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MARITIME SERVICE PORTFOLIOS: DIGITISING MARITIME SERVICES

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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

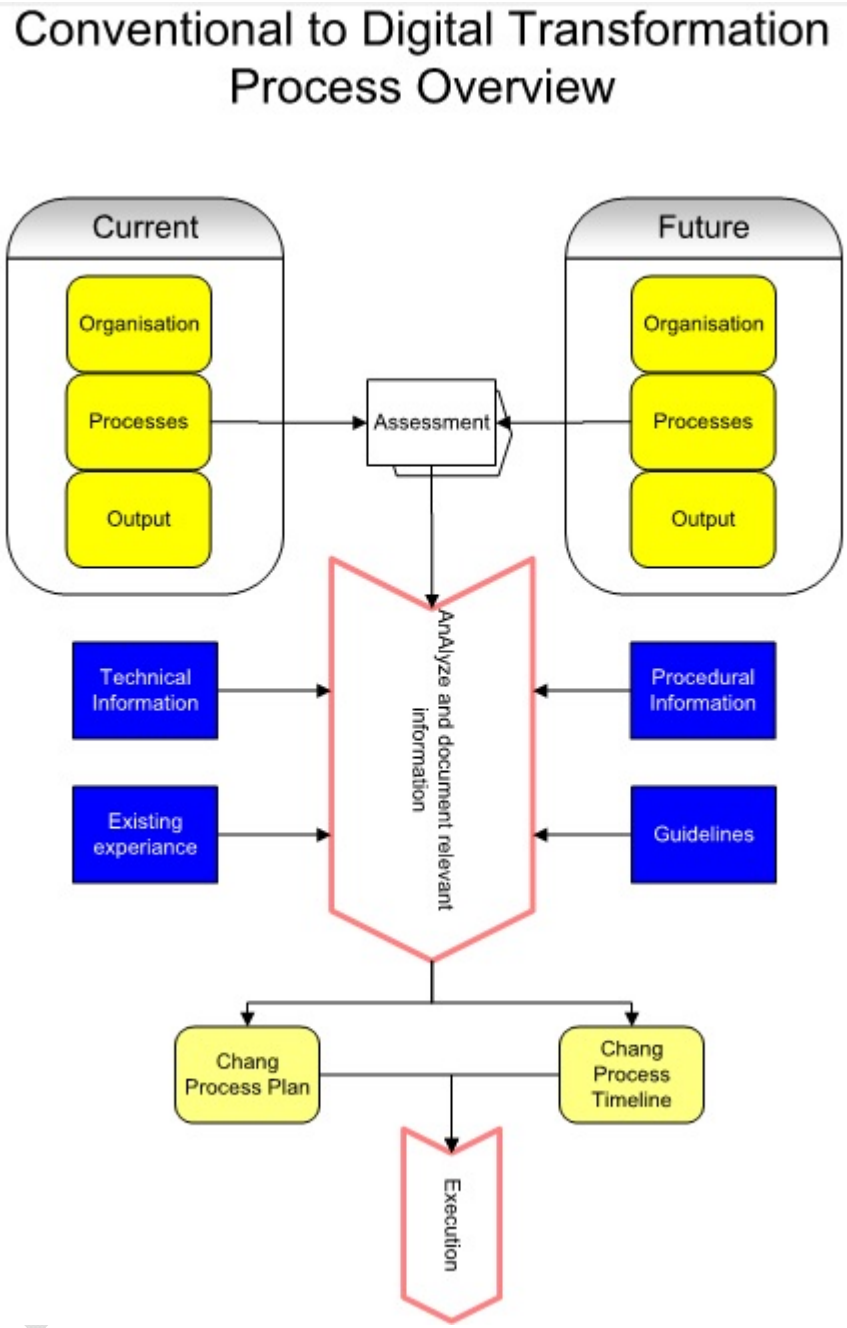
The services described within this guideline can be implemented in full or in part, based on individual service providers local circumstances.

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.



For example: If a certain Competent Authority decides to change a service to digital (implementing an MSP), it should take into account the following steps:

a Assess the services being delivered by traditional means and the actual delivery platforms (e.g. VHF network);

b Identify the services under own responsibility and the eventual need for new delivery platforms.

c Identify the services to be delivered in the new format (MSP) and the timeline for the implementation

d Identify the providers of information for the selected MSP's

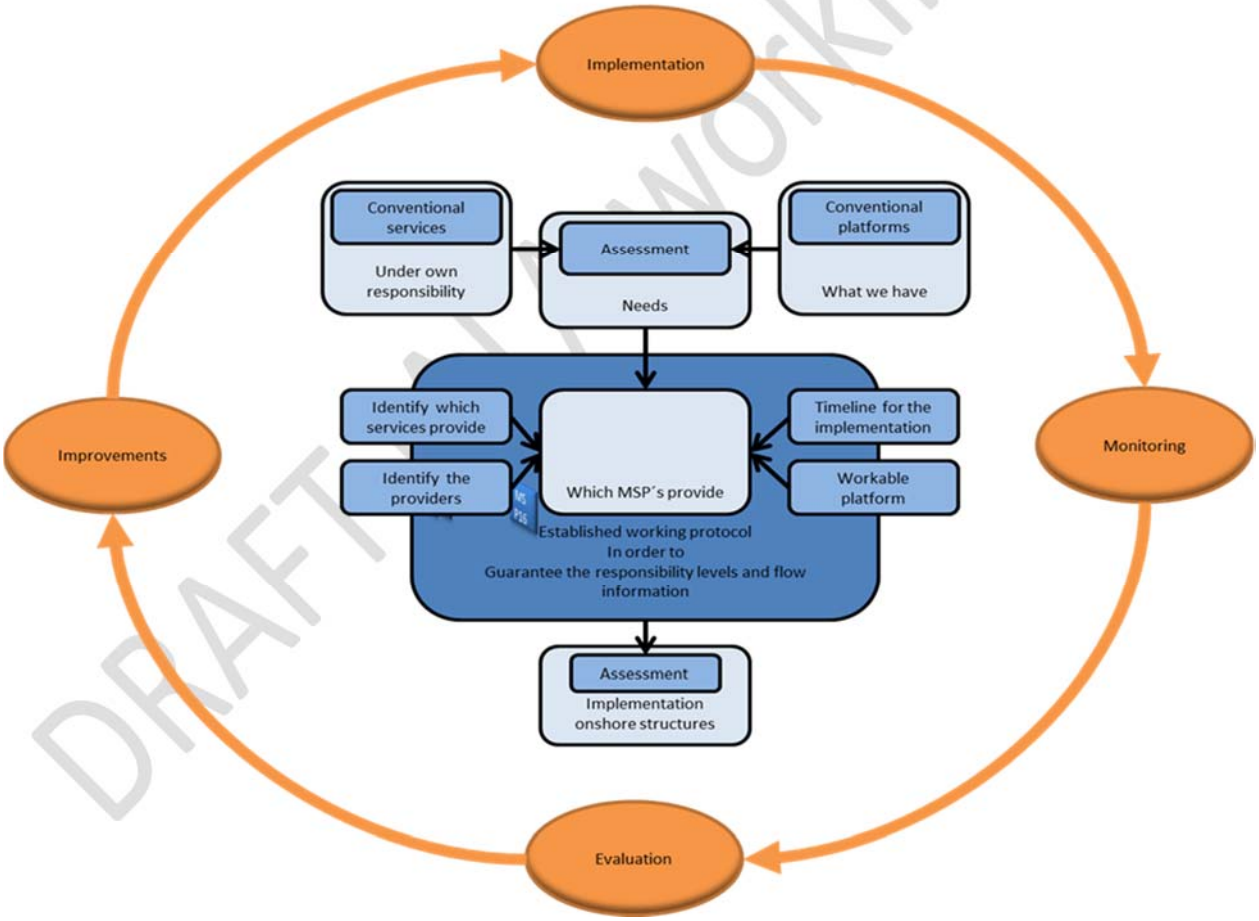
e Establish a common workable platform between all providers. This platform must be able to allow interoperability between the different providers and systems. It must also be established a working protocol to guarantee the responsibility levels and the flow of information.

f Coordinate the intended work with MSP users and organizations creating tools for utilizing MSP output to ensure usability by intended end users.

g Implement the onshore structures (infrastructures, hardware and software) necessary for the delivery of the MSP's.

h Guarantee an experimental faze in order to allow assess the resilience of the system. When the Competent Authority decides that the service is mature enough, it can be delivered to the mariners and be used as primary means for the delivery of that information. However, due to the existence of different levels of equipment on board of vessels, both services must be provided simultaneously.

i During the transformation procedures, it is necessary to continuously evaluate the process in order to see if the service can be improved, optimized, identify gaps and implement the necessary changes. This is a continuous process, and it must be complemented with a permanent monitoring of the system (e.g. feedback from mariners and other stakeholders)



1.4. CURRENT STATUS OF COMMUNICATIONS MEANS

The following table shows the current communications means available for MSPs

Table 1 Current status of e-Navigation Communication means

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

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 for the collection or creation of 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 IALA 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.

Table 2 Responsible Authorities (use table derived from NCSR1/28, annex 7?)

Service No	Identified Services	Identified Responsible Service Provider

Service No	Identified Services	Identified Responsible Service Provider
MSP1	VTS Information Service (INS)	VTS Authority
MSP2	Navigational Assistance Service (NAS)	VTS Authority
MSP3	Traffic Organisation Service (TOS)	VTS Authority
MSP4	Local port Service (LPS)	Local Port/Harbour Authority
MSP5	Maritime Safety Information (MSI) Service	National Competent Authority
MSP6	Pilotage service	Pilotage Authority/Pilot Organization
MSP7	Tug Service	National Competent Authority; Local Port/Harbour Authority
MSP8	Vessel Shore Reporting	National Competent Authority and appointed service providers
MSP9	Telemedical Assistance Service (TMAS)	National health organization / dedicated health organization
MSP10	Maritime Assistance Service (MAS)	Coastal/Port Authority / Organization
MSP11	Nautical Chart Service	National Hydrographic Authority / Organization
MSP12	Nautical Publications service	National Hydrographic Authority / Organization
MSP13	Ice navigation Service	National Competent Authority /Organization
MSP14	Meteorological information service	National Meteorological Authority Public Institutions
MSP15	Real time hydrographic and environmental information service	National Hydrographic and Meteorological Authorities
MSP16	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

The VTS 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)).

The *information service* is provided by broadcasting information at fixed times and intervals or when deemed necessary by the VTS or at the request of a vessel, and may include for example reports on the position, identity and intentions of other traffic; waterway conditions; weather; hazards; or any other factors that may influence the vessel's transit .(IMO Res A.857(20))

IALA Guideline No. 1089 defines the "Provision of Vessel Traffic Services"(INS, TOS & NAS).

Table 3 provides a general overview of information service that can be provided by VTS, however the role of VTS in the provision of information service may differ from country to country

Table 3 Examples of the types of information that may be provided by the VTS operating an Information Service

Information related to:	Examples:
Navigational situations (including traffic and route information)	• 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	• Dangerous wrecks, obstacles not otherwise promulgated, diving operations, vessels not under command, failures of AtoNs, etc.
Meteorology	• 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	• Gale, storm, tsunami, restricted visibility, etc.
Hydrography	• 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	• The availability of electronic navigational aids such as: GNSS, Loran, DGPS, AIS, RACON etc.
Other information	• Port information, pilot or tug request, cargo information, health condition, PSC, ISPS, etc.

4.1.2. AREA OF OPERATION

MSP1 can be delivered in an established VTS area

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 A, MSP 1, Information Service Template.

4.1.4. USER REQUIREMENT

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 to vessels in the immediate vicinity and to a VTS centre to ensure a 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 equipments 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 with 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 or enacting of changes in legislated equipment carriage requirements 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, 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 centers with respect to these data. In some cases, the digitalization process will allow the direct transmission of the information to mariners without necessarily passing through a VTS centre. However, this situation requires 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.

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).

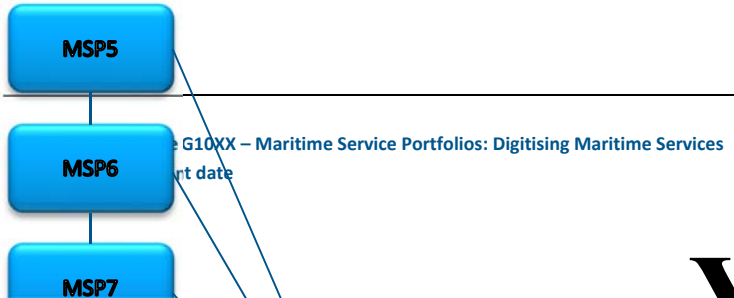


Figure xx: Illustration of the historical communication process between shore and ship.

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 the information service cannot be communicated to ships, VTS will be in a position to notify as well mariners as the service producer and 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.

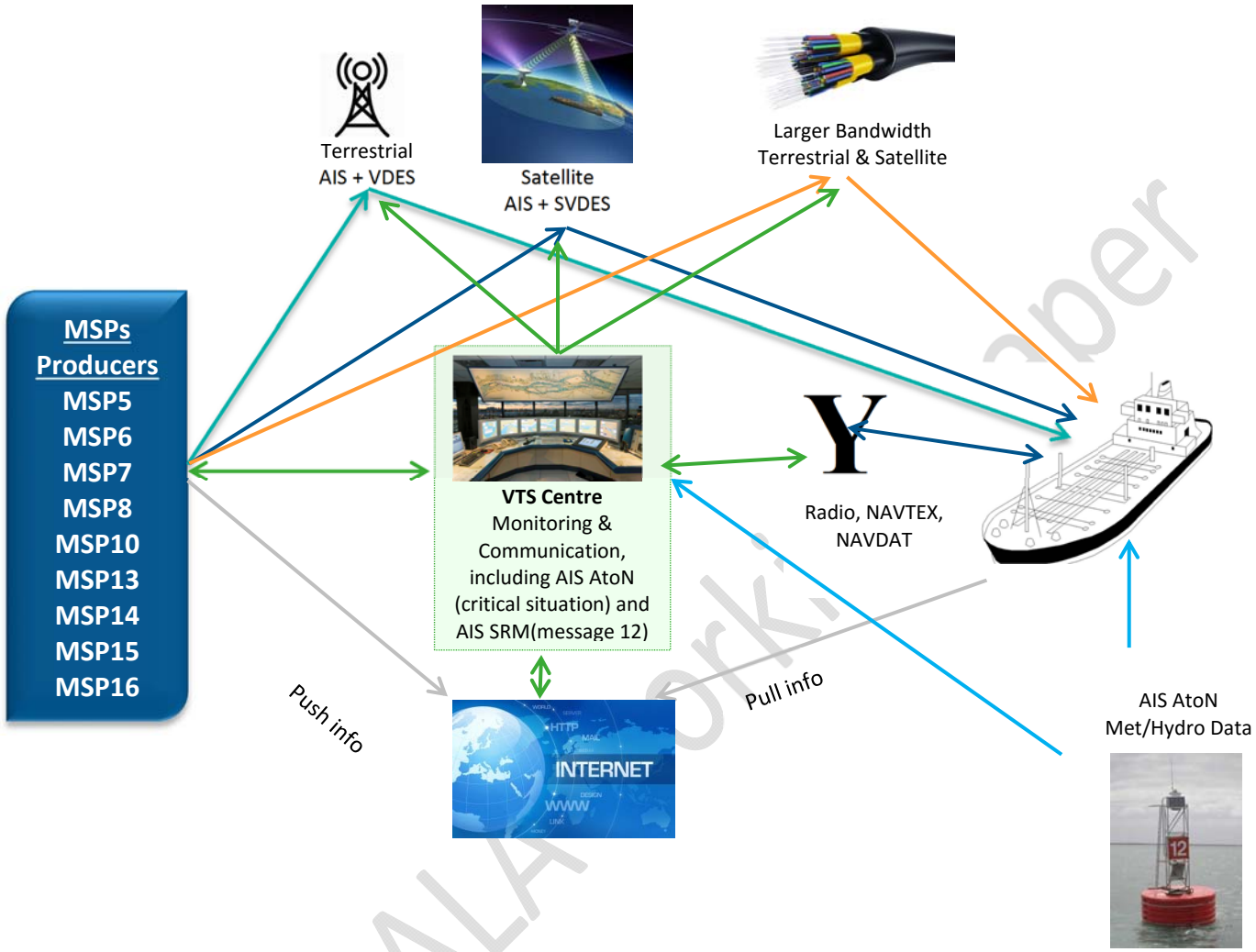


Figure xxx: Illustration of some current and future communication processes between shore and ship.

Implementation of MSP1 by a national authority will require a strong coordination with all other MSP producers to clarify the mean of communication that wil 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 the 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 the equipment onboard MSP information received from a recognized and official means of communication, including GMDSS approved communication systems. 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 is still work to do on the ships' side to ensure the harmonization of display. The Table xx above summarizes the status of these means of communication. This Table wiil be amended whenever the status of a mean of communication changes.

4.1.5. EXAMPLES

Examples of MSP1

The example is generic and simplified through an example for description purposes only. Actions and template categories may differ for different countries. *Content in the column named "Template Info (technical)" is pending submissions from relevant stakeholders.*

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

For example:

- Pre arrival reporting can be done digitally without VHF voice communication say for update of voyage plan.
- The content of the VHF communication can be transmitted digitally and be displayed as text in parallel to voice communication.

4.1.5.1. Example - Vessel Arrival

The vessel provides pre-arrival information to VTS, such as ETA and destination. The VTS replies, providing information on weather. In the template, this is categorised as Environmental information.

After entering the VTS area, the vessel provides its sailing route to the VTS. The VTS responds with traffic information, such as position, identity and intention. In the template, this action is categorised as Traffic and Route information.

The vessel passes the reporting point line, upon which the VTS provides information on currents, wave height, etc. In the template, this action is categorised as Hydrographical information.

The vessel requires port information. The VTS provides quay details. In the template, this action is categorised as Traffic and Route information.

The vessel passes the second reporting point line. The VTS responds by giving operational information on AtoNs. In the template, this action is categorised as Navigation Hazard information.

The vessel comes along side, upon which the VTS provides information on speeds and visibility. In the template, this action is categorised as Environmental information.

Time	Ship Action	VTS Action	Template Info (category)	Template Info (technical)
01:00	Provides pre-arrival info	Replying with information on weather	Environmental	Annex 1
02:00	Enters VTS Area, provides sailing route	Traffic information to vessels	Traffic and Route information	
02:30	Passes reporting point line	Provides information on current, wave height, etc.	Hydrographical information	
03:00	Requires port information	Provides quay details	Traffic and Route information	
03:30	Passes second reporting point	Provides operational information on AtoNs	Navigation Hazards	
04:00	Ship along side	Gives information on wind speeds, visibility	Environmental	

Prior to arrival: The vessel uses a data collecting system on board to send all details regarding the arrival via relevant infrastructure to the VTS. The VTS collects the vessel's data directly into its system, and automatically

updates the vessel's pre-registered data. Both vessel and VTS use chart systems as a graphic interface to present details that are of interest to the voyage, such as reporting point line and VHF channel.

Upon arrival: By using the data collecting system on board, the vessel sends Actual Time of Arrival via relevant infrastructure to VTS. Examples of infrastructure could be national single window, maritime cloud, etc.

4.1.6. RELATIONSHIP TO OTHER MSPS

MSP1 has relationships with other MSPs where it affects the VTS:

May be different depending on the coastal state arrangements.

MSP 1 VTS INS	Associated
MSP 2 VTS NAS	
MSP3 VTS TOS	
MSP 4 Local Port Service	Delays, obstruction, cargo operations, port availability,
MSP 5 Maritime Information Service	All information depending on structure of MIS
MSP 6 Pilotage Service	Updates, delays,
MSP 7 Tug Service	Updates, delays,
MSP 8 Vessel Shore Reporting	Notification of arrival, dangerous cargo etc
MSP 9 Telemedical	Delays,
MSP 10 Maritime Assistance Service	Notifications, routing, places of refuge
MSP 11 Nautical Chart Service	Local Area updates, chart updates
MSP 12 Nautical Publication Service	Updates to publication
MSP 13 Ice Navigation Service	Ice channels, ice information
MSP 14 Meteorological Service	VTS area weather
MSP 15 Real Time Hydro and Inf Service	Tidal information in VTS area
MSP 16 Search and Rescue service	Search pattern and delays

4.1.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

4.2. MSP2 NAVIGATIONAL ASSISTANCE SERVICE (NAS)

4.2.1. DEFINITION

The VTS Navigational Assistance Service is defined by IMO as "a service to assist on-board navigational decision-making and to monitor its effects. (IMO Res.A857(20))

The *navigational assistance service* 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))

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).

4.2.2. AREA OF OPERATION

MSP2 can be delivered in an established VTS area

4.2.3. OBJECTIVE

This service is normally rendered at the request of a vessel or by the VTS when deemed necessary (IMO Res. A857(20)) and it should have a start and end time. It should be conducted in a clear and concise manner in order to maximise on board understanding and to eliminate the chance of misinterpretation and to minimize the risk of unwanted consequences (IALA Guideline No. 1089 On – Provision of Vessel Traffic Services (INS, TOS & NAS) December 2012).

Below are some examples of developing situations where a Navigational Assistance Service may be provided :

- Risk of grounding;
- Vessel deviating from the VTS sailing/passage plan;
- Vessel unsure of its position or unable to determine its position;
- Vessel unsure of the route to its destination;
- Assistance to a vessel to an anchoring position;
- Vessel defects or deficiencies, such as navigation or manoeuvring equipment failure;
- Severe meteorological conditions (e.g. low visibility, strong winds);
- Risk of collision between vessels;
- Risk of collision with a fixed or floating object;
- Assistance to a vessel to support the unexpected incapacity of a key member of the bridge team.

The categories of services and the associated details are listed in Annex B, MSP 2, Navigation Assistance Service Template.

4.2.4. USER REQUIREMENTS

The following table describes the types of information provided

Table 4 Examples of the types of information that may be provided by a VTS operating a NavigationalAssistance Service

Information related to NAS	Examples
Request and identification	• availability of NAS, start and end of NAS; • request for ship identification such as position, course made good and speed over the ground; • status of ship's equipment; etc.

Navigational information (including position and course information)	• Examples provided to an individual vessel: • provide range and bearing from fixed objects, fairway/channel or way-points; proximity to navigational hazards, etc. • provide information related to navigating into a channel/fairway/lane (i.e.track is parallel/diverging/converging with/from/to reference line); etc.
Advice (or instruction)	• advise (or instruct) a ship to alter the course, speed; • advise (or instruct) to keep clear from area/position, close up/drop backon/from vessels; etc.
Warning	Diverging from the recommended track towards dangerous wrecks, obstacles not otherwise promulgated; diving operations; vessels not under command; etc.

Table Y - Examples of the type of information that may be provided by a VTS operating a Navigational Assistance Service (IALA 1089).

Navigational Assistance Service has been implemented to respond mainly to time critical situations and for that purpose, communication between VTS and vessel must be unambiguous and clearly understood by both parties in order to avoid confusion or misinterpretation of the manoeuver (IALA Guideline No. 1089). Examples of communication phraseology to use is provided int the Standard Marine Communication Phrases (IMO Resolution A.918(22)).

Responding to critical situations through electronic communication in a timely manner may represent several challenges with respect to equipment standards (all ships will need to have the same performance standards implemented), capacity of the officers on board to interpret properly the information provided electronically, and the interaction with the VTS center.

Prior the utilization of electronic communication to assist a vessel in difficult situation, national authorities must ensure that all ships under their areas of responsibility are complying with the latest equipment performance standards adopted by international organizations. In addition, national authorities are encouraged to conduct test beds representing different assistance situations and ways to communicate information electronically in order to familiarize as well ships' officers as VTS operators, and to evaluate the clarity and understanding of the information transmitted. Utilization of electronic communications to assist vessel will also require the development and adoption of new procedures by VTS operators.

As long as equipment performance standards and clear communications protocols are not widely implemented and well tested on both side, vessel and VTS centers, assistance to vessel in difficult situation should rely primarily on voice communication with the possibility to introduce electronic communication whenever conditions become suitable and safe.

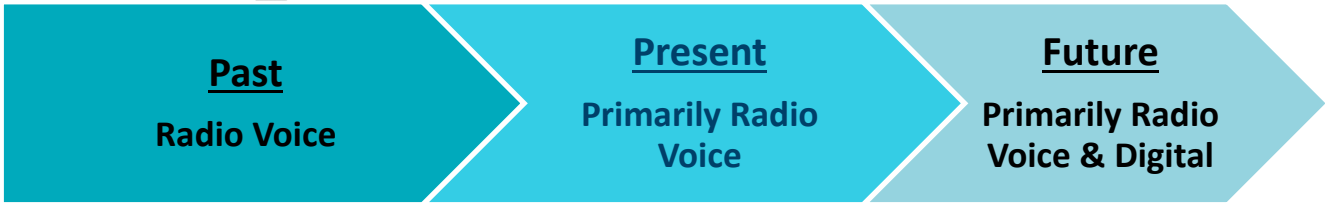


Figure Y - Illustration of the provision of the navigational assistance service over time.

Until these conditions are met, and especially for time critical situations, it is not recommended to provide information electronically with the intent to complement it with VHF communication as it may result in confusing messages. Prior to starting the navigational assistance procedure, it is recommended both the vessel and VTS centre agree on the type of communication to be used to keep the same mode of communication during the entire the operation, unless an unpredicted communication problem or electronic malfunction happens.

For non-time critical situation, where appropriate, it might be possible to replace VHF voice communication with electronic information only.

It is not clear to what extent existing electronic communication means can be used safely in time critical situations and for this reason, it is recommended to proceed first with test beds to evaluate their reliability and potential operational utilization. A training period is highly recommended for ships' officers and VTS operators to get familiar with these new tools and develop confidence in their use.

4.2.5. EXAMPLES

(FIND BETTER EXAMPLES)Don't need future here) (try to formulate text to avoid examples that don't cause regulation)

4.2.5.1. Example – vessel approaches shallow waters

The VTS operator concludes that the vessel wanted to make a lee for the pilot boat. Course given by the pilot boat would put the vessel into an even worse situation regarding shallow waters. VTS interrupted the boarding operation and gave instruction and guided the ship into a safe area for the embarkation of the pilot.

The VTS requests that the ship states its intention in the VTS area. In response the ship provides its sailing route. In the template, this action is categorised as Navigational information.

The VTS gives a warning when the ship has run into shallow waters, upon which the ship confirms that the information has been received. In the template, this action is categorised as Navigational warning.

The VTS advices the ship to change course. The ship confirms. In the template, this action is categorised as Navigational advice.

The VTS instructs the ship to alter its course, upon which the ship confirms. In the template, this action is categorised as Navigational instruction.

Time	VTS Action	Ship Action	Template Info (category)	Template Info (technical)
00:00	Question: What is your intention?	Provides sailing route	Navigation Information	
02:00	Warning: You are running into danger - shallow waters...	Confirms	Navigational warning	
02:10	Advice: Recommended course to make good...	Confirms	Navigational advice	
02:20	Instruction: Alter course to south-west...	Confirms	Navigational advice (revise to include *Navigation instruction* in template)	

The VTS application indicate to the VTS operator the situation and suggests an appropriate decision. The VTS operator selects the correct decision from the VTS application and provides it digitally to the vessel .The vessel verifies the decision and takes appropriate action.

4.2.6. RELATION TO OTHER MSPS

MSP2 has relationships with other MSPs where it affects the VTS:

May be different depending on the coastal state arrangements.

MSP 1 VTS INS	Associated
MSP 2 VTS NAS	
MSP3 VTS TOS	
MSP 4 Local Port Service	Delays, obstruction, cargo operations, port availability,
MSP 5 Maritime Information Service	All information depending on structure of MIS
MSP 6 Pilotage Service	Updates, delays,
MSP 7 Tug Service	Updates, delays,
MSP 8 Vessel Shore Reporting	Notification of arrival, dangerous cargo etc
MSP 9 Telemedical	Delays,
MSP 10 Maritime Assistance Service	Notifications, routing, places of refuge
MSP 11 Nautical Chart Service	Local Area updates, chart updates
MSP 12 Nautical Publication Service	Updates to publication
MSP 13 Ice Navigation Service	Ice channels, ice information
MSP 14 Meteorological Service	VTS area weather
MSP 15 Real Time Hydro and Inf Service	Tidal information in VTS area
MSP 16 Search and Rescue service	Search pattern and delays

4.2.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

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)).

The traffic organisation service 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. The 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)

IALA Guideline No. 1089 defines the Provision of Vessel Traffic Services (INS, TOS & NAS).

4.3.2. AREA OF OPERATION

MSP3 can be delivered in established VTS areas.

4.3.3. OBJECTIVE

IALA guideline 1089 lists situations/conditions where a TOS should be provided:

- vessel movements need to be planned or prioritised to prevent congestion or dangerous situations;
- special transports or vessels with hazardous or polluting cargo may affect the flow of other traffic and need to be organised;
- an operating system of traffic clearances or sailing plans, or both, has been established;
- the allocation of space needs to be organised;
- mandatory reporting of movements in the VTS area has been established;
- special routes should be followed;
- speed limits should be observed;
- the VTS observes a developing situation and deems it necessary to interact and coordinate vessel traffic;
- nautical activities (e.g. sailing regattas) or marine works in-progress (such as dredging or submarine cable-laying) may interfere with the flow of vessel movement.

A Traffic Organization Service should be responsible for separating traffic in the interest of safety. This separation could be defined in space, time and/or distance.

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

4.3.4. USER REQUIREMENTS

Table 5 Examples of types of information that may be provided by the VTS within a Traffic Organization Service:

Information related to:	Examples
Traffic clearance	Give authorization under conditional circumstances to a vessel when: prior to or entering a VTS area; • departing from a berth or an anchorage position within a VTS area; • entering into a fairway within a VTS area; or • prior to commencing a manoeuvre that may be detrimental to safe navigation. Examples of conditions: • a VTS sailing plan before entering a VTS area; • lock and bridge passage planning; • report position at determined reporting point/line/pilot station; • use a second fairway in case of bad visibility/weather; • use a tug boat in case of strong wind; • dredging or compass swing in confined waterway.
Anchorage	Examples of anchorage situations: • organizing the movements to/from an anchorage position/area; • assignment of an anchorage position; • assisting vessels into anchorage position.
Enforcement	Examples of enforcement: • speed limits; • adherence to rules regarding traffic routeing measures;

	• pilotage requirements; • other traffic regulations and possibly local by-laws
Waterway (sea, channels and fairway) management	Examples of management measures: • the use of one-way traffic as an alternative of two way traffic, depending on the dimensions of ship or the weather conditions; • organizing other traffic when a vessel has passed point of no return; • slot management to allocate ships in a time window; • organizing the traffic concerning vessel dimensions in comparison to fairway restrictions; • instruct vessels when overtaking is not permitted; • establish and organise ship safety zones in case of particular operations; • establish and organise exclusion zones; • instruct vessels to keep clear from special areas/positions; • organizing the traffic as regards to meteorological, hydrographical or other restrictions such as visibility, wind speed, current, sea state and under keel clearance.

Utilization of electronic communication may apply to elements of the Traffic Organization Service that are not implying risky situations. For instance, AIS Application Specific Messages (IMO SN. 1/Circ. 289) can be used to provide information related to:

- Clearance time to enter port
- Berthing data
- Area notice
- Route information
- Meteorological and hydrographical information
- Etc.

The figure Z is an example of potential application with respect to area notice.

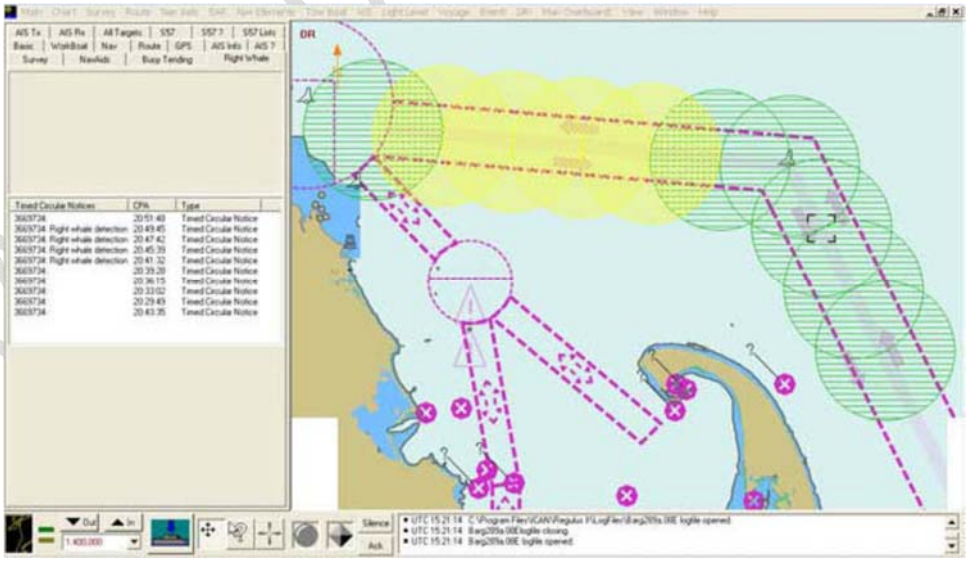


Table 6 Figure z - Example of data pertaining to the date/time detection and location of North Atlantic right whales (an endangered species) in a traffic separation scheme within a marine sanctuary area. Transmitted via AIS Application-Specific Message from a competent authority, this information is displayed on shipborne Electronic Chart System (ECS) as semi-transparent red-yellow-green colours

that do not obscure the underlying Electronic Navigational Chart (ENC) data (IMO SN.1/Circ.290 (2010)) .

However, other situations such as the intention to overtake another vessel might require radio communication, although an AIS Safety Related Message could be used here as well. A national authority intending to use electronic communication in TOS situations must first ensure that all ships have the onboard capacity to receive and interpret the AIS SRM data correctly.

In order to maintain safe navigation, a transition period from radio voice to digital data is recommended. This transition period will allow national authorities to evaluate the reliability and effectiveness of electronic communication and to take proper measures to correct undesirable situations. The figure ZZ below summarizes this transition period.

Figure 1 Illustration of the provision of a Traffic Organization Service over time.

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

4.3.5. EXAMPLES

The use case is generic and simplified through example for description purposes only. Actions and template categories may differ for different countries. *Content in the column named "Template Info (technical)" is pending submissions from relevant stakeholders.*

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

For example:

- Traffic clearance, reporting can be done digitally without VHF communication for example time slot allocation send and received.
- The content of the VHF communication can be transmitted digitally and be displayed as a text in parallel to voice communication for no go area sent received and displayed, for example for its draft, closed fairway/port/quay.

4.3.5.1. Example – vessel leaves quay

The vessel requests permission to leave the quay. The VTS instructs the vessel to remain alongside. Permission is granted to leave in five minutes. In the template, this action is categorised as Traffic clearance.

The vessel passes reporting point before entering fairway A. The VTS gives instruction and provides sequence slot due to other traffic. In the template, this action is categorised as Waterway management.

While vessel is underway, the VTS provides information on speed limit in fairway. The vessel is instructed to keep safe speed. In the template, this action is categorised as Enforcement.

The vessel requests anchorage, upon which the VTS provides anchorage position. In the template, this action is categorised as Waterway management.

Time	Ship Action	VTS Action	Template Info (category)	Template Info (technical)
00:00	Requests permission to leave quay	Instruction: Remain alongside. Permission to leave in five minutes	Traffic clearance	
02:00	Vessel passing reporting point before entering fairway A	Instruction: Provides sequence slot due to other traffic	Waterway management	
02:10	Vessel had exceeded speed limit in the fairway	Instruction: speed limit in fairway 8 knots, keep safe speed	Enforcement	
02:20	Requests anchorage	Provides position for anchorage	Waterway management	

Vessel sends planed ETD digitally to VTS where it is presented in the VTS application and the VTS operator takes action and instructs vessel digitally to remain alongside for five more minutes. The instructions are graphically displayed in applications, acknowledged and provided to other traffic via digital and/or verbal means for non MSP-ready vessels. The application alerts operator on upcoming traffic conflicts and advice on a solution, which is acknowledged and transmitted to vessels.

4.3.6. Relation to other MSPs

MSP3 has relationships with other MSPs where it affects the VTS:

May be different depending on the coastal state arrangements.

MSP 1 VTS INS	Associated
MSP 2 VTS NAS	
MSP3 VTS TOS	
MSP 4 Local Port Service	Delays, obstruction, cargo operations, port availability,
MSP 5 Maritime Information Service	All information depending on structure of MIS
MSP 6 Pilotage Service	Updates, delays,
MSP 7 Tug Service	Updates, delays,
MSP 8 Vessel Shore Reporting	Notification of arrival, dangerous cargo etc
MSP 9 Telemedical	Delays,
MSP 10 Maritime Assistance Service	Notifications, routing, places of refuge
MSP 11 Nautical Chart Service	Local Area updates, chart updates
MSP 12 Nautical Publication Service	Updates to publication
MSP 13 Ice Navigation Service	Ice channels, ice information
MSP 14 Meteorological Service	VTS area weather
MSP 15 Real Time Hydro and Inf Service	Tidal information in VTS area

MSP 16 Search and Rescue service	Search pattern and delays

4.3.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

4.4. MSP4 LOCAL PORT SERVICE (LPS) IHMA

4.4.1. DEFINITION

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. AREA OF OPERATION

4.4.3. OBJECTIVE

4.4.4. USER REQUIREMENTS

4.4.5. EXAMPLES

4.4.6. RELATION TO OTHER MSPS

4.4.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

4.5. MSP5 MARITIME SAFETY INFORMATION SERVICE (MSI) (PDA+TC)

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 government's responsibilities with regards to providing MSI information.

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

Table 7 Maritime Safety Information Service

Information related to:	Examples:
Impediments to shipping and areas to avoid, including no-go areas	• 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 • Etc.
Status of navigation aids	• 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	• 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.

Information related to:	Examples:
Marine weather warnings and forecasts	• 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. AREA OF OPERATION

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.

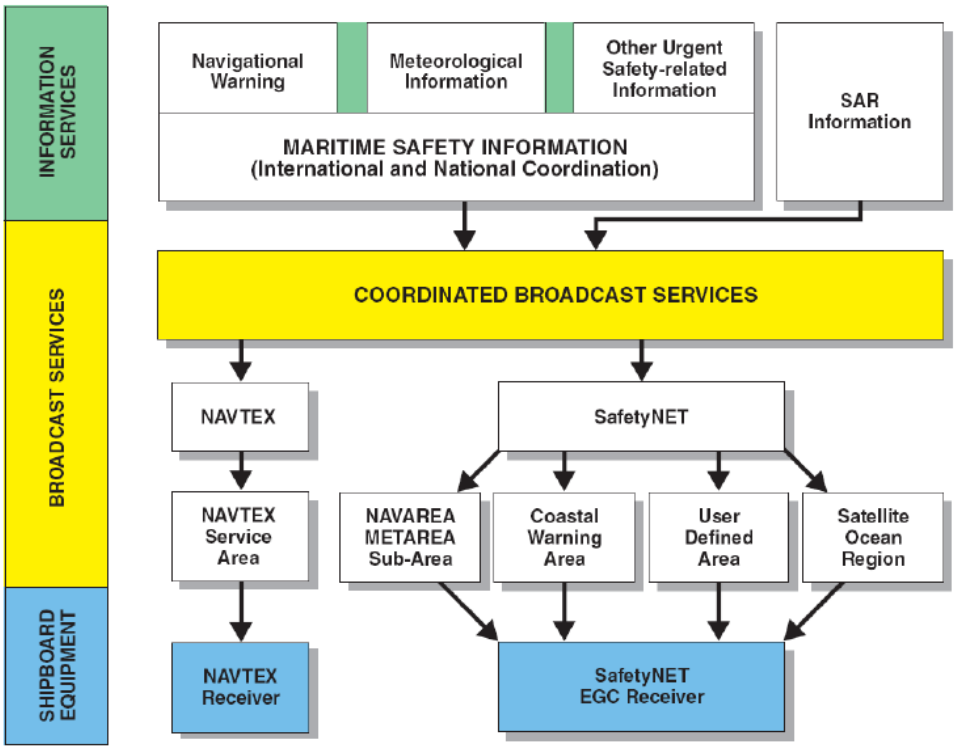


Figure 4.5-1 The maritime safety information service of the Global Maritime Distress and Safety System (Source: S-53)

*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.

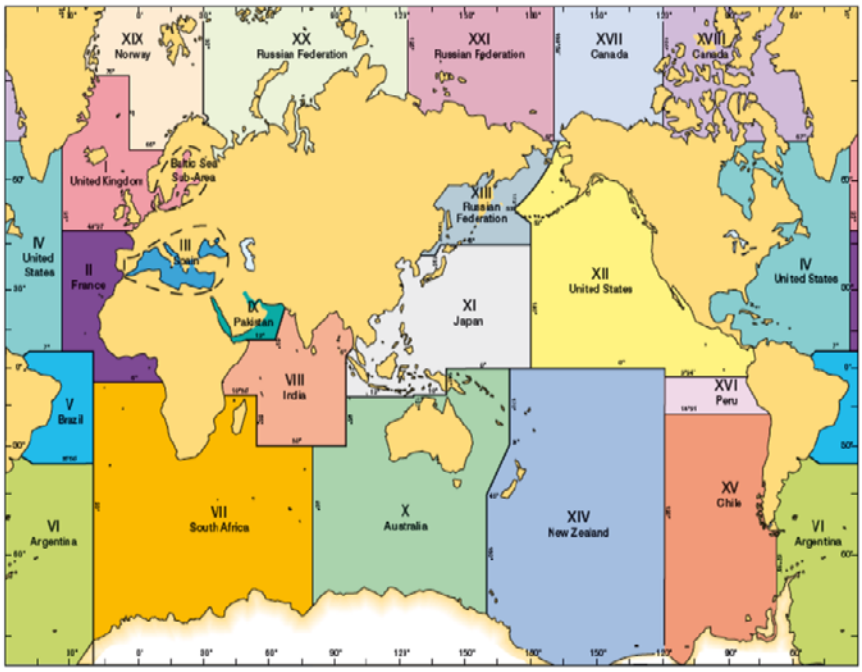


Figure 4.5-2 NAVAREAs for coordinating and promulgating navigational warnings under the World-Wide Navigational Warning Service (Source: S-53)

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.

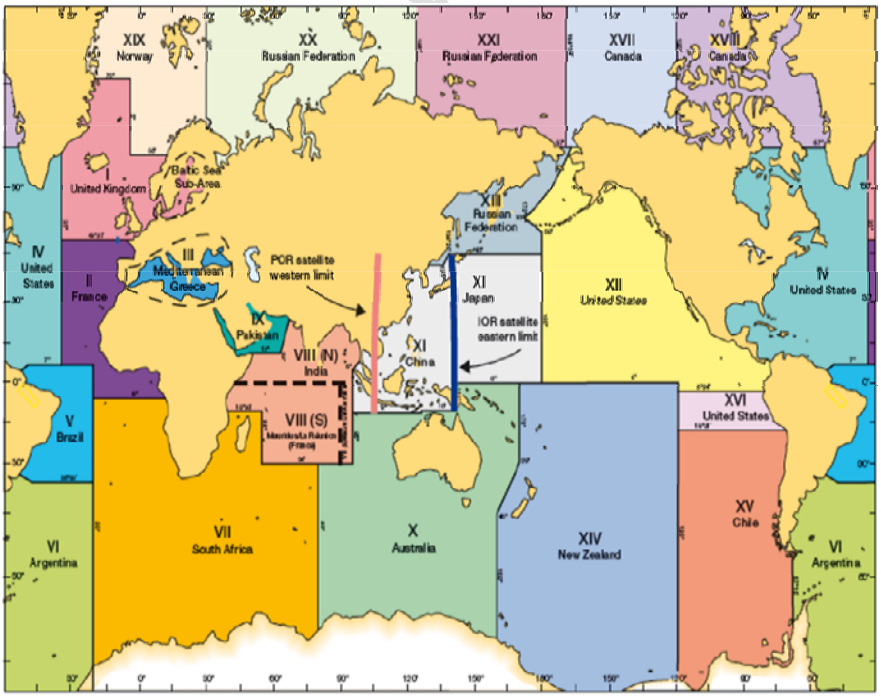


Figure 4.5-3 METAREAs for coordinating and promulgating meteorological warnings and forecasts within the GMDSS (Source: S-53)

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:

- NAVTEX: broadcasts to coastal waters; and
- 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. EXAMPLES

4.5.6. 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.

4.5.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

4.6. MSP6 PILOTAGE SERVICE [IMPA]

4.6.1. DEFINITION

The aim of the pilotage service is to safeguard traffic at sea and protect the environment by ensuring that vessels operating in pilotage area have navigators with adequate qualifications for safe navigation. Each pilotage area needs highly specialized experience and local knowledge on the part of the pilot.

Efficient pilotage depends, among other things, upon the effectiveness of the communications and information exchanges between the pilot, the master and the bridge personnel and upon the mutual understanding, each has for the functions and duties of the other.

Establishment of effective co-ordination between the pilot, the master and the bridge personnel, taking due account of the ship's systems and equipment available to the pilot, will aid a safe and expeditious passage.

4.6.2. AREA OF OPERATION

MSP 6 can be used in

4.6.3. OBJECTIVE

4.6.4. USER REQUIREMENTS

4.6.5. EXAMPLES

4.6.6. RELATION TO OTHER MSPS

4.6.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

4.7. MSP7 TUGS SERVICE (IHMA?)(ITA?)

4.7.1. DEFINITION

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.
- Ice breaking

4.7.2. AREA OF OPERATION

4.7.3. OBJECTIVE

4.7.4. USER REQUIREMENTS

4.7.5. EXAMPLES

4.7.6. RELATION TO OTHER MSPS

4.7.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

4.8. MSP8 VESSEL SHORE REPORTING [FRED POT]

4.8.1. DEFINITION

The aim of vessel shore reporting is to safeguard traffic at sea, ensure personnel safety and security, ensure environmental protection and increase the efficiency of maritime operations.

Automated ship reporting is one of the most important solutions to reduce the Mariners workload (amount of time spent on preparing and submitting reports to shore-based authorities). To achieve this, reports should be automatically generated as much as possible from on-board systems. Some 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, it's 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).

4.8.5. EXAMPLES

4.8.6. RELATIONSHIPS WITH OTHER MSPS

4.8.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

4.9. MSP9 TELEMEDICAL ASSISTANCE SERVICE (TMAS) [NORWAY]+NTNU

4.9.1. DEFINITION

The ILO Convention 164 adopted in 1987 provides requirements to the competent authority shall ensure by a prearranged system that medical advice by radio or satellite communication to ships at sea, including specialist advice, is available at any hour of the day or night. The ILO Maritime Labour Convention (2006) provides the same requirements and stipulate that this service shall be available free of charge to all ships irrespective of the flag that they fly.

The IMO Maritime Safety Committee, at its seventy-second session (17 to 26 May 2000), noted the general tendency to regard medical assistance at sea as an integral part of rescue and that this approach is consistent with the International Convention on Maritime Search and Rescue (SAR). Noting further that the Convention requires the search and rescue services to perform distress monitoring, communication, co-ordination and search and rescue functions, including provision of medical advice, initial medical assistance or medical evacuation, the Committee approved the MSC.1/Circ.960 on Medical Assistance at Sea and clarifying the role of Telemedical Assistance Services (TMAS).

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. The MSC.1/Circ.1218 is providing guidance on exchange of medical information between TMAS involved in international SAR operations.

4.9.2. AREA OF OPERATION

MSP9 can be delivered in all sea areas (1-6), but differences in bandwidth depending on available types of transmission techniques will result in different levels of service.

4.9.3. OBJECTIVE

The objective of TMAS is to give decision support and advice to medically responsible personal onboard in cases of medical emergency where treatment cannot wait. This is today mostly done by voice communication using VHF, MF or short wave radio, or mail. In a future e-navigation scenario, the quaity of remote diagnostics and even treatment can be expected to improve.

In addition to prevailing TMAS provisions, real time monitoring of the patients current health status will be important. The parameters monitored may differ in different systems, but may include hart rate, blood oxyen saturation and pressure. As an example see the telemetric medical information screen below.

Figure 2 *An example of a typical telemetry screen: top (green) curve is hart rate (Beats Per Minute from two redundant connectors), below (in red) is* ***Ambulatory Blood Pressure (ABP) in mmHg, the third curve is Peripheral Capillary Oxygen Saturation (SPO2), the oxygen saturation of the blood (normal is 95-100 %), at the bottom of the screen are Noninvasive Blood Pressure (NBP) and the patient's temperature in degrees Celsius.***

Further needs might involve real-time video chat between the remote specialist doctor and the patient as well as examinations with remotely controlled cameras. Also extensive, detailed, cardiovascular (hart) data for a period of time should be able to be collected and sent as compressed files for further monitoring by the specialist doctor.

One may envision that in the not too distant future, what today is very expensive medical equipment could be installed on (at least some) ships, e.g. large cruise vessels. Examples of such equipment could be:

[short version] ultrasonography, computer tomography (CT) and surgical operation robots. Such equipment will then be remotely operated from land given reliable radio connections.

[long version]

Diagnostic ultrasonography
is used to see internal body structures such as tendons, muscles, joints, vessels and internal organs. Its aim is often to find a source of a disease or to exclude any pathology. The practice of examining pregnant women using ultrasound is called obstetric ultrasound, and is widely used.

The European Space Agency has already tested a long-distance robotic ultrasound system for remote operation by distant specialists. An assistant onboard simply holds the device against the patient and the ultrasound expert can move the probe as if present in the examination room, rather than thousands of kilometres away. They control the device in real time using a joystick, based on ultrasound imagery relayed back.

CAT
Computed tomography, more commonly known as a CT or CAT scan, is a diagnostic medical test that, like traditional x-rays, produces multiple images or pictures of the inside of the body.

Remote surgery (also known as tele-surgery)
Remote surgery allows the surgeon to remotely perform surgery either using direct tele-manipulator or through computer control. the surgeon does not have to be present, but can be anywhere in the world, leading to the possibility for remote surgery.

4.9.4. USER REQUIREMENTS

Now

- A digital health emergency monitoring system allowing logged text interchange between a ship and medical specialist at a shore hospital including
- Voice communication not only with the medical officer onboard, but also with the patient in the medical bay
- Real-time video for visual examination by the remote specialists using video
- Real-time transmission at length of medical telemetry
- Transmission of compressed data packages of e.g. EEG data

In the future (examples)

- Transmission of data and remote control of ultrasonography
- Transmission of data and remote control of computer tomography and the like imaging techniques
- Transmission of data and remote control of robotic surgery

4.9.5. EXAMPLES

4.9.6. RELATIONSHIP WITH OTHER MSPS

4.9.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

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, See IMO Res 950

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 seakeeping 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. AREA OF OPERATION

Text- coastal states? SAR areas?

4.10.3. OBJECTIVE

Text (IMO RES?)

4.10.4. USER REQUIREMENTS

4.10.5. EXAMPLES

4.10.6. RELATIONSHIP WITH OTHER MSPS

4.10.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

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	• Paper charts • Raster Navigational Charts (RNC) • Electronic Navigation Charts (ENC)
Chart catalogue	• Catalogue of available products
Bathymetric charts	• Bathymetric Information with greater details than normally given in a navigational chart

Information related to:	Examples:
Notice to Mariners	• Regular updating service for products issued by the individual Nautical Chart Service.
Hydrography	• 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. AREA OF OPERATION

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.

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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.

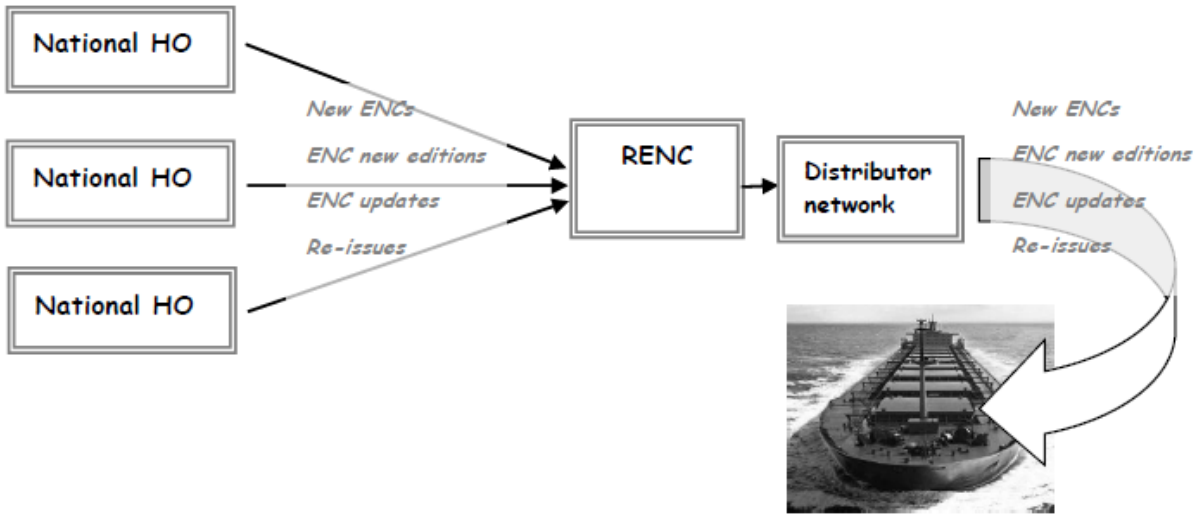

Figure 4.11-1 - General principle of ENC distribution (Source: S-65)

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. EXAMPLES

[Thomas P]

4.11.6. RELATIONSHIP TO OTHER MSPS

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.

4.11.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

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	• Routes in constricted shipping lanes or • Routeing measures, traffic separation schemes, and shipping lanes
Summary information about port facilities	• Depth alongside berths, and quay lengths • Cargo handling facilities at specified terminals and berths
Variations from charted information	• Tendencies toward silting at river mouths, shifting sandbanks, etc., that may degrade the accuracy of charted information
Marine radio services	• Geographic availability of services • Frequencies and channels used and broadcast schedules • Type of traffic supported – Weather forecasts, radiofax, telemedical assistance, etc.
Protected area information	• Locations of marine protected areas • Restrictions and regulations applicable within specific areas
Prevailing natural conditions	• Seasonal hazardous conditions • Periodic (e.g., tide-related) or irregular hazardous conditions
Regulatory information	• 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	• Waste disposal, repair, bunkering, collection of ship pollutants such as oily wastes • Pilot services contact information and notice times
Navigation aids	• List of Lights
Tide information and forecasts	• Tide tables, tide stream atlases
Planning	• Routeing guides
Controlled areas	• VTS contact information

4.12.2. AREA OF OPERATION

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;

- NP1 – Printed paper publications
- NP2 – Digital publications based upon existing paper publications
- 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 navaid 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. EXAMPLES

xxx

4.12.6. 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.

4.12.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

4.13. MSP13 ICE NAVIGATION SERVICE

4.13.1. DEFINITION

An ice navigation service provides valuable assistance and information to ships operating in and around ice-infested waters. Information about sea ice and icebergs at varying time scales may be available as text bulletins, graphic charts or electronic data.

Services provided by an ice navigational service typically include:

- ice condition information and operational recommendations/advice;
- ice conditions around a vessel;
- vessel routing;
- vessel escort and icebreaking;
- ice drift load and momentum;
- ice observations from ships or aircraft.

Ice observations may be prepared once a day, depending upon the availability to the information. Ice forecasts may be prepared daily or less often, and cover periods of 24 hours to a few days. Long-range predictions e.g., 30 day predictions and seasonal predictions may be available online or by email.

WMO publication 574 (Sea Ice Information Services of the World) has comprehensive information on National Ice Services.

Examples of Ice Navigation Services are listed in Table x.

Table x – Ice Navigation Service

Information related to:	**Examples:**
Ice conditions	• Sea ice concentrations • Sea ice stage of development (type or thickness) • Iceberg location and drift • Limit of all known sea ice or icebergs
Ice reports and bulletins	• Text summaries of ice conditions
Ice forecasts	• Near-term or long range forecasts
Routeing aid	• Recommended routes • Icebreaker assistance

4.13.2. AREA OF OPERATION

MSP13 can be delivered in all sea areas (1-6) where and when sea ice or icebergs are present. Frequency of the data availability and the amount of detail may vary.

4.13.3. OBJECTIVE

Ice navigational services use data from a variety of sources, combined to represent conditions at a particular date or time. Satellite imagery is most commonly used, but ship and aircraft reports are an important source of additional data. Forecast ice information is usually based on meteorological, oceanographic and ice model output which might be automated or combined with a forecaster's local knowledge of currents and tides. Most ice information is available online and may be transmitted through marine radio or by email.

4.13.3.1. International 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.

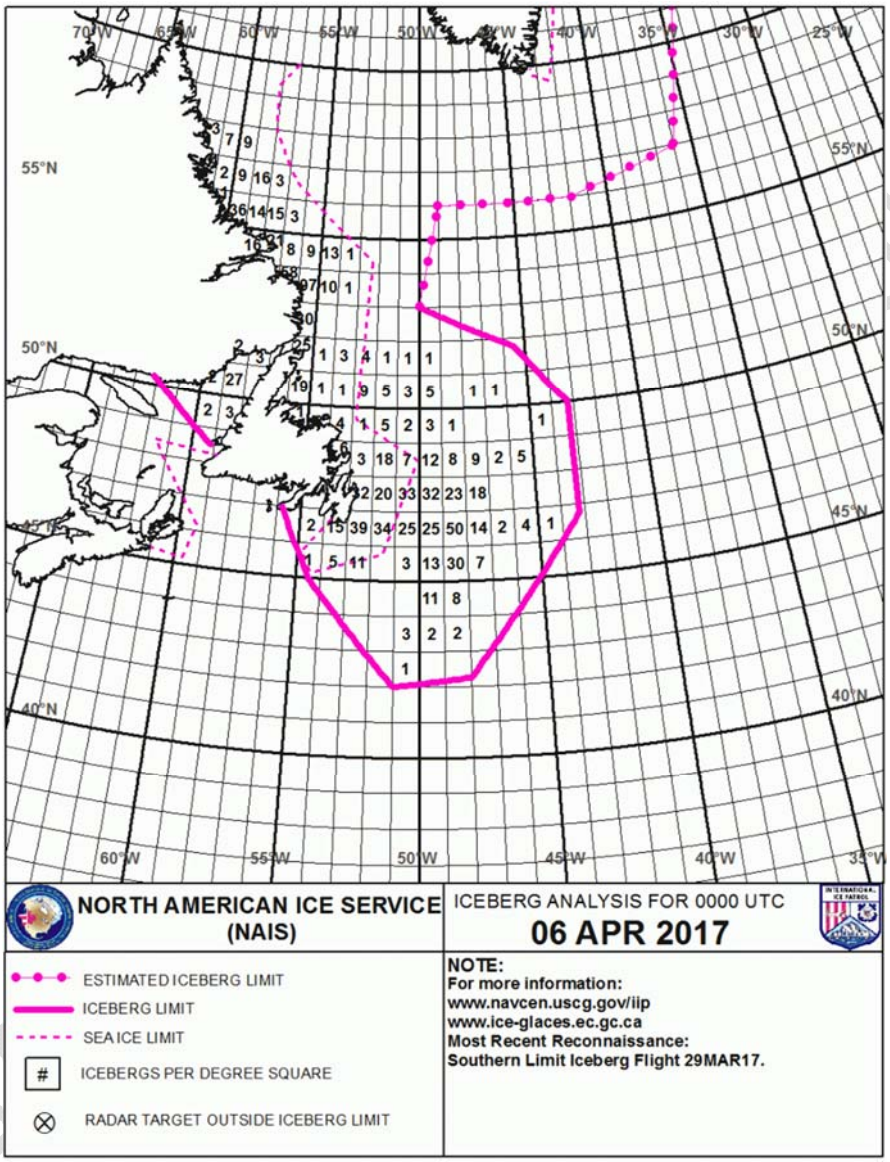

Figure 4.13-1 – Map of icebergs produces by the International Ice Patrol Credit photo Canadian Coast Guard).

4.13.3.2. Ice charting

Some 20 nations around the world offer an ice information service, and these organisations relay charts of ice conditions mostly by radio facsimile and online. Time slots and schedules usually dictate the scale and number of charts provided by the broadcast station in the area of concern. Services may provide ice forecasts once a day for a period of 24 to 144 hours. These are tactical forecasts and 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 based on climatological, analogue or statistical methods. They are more commonly available online or sent directly to shipping companies and agents or individual ships.

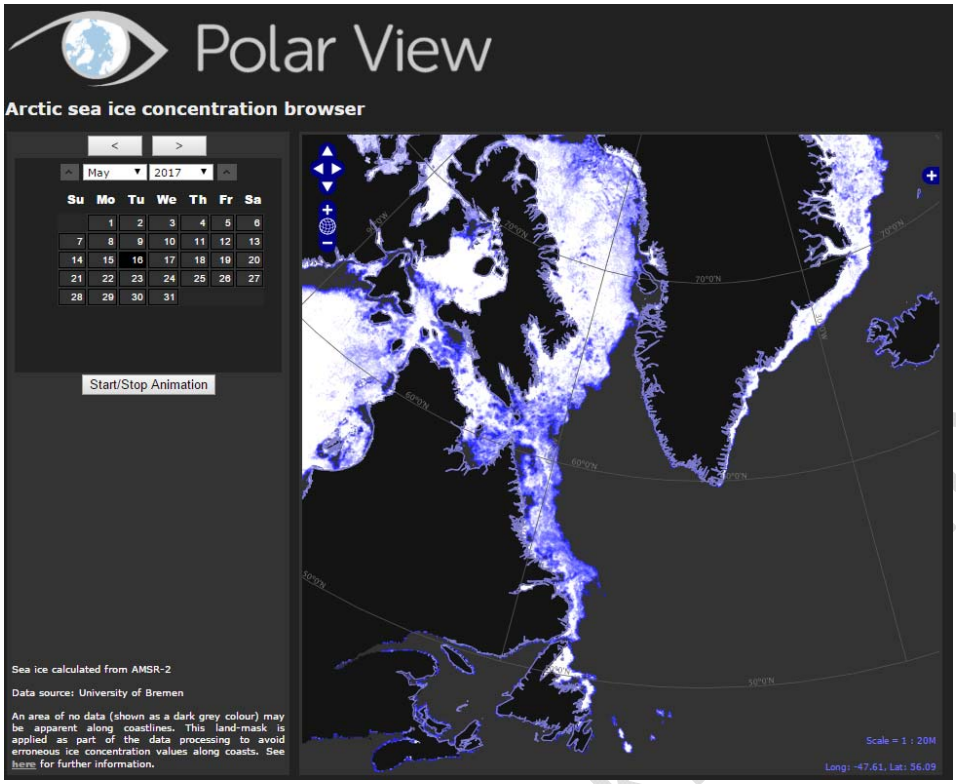

Figure 4.13-2 - Example of Sea Ice satellite service (www.polarview.aq)

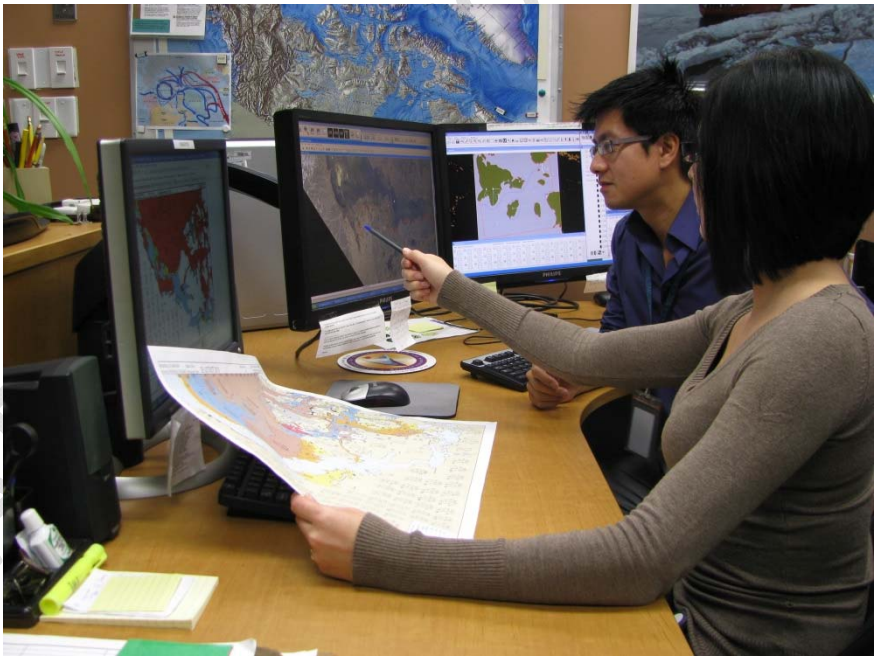

Figure 4.13-3 – Analysis of ice charts

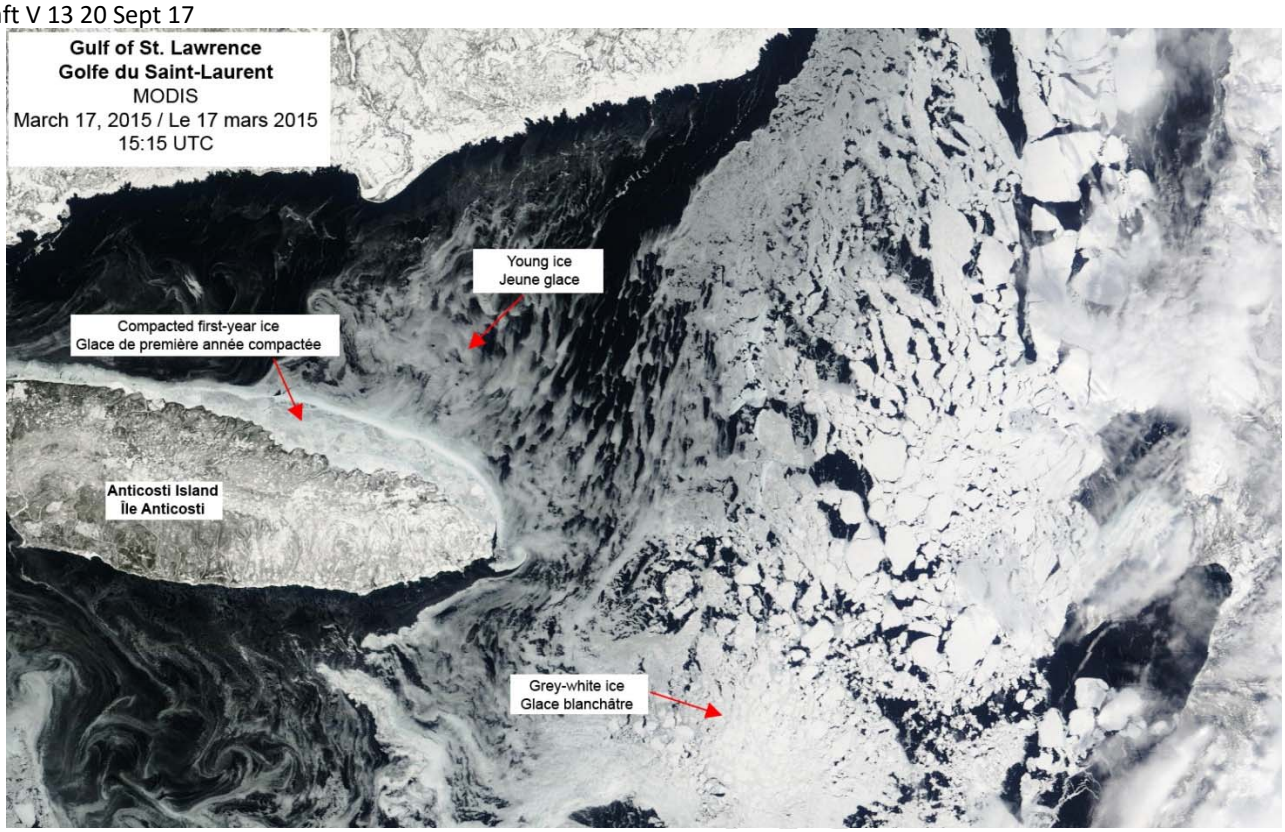

Figure 4.13-4 – A MODIS satellite image taken on March 17, 2015 of the Gulf of St. Lawrence. The image highlights compacted first-year ice along Anticosti Island as well as young ice and grey-white ice off the coast. (Image credit: NASA)

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. 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 in 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.

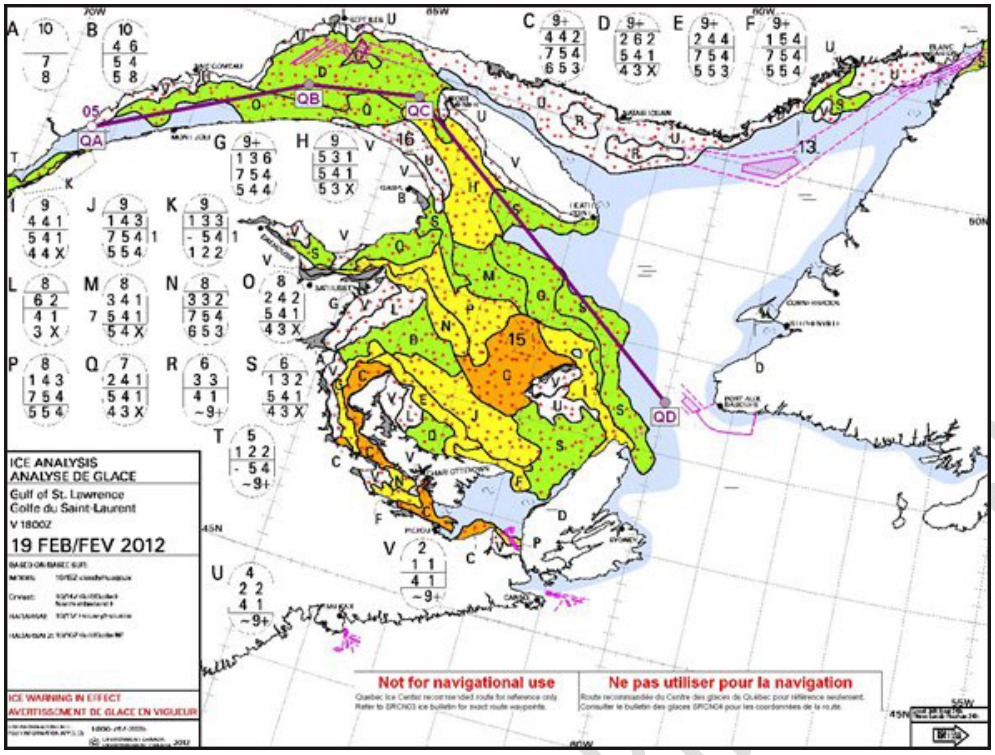

Figure 4.13-5 Example of a Recommended Ice Route in the Gulf of St. Lawrence (source "Ice Navigation in Canadian Waters" – Canadian Coast Guard)

Figure 4.13-6 – Vessel escort (photo: Canadian Coast Guard).

4.13.4. USER REQUIREMENTS

The Master relies upon accurate ice information and advice to make decisions about their future course and progress. Effective icebreaker support, assistance to shipping or up-to-date ice information requires reliable communications. In northern or remote areas, internet communications may be limited. 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), as well as the use of the S-411 format will give benefits in terms of enabling services with more detailed information than traditional radio services currently provide. Navigation systems will need a capability to utilize electronic data to be able to make use of all available ice information.

Figure 4.13-7 – Ice conditions in the Gulf of St. Lawrence (photo: Canadian Coast Guard).

4.13.5. EXAMPLES

4.13.6. 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.

4.13.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

4.14. MSP14 METEOROLOGICAL INFORMATION SERVICE [WMO]+NORWAY

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 routeing to mariners who will use these types of information to support their decision-making. Such information includes:

- weather routeing, 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 of television.

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

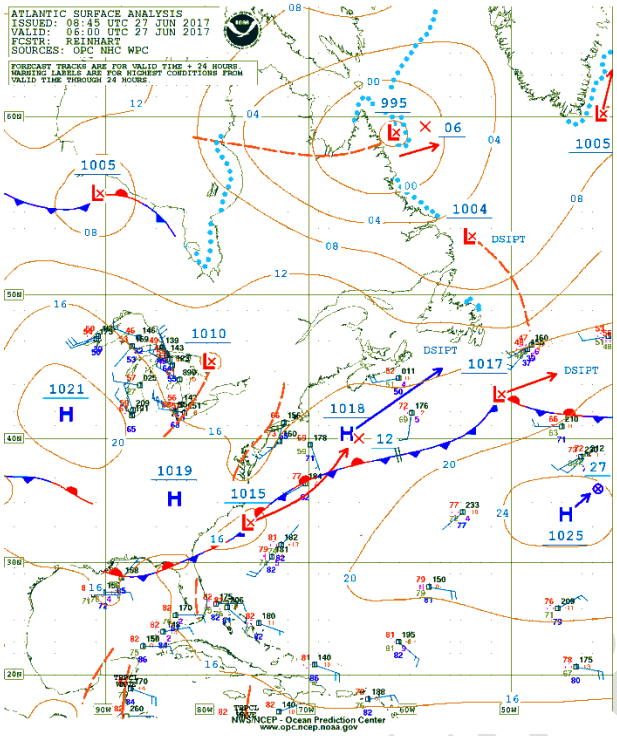

Figure 4.14-1. Surface analysis, West Atlantic. (NOAA)

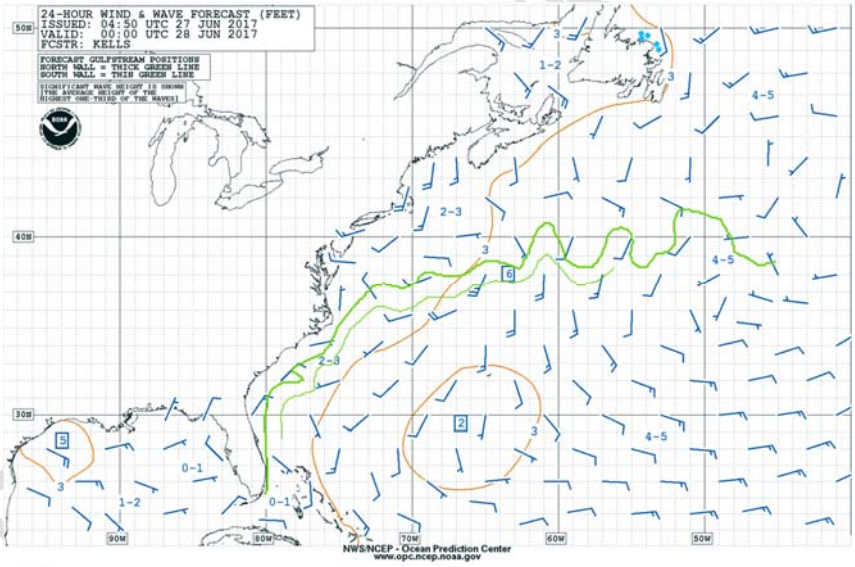

Figure 4.14-2. Wind and wave forecast. (NOAA)

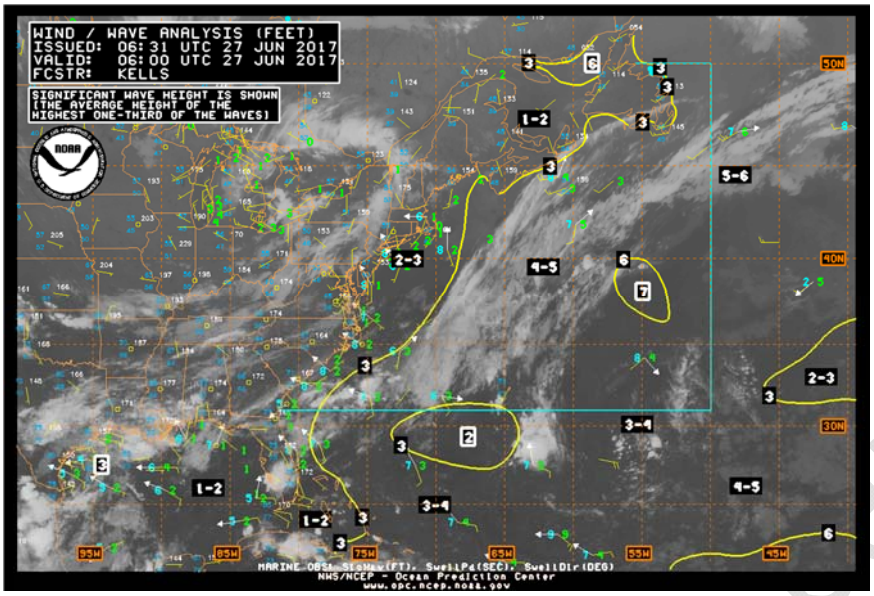

Figure 4.14-3. Wind and wave analysis (NOAA)

Examples of Meteorological Information Service is listed in Table x.

Table x – Meteorological Information Service

Information related to:	Examples:
Wind and wave analysis	• Wind speed, direction, gust information • Wave height, swell period, direction • Graphics depicting analysis
Weather conditions	• Current conditions • Graphics depicting current conditions and tendencies
Severe weather information	• Warnings about location, strength, and movement of storms • Information about areas under sever weather warnings and watches
Bulletins and forecasts	• Surface weather analysis, synoptic information • Weather forecasts • Temperature, barometric pressure, tendencies
Ship observations	• Receipt of reports from ships in the Voluntary Observation System • Transmission of information extracted from received ship reports to shipping

4.14.2. AREA OF OPERATION

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 Center'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. EXAMPLES

4.14.6. RELATIONSHIP TO OTHER SERVICES

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

4.14.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

4.15. MSP15 REAL-TIME HYDROGRAPHIC AND ENVIRONMENTAL INFORMATION SERVICES (IHO)(WMO)

4.15.1. DEFINITION

Check IMO 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	• databuoy information via AIS • Surface current snapshots
Surface conditions	• Wave heights via radar
Real time environmental conditions	• Temperature, pressure, tendencies (rising/falling) • Wind speed and direction • Visibility
Water column	• Depths, salinity, temperatures

4.15.2. AREA OF OPERATION

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 onboard 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. EXAMPLES

xxxx

4.15.6. RELATIONSHIP TO OTHER SERVICES

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

4.15.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

4.16. MSP16 SEARCH AND RESCUE (SAR) SERVICE [NORWAY] +IMRF+SWEDEN

4.16.1. DEFINITION

IMO definition?

The SAR service is responsible for assisting [and 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. AREA OF OPERATION

4.16.3. OBJECTIVE

4.16.4. USER REQUIREMENTS

4.16.5. EXAMPLES

4.16.6. RELATIONSHIP WITH OTHER MSPS

4.16.7. ASSOCIATED TECHNICAL SERVICES

Name	ID (MRN)	Description	Architect(s)	Standardisation Body

4.17. MSP17 AIDS TO NAVIGATION SERVICES (ATON)

4.18. MSP18 COMMUNICATION SERVICES [IALA]

4.19. MSP19 PNT AND AUGMENTATION SERVICES [UK GLA]

4.20. [MSP20 ANTI-PIRACY INFORMATION] [IMB](US)

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 MSC94, 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

ANNEX A