipt of weather reports from ships, facilitation of any processing required of such reports, and dissemination of the result to shipping as appropriate for navigation.
- Support for increasingly graphic-based weather information, including potentially animations implies a service that is compatible with the relevant OGC specifications – WFS (Web feature Service), WMS (Web Map Service), and WCS (Web Coverage Service).

Communication of weather information must be as reliable as possible under all conditions especially during severe weather or at large distances from shore, or in areas where radio communications coverage is lower, e.g., polar areas. This means that the communication of important information can be supplemented by placing it on Web sites but Web sites cannot be the sole or main source of such information.

4.14.5. Relationship to other services

MSP5 for communicating warnings about extreme weather. Complements certain services in MSP13, namely ice charts.

4.15. MSP15 Real-time hydrographic and environmental information services

4.15.1. Definition

The real time hydrographic and environmental information service is essential to safeguard navigation at sea and protect the environment. The services provided include:

- current speed and direction;
- wave height;
- marine habitat and bathymetry;

Sensor networks such as ODAS, wave radar, water level gauges, anemometers, current gauges, etc., are widespread and utilized in providing data for these services. This data is often made available on web sites, web mapping services, and other appropriate Internet locations, for example Web sites of major ports or from VTS. The format in which processed data from such sensors is available to the public appears to be variable.

Examples of Real-time Hydrographic and Environmental Information Service are listed in Table x.

Table x – Real-time Hydrographic and Environmental Information Service

Information related to:	Examples:
Current speed and direction	<ul style="list-style-type: none"> • data buoy information via AIS • Surface current snapshots
Surface conditions	<ul style="list-style-type: none"> • Wave heights via radar
Environmental conditions	<ul style="list-style-type: none"> • Temperature, pressure, tendencies (rising/falling) • Wind speed and direction • Visibility
Water column	<ul style="list-style-type: none"> • Depths, salinity, temperatures

4.15.2. Scope

In general MSP 15 services can be delivered in all sea areas (1-6). Specific services may be limited to areas where the type of hydrographic and environmental information conveyed by the service is collected.

4.15.3. Objective

The main objective of services in this portfolio is similar to MSP 14, and consists of conveying hydrographic and environmental information to shipping where needed, including in the middle of ocean voyages, robustly under different conditions especially severe weather, in a timely fashion, and in a form, that is of maximum practicable utility to mariners and conveys the maximum appropriate information. Information must be conveyed by means and formats that are easy for ships to receive. IHO M-3 2/1962 as amended recommend that the results of oceanographic observations be communicated for the maximum utilization by all marine scientific and hydrographic users.

The transmission of environmental conditions by ships and the distribution of information gathered from weather reports to shipping, is also an objective.

Local and regional services may transmit hydrographic and environmental information with AIS-ASM, specifically messages 6 and 8.

IHO is developing a product specification for surface currents named S-111, which is intended for use in ECDIS.

4.15.4. User requirement

Real-time hydrographic and environmental information is distributed in a variety of ways, including radio, AIS-ASM, and internet.

For accurate on-board display of AIS messages, receiving vessels must be equipped with a proper Class A AIS device.

Internet access and possibly a user account is required to access real-time hydrographic and environmental information via internet.

4.15.5. Relationship to other services

MSP1 for communication. MSP5 for communicating warnings about extreme cases. MSP14 for meteorological information.

4.16. MSP16 Search and Rescue (SAR) Service

4.16.1. Definition

[More information required]

The SAR service is responsible for assisting, coordinating search and rescue operations at sea. In maintaining a state of full readiness, the Services may assist the following search and rescue functions:

- The crew and passengers of vessels in distress;
- Victims of maritime and aircraft accidents or incidents.

The SAR services must also coordinate the evacuation of seriously injured or ill person from a vessel at sea when the person requires medical treatment sooner than the vessel would be able to get him or her to a suitable medical facility.

The Services may also be pro-actively involved in 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.

4.16.2. Scope

4.16.3. Objective

4.16.4. User requirements

4.17. MSP17 Aids to Navigation services (AtoN)

[More information required]

4.18. MSP18 Communication services

[More information required]

4.19. MSP19 PNT and augmentation services

[More information required]

4.20. [MSP20 Anti-piracy information]

[More information required]

5. ASSESSMENT OF SUITABLE SERVICES

5.1. Introduction

The assessments in this section are of currently known services pertaining to the MSP. At present they are assessed for the MSP as a whole. Assessments may be broken out by means of communication or other categorization where there are significant differences between different communication methods, etc. Future iterations of this document may develop details for specific sub-families of services or services for specific types of information and break out the summary tables accordingly.

The table format used in the summary assessments is explained below.

Data availability	Whether data needed for the services constituting the MSP does in fact exist – whether the information carried by the services is being collected, acquired, or generated, or otherwise available
Transport	Means of communications by which services in this MSP are provided or can be provided.
Service Availability	How widespread is the availability of services and whether there are likely to be constraints on its availability.
Accessibility	Whether application software can easily access the service and extract necessary data elements from the service data stream.
Reliability	How reliable services are and
Interface standardization	Whether standard application interfaces for consumption of service information by software applications are available or being defined.
Data standardization	Whether the data payload of the services conforms to standards, or a standard for such data is being defined.

5.2. Services

5.2.1. Assessment – MSP 1

[Text]

Summary assessment:

Data availability	
Transport	
Service Availability	
Accessibility	
Reliability	
Interface standardization	
Data standardization	

5.2.2. Assessment – MSP 2

5.2.3. Assessment – MSP 3

5.2.4. Assessment – MSP 4

5.2.5. Assessment - MSP 5 Maritime Safety Information Services

MSI is available worldwide as a voice and text service (with constraints in polar regions) but digitization of MSI is an ongoing activity. Many NAVAREA coordinators as well as other state or regional authorities make navigational warnings available over the Internet but due to the incompletely structured nature of MSI information access often involves human interaction. There are exceptions where messages are communicated in XML form but this is not universal and the structure was locally developed (and therefore varies depending on the source organization). Some authorities distribute MSI including local warnings by e-mail as well as making it accessible on their internet sites. A standard for data content is under development (S-124) but at present navigational warnings are not structured enough for deconstruction by software, which means it is difficult to integrate them with other applications such as a chart display on an ECDIS.

Summary assessment:

Data availability	Good but unstructured.
Transport	Radio (voice, text, NAVTEX, SafetyNet, radiofax, etc.); Internet: web, e-mail
Service Availability	Good
Accessibility	Radio: high; Internet: good, but not suitable for time-critical information
Reliability	Good
Interface standardization	High for NAVTEX and SafetyNET receivers but Low for interconnected systems
Data standardization	S-53, Joint IHO/IMO/WMO Manual on Maritime Safety Information (MSI) structures navigational warnings to some extent but far from sufficiently for software deconstruction. Messages are in text format at present and difficult for software to decode messages currently largely in text format; standard under active development (S-124).

5.2.6. Assessment – MSP 6

5.2.7. Assessment – MSP 7

5.2.8. Assessment – MSP 8

5.2.9. Assessment – MSP 9

5.2.10. Assessment – MSP 10

5.2.11. Assessment - MSP 11 Nautical Chart Services

Nautical chart services are available world-wide from several providers. Generally national hydrographic offices provide a coverage in national waters, but several also provide coverage within their region as well. Some hydrographic offices provide a world-wide nautical chart service. Nautical chart services are available in paper charts, raster charts and as Electronic Navigational Chart (ENC) for use in ECDIS and ECS. Nautical charts are usually available from chart agents and other service providers.

Summary assessment:

Data availability	Widely available
Transport	Logistics services for paper charts, electronic means for digital data. Digital data may also be distributed via logistical services, in form of CD, DVD, USB drive or other media.
Service Availability	Widely available from numerous service providers.
Accessibility	Widely available from numerous service providers.
Reliability	High
Interface standardization	High for ECDIS
Data standardization	High – S-4, INT1, INT2 and INT3 for paper charts, S-61 for raster charts and S-57, S-58 and S-65 for ENC. IHO is developing S-101 for the next generation ENC.

5.2.12. Assessment - MSP 12 Nautical Publication Services

Nautical publication services are typically provided by hydrographic services that produce and distribute nautical publications in their areas of responsibility. Other government agencies, such as costal administrations, may also produce nautical publication. Some nautical publication services extend the service to a larger region if such is of importance to their national interests and some provide a world-wide service. Nautical publication services provide a number of nautical publications, such as Distance Tables, List of Buoys and Beacons, List of Lights, List of Radio Signals, List of Symbols, Abbreviations and Terms used on Charts, Mariners' Handbooks, Notices to Mariners, Routeing Guides, Sailing Directions, Tidal Stream Atlases, Tide Tables.

Nautical publications may be in printed form or digital form. The digital form may be a digital representation of the printed version, such as is often the case with PDF files, and it may be in other forms such as XML. IHO M-3 classifies the different types of nautical publications in the following manner;

- a) NP1 – Printed paper publications
- b) NP2 – Digital publications based upon existing paper publications
- c) NP3 – Digital dataset(s) fully compatible with ECDIS that serve the purpose otherwise provided by NP1 or NP2.

It should be noted that Data Specifications for NP3 have yet to be finalised and IHO is working on developing S-100 based product specifications that are functionally equivalent to the paper chart versions. These are often referred to as the S-12x series of standards.

Summary assessment:

Data availability	Widely available
Transport	Logistics services for paper charts, electronic means for digital data. Digital data may also be distributed via logistical services, in form of CD, DVD, USB drive or other media.
Service Availability	Widely available from numerous service providers.
Accessibility	Widely available from numerous service providers.
Reliability	High
Interface standardization	Not standardized
Data standardization	M-3 for NP1 and NP2. NP3 standardisation is in progress - S-122, S-123, other product specifications

5.2.13. **Assessment - MSP 13 Ice Navigation Services**

Ice navigation services commonly include ice reports, ice charts, and ice forecasts. Sea surface temperature charts accompany ice charts. Remote sensing imagery is commonly also distributed.

Digital ice charts are in S-411 formats but additional formats are also provided for use in current systems.

Advances in computer models for ice prediction allow more detailed data but these require more communication resources.

Analysed information is also distributed e.g., ice edge information, sea ice forecasts, ice types, ice concentration, ice drift, berg information.

Ice charts may be available in multiple digital formats. For example, BSH distribute their ice charts the following formats as AML (additional military layer), MIO (marine information overlay), and S-411 (S-100-based product specification format)

Radio forecasts are scheduled broadcasts that describe difficult ice conditions forming or dissipating, the general motion of the pack, opening and closing of leads.

Some consortia/service providers

- North American Ice Service (NAIS) – joint U.S./Canada production of ice charts, ice hazard bulletins, 30-day forecasts and seasonal outlooks for the Great Lakes.

- Baltic Sea Ice Services (BSIS) is under steady development and includes informational exchange between Denmark, Estonia, Finland, Germany, Latvia, Lithuania, the Netherlands, Norway, Poland, the Russian Federation and Sweden.
- Polarview (www.polarview.org)

Summary assessment:

Data availability	Good
Transport	Internet (web and ftp) and subscription from service provider; radio broadcast of ice forecasts and ice reports/bulletins
Service Availability	Availability from hydrographic offices and other service providers; probable communication constraints including interrupted or low-bandwidth communications for ships in polar areas
Accessibility	Available with human intervention, by automated means, or direct delivery from on service provider
Reliability	High
Interface standardization	Custom interfaces depending on service provider
Data standardization	Ice charts are standardized on S-411. Other geographic information may be available as feature layers which can be loaded.

5.2.14. **Assessment - MSP 14 Meteorological Information Services**

Voice and text services communicating MSP 14 information over various radio methods are universally available and are expected to continue to be the best method of communicating time-and-safety-critical information. Graphical information services are widely available but generally require high bandwidth for adequate access.

Two principal methods are used for broadcasting marine meteorological information as part of MSI:

- NAVTEX: broadcasts to coastal and offshore areas; and
- SafetyNET: broadcasts which cover all the waters of the globe except for sea area A4, as defined by resolution A.801(19) on Provision of radio services for the GMDSS, Annex 3, paragraph 4, as amended.

HF narrow-band direct printing (NBDP) may be used to transmit marine meteorological information in areas outside Inmarsat coverage.

Information has to be provided for unique and precisely defined sea areas, each being served only by the most appropriate systems. Although there will be some duplication to allow a ship to change from one system to another, the majority of messages will only be broadcast on one system.

Summary assessment:

Data availability	Widely available. Depending on the nature of information, may be in the form of either analytic results or processed data.
Transport	Radio (NAVTEX, SafetyNet, voice broadcast, radiotelex, radiofax), Internet.
Service Availability	Internet sources are widely but not universally available. Radio services are widely available in most (all?) regions of the world.
Accessibility	Internet services often require human intervention to access data. Radio services: currently most are designed only for human access.
Reliability	High
Interface standardization	Reception standardization high for NAVTEX and SafetyNET receivers but low for interconnected systems like ECDIS.
Data standardization	S-412 is in development. GRIB format for graphical data.

5.2.15. Assessment - MSP 15 Real-time Hydrographic and Environmental Services

Several states or organizations have installed and maintain ODAS networks and real-time hydrographic and environmental data from such networks, tide gauges, and other sensors is widely available. Real-time hydrographic and environmental information is principally distributed in three ways, including radio, AIS-ASM, and Internet. Of these, AIS-ASM and Internet are most amenable to use in digital services, since the radio transport appears to consist of text/voice messages constructed from raw or processed data by filling in templates.

Distribution via AIS-ASM has been implemented in different regions of the world. Messages 6, 8, 25 and 26 provide a structure which can accommodate data suited for a specific application. Message formats and content are different for different regions, since the organizations developed formats according to their own needs.

Perhaps the most comprehensive and accessible Internet data distribution system is NOAA's data portal, especially NOAA PORTS® (Physical Oceanographic Real-Time System) which incorporates information from tide gauges, data buoys and other sensors. The system also integrates information from other sensor networks such as NOAA's NWLON (National Water Level Observation Network) station data, and selectively, other sources (the Texas Coastal Ocean Observation Network is listed by NOAA as one source). ODAS, tide, water level, or current gauge, and similar data such as wind speeds is often available on other appropriate web sites as well, for example port Web sites of major ports may include local tide, current, or water level data; however, this depends on the port authority and this practice is by no means worldwide. Where available, information is generally available through web presentations, and less often as periodically updated data files that can be downloaded by software clients. The format in which processed data from such sensors is available to the public appears to be variable, though this would seem to be an excellent candidate for standardization. Efforts to develop metadata standards for instrumental data (under JCOMM auspices) are in advanced stages, which will facilitate the integration of this data into MSP services.

Internet distribution is implemented in a variety of interfaces some of which need human intervention for access.

Summary assessment:

Data availability	Data for MSP 15 services is widely available.
Transport	Processed data distributed via AIS and Internet; derived summary messages distributed via radio.
Service Availability	Internet sources are widely but not universally available. AIS MSP15 data is frequently available but less than Internet sources.
Accessibility	Some Internet-based services require human intervention to access the data, which would require diverting attention from more urgent tasks especially on the bridge. Others are amenable to automated access by applications. Access to AIS data requires on-board software capable of decoding the message structure. Interfaces to other platforms or software e.g., ECDIS is feasible and often(?) already implemented by manufacturers.
Reliability	Localized congestion issues affecting reliability of AIS-based services have been observed. Reliability of Internet sources for this data is sometimes inadequate since data is occasionally missing for one reason or another.
Interface standardization	Uncertain for software access to Internet sources. AIS-ASM is better standardized but there are regional legacy implementations historically developed by different organizations.
Data standardization	IMO Circ.289 for AIS. IHO is developing S-112 for real-time water level. Uncertain or partial for Internet services.
Examples	NOAA PORTS®

5.2.16. Assessment – MSP 16 Search and Rescue (SAR)

[Text]

Summary assessment:

Data availability	
Transport	
Service Availability	
Accessibility	
Reliability	
Interface standardization	
Data standardization	

5.2.17. Assessment – MSP 17 Aids to Navigation

5.2.18. Assessment – MSP 18 Communication Service

5.2.19. Assessment – MSP 19 PNT and Augmentation

5.2.20. Assessment – MSP 20 Anti-piracy information

6. RELEVANT ASSOCIATED IMO GUIDELINES

6.1. Guidelines on SQA and HCD

6.2. Guidelines on Display of navigation information from communications

6.3. Guidelines on test beds reporting

7. LIST OF PUBLICATIONS THAT CAN BE DIGITAL

8. ACRONYMS To be checked

AtoN	Aid(s) to Navigation
Circ.	Circular (IMO)
CMDS	Common Maritime Data Structure
COMSAR	Former Sub Committee on Communications and Search and Rescue (IMO)
CSV	Comma Separated Variable(s)
fax	Facsimile
FONSABA	Federation of National Associations of Ship Brokers and Agents
GMDSS	Global Maritime Distress and Safety System
HCD	Human Centred Design
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ICT	Information and Communications Technology
IEC	International Electrotechnical Commission
ILO	International Labour Organization (UN)
IoT	Internet of Things

IS	Information Service, as part of Vessel Traffic Services
IMO	International Maritime Organization (UN)
LPS	Local Port Service(s)
MAS	Maritime Assistance Service
MSC	Maritime Safety Committee (IMO)
MSIS	Maritime Safety Information Service
MSP	Maritime Service Portfolio(s)
NAS	Navigational Assistance Service, as part of Vessel Traffic Services
NAV	Former Sub Committee on Safety of Navigation(IMO)
NCSR	Sub-Committee on Navigation, Communications and Search and Rescue (formerly COMSAR and NAV) (IMO)
PDF	Portable Document Format
PNT	Position, Navigation and Timing
RCC	Rescue Co-ordination Centre(s)
Res.	Resolution
RTF	Rich Text Format
SAR	Search and Rescue
SIP	IMO e-Navigation Strategy Implementation Plan (NCSR1/28, annex 7; as adopted by MSC 94, Nov. 2014)
SOLAS	International Convention for the Safety of Life at Sea, 1974 (as amended)
SQA	Software Quality Assurance
S-100	Universal Hydrographic data model (IHO)
S-200	IALA domain for S-100 Product Specifications
TMAS	Telemedical Assistance Service
TOS	Traffic Organisation Service, as part of Vessel Traffic Services
VTS	Vessel Traffic Service(s)
XML	eXtensible Markup Language