



IALA GUIDELINE

G1121

NAVIGATIONAL SAFETY WITHIN MARINE SPATIAL PLANNING

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CONTENTS

1	INTRODUCTION	4
1.1	Background	4
1.2	Purpose	4
1.3	Scope	4
2	FRAMEWORK: ASPECTS AND REFERENCES	5
2.1	Aspects of MSP	5
3	THE MARINE SPATIAL PLANNING PROCESS	5
4	MARITIME SPATIAL DATA INFRASTRUCTURE TOGETHER WITH GEOGRAPHICAL INFORMATION SYSTEMS	9
4.1	Data requirements	10
4.2	Content of a GIS	10
4.3	Analyses supported by GIS	10
5	RISK MANAGEMENT	11
5.1	Risk Assessment	11
5.2	Risk Acceptance	12
5.2.1	Risks to people	12
5.2.2	Risks to the environment	12
5.2.3	Risks to property and assets	12
5.2.4	Risks to business	12
5.3	Risk Mitigation	12
6	DEFINITIONS	13
7	ACRONYMS	13
8	REFERENCES	14
ANNEX A	SPATIAL DEMANDS	17
ANNEX B	LINKS TO RELEVANT SOURCES	20
ANNEX C	Categorisation of GIS layers for MSP	23

List of Tables

<i>Table 1</i>	<i>Specific spatial requirements</i>	<i>17</i>
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List of Figures

<i>Figure 1</i>	<i>The UNESCO 10-step approach (Flow chart provided courtesy of UNESCO)</i>	<i>6</i>
<i>Figure 2</i>	<i>Risk Management process scheme, from [Guideline on risk management]</i>	<i>11</i>



1 INTRODUCTION

1.1 BACKGROUND

For millennia the seas have been the preserve of the mariner alone. In the second half of the 20th century the seas became not only trade routes and a source of food but also a source of energy. Oil and gas installations became the first significant man-made developments that were often situated in proximity to or amidst navigable waters. In the 21st century the drive to reduce carbon emissions and improve energy security has led to a global expansion of Offshore Renewable Energy Installations (OREI). Many sites are either under construction or have been approved to start construction in the near future, with wind energy being the technology of choice for many countries.

The construction of large offshore wind farms and tidal and wave sites requires coherent planning to ensure the safety of navigation, achieve environmental protection and provide for energy needs. Although wind farms are currently the most space-consuming, in the future, other interests such as aquaculture, environmental protection and preservation and exploitation of natural resources may increase. Significant areas of navigable waters may no longer be available to the mariner.

The IALA workshop on the Application of Aids to Navigation (AtoN) within Marine Spatial Planning (MSP)¹, held in May 2013 and attended by delegates from a diverse range of backgrounds, and the continued work of IALA's AtoN Requirements and Management (ARM) Committee, resulted in this 'Guideline on Navigational Safety within Marine Spatial Planning'. It is expected that the Guideline will contribute to facilitating engagement in the process and inter-stakeholder co-operation at local, national and international levels.

1.2 PURPOSE

The purpose of this Guideline is to inform AtoN and other maritime authorities of the main elements of the Marine Spatial Planning (MSP) process. Specific navigational concerns should be considered when assessing the impact on existing marine traffic routing and navigational safety caused by offshore developments. Protection of marine environment may also affect traffic organisation. The Guideline will provide information to other MSP stakeholders and the MSP authority of the underlying navigation factors to be taken into account during the process.

This document describes the MSP process and provides guidance on the role of AtoN and other maritime authorities have in contributing to the navigational assessment elements of MSP. It is important that preparation and planning takes place to ensure that safety at sea and navigation requirements are adequately addressed. This Guideline also provides reference to other industry documents for further technical and procedural details.

1.3 SCOPE

The MSP process brings together multiple users of marine areas to make informed, coordinated decisions about how to use marine resources sustainably and reduce conflicts. Users may include shipping, offshore energy, aquaculture, fishing, government, conservation and recreation entities. MSP has its origins in marine ecological and environmental protection, but has evolved to encompass economic and navigational safety concerns. It also provides means for optimising the utilisation of sea areas with respect to ecological, social and economic values and improving long-term international policy development, efficiency of shipping and maritime safety. MSP should therefore not only be seen as a national or cross-border issue, but should also take into consideration international navigational interests.

¹ Note that the acronym MSP is also used for Maritime Services Portfolio.



2 FRAMEWORK: ASPECTS AND REFERENCES

The MSP process is not new. Conflicting interests have occurred before, but solutions could be found on a relatively small scale. However, offshore space has become increasingly valuable and utilised and a more holistic spatial planning approach is required. Integrated Pollution Prevention and Control (IPPC) emission regulations have stimulated a considerable demand for OREI developments. These developments may take up large sea areas and may have significant effects on navigation, the environment and economies.

2.1 ASPECTS OF MSP

It is important that early preparation and planning takes place to ensure that safety at sea and navigation requirements are adequately addressed. Therefore, maritime authorities should be proactive in the development of MSP rather than reactive. As there are many different interests involved in MSP it is important that all maritime authorities, especially the AtoN authority, are involved in an early stage and are prepared to contribute to the planning process. These authorities should therefore have the necessary data available and have a clear understanding of the risks involved. It is equally important that the MSP leading authority is aware of the maritime concerns, needs and risks.

The following aspects may be considered in developing marine spatial plans:

- safety of navigation;
- economic and environmental impacts of activities such as shipping and fisheries industries;
- energy targets (e.g. renewable energy capacity);
- environmental requirements (e.g. Marine Protection Areas);
- singular, multi, or co-uses of an area;
- cumulative effects of adjacent project infrastructure;

Additional explanations of the above bullets can be found in 0.

The main purpose of MSP is to achieve a balanced approach towards navigational safety, environmental protection, economic effects and communication (information management). Typically, a marine spatial plan is not based upon one solution. Multiple options are usually presented to address key issues over the plan development using an iterative and continual learning approach. Plan developers should take into account jurisdictional issues between adjacent states. The MSP process in every country may be subject to international laws and regulations, national legislation, laws, rules, regulations and other guidance documents.

3 THE MARINE SPATIAL PLANNING PROCESS

A basic ten-step MSP development process is shown as a flow chart in Figure 1. The paragraphs following the flowchart explain the steps identified and provide guidance to the authority/authorities responsible for maritime safety identified in Step 1. The planning process should include stakeholder interaction in multiple stages of the project.

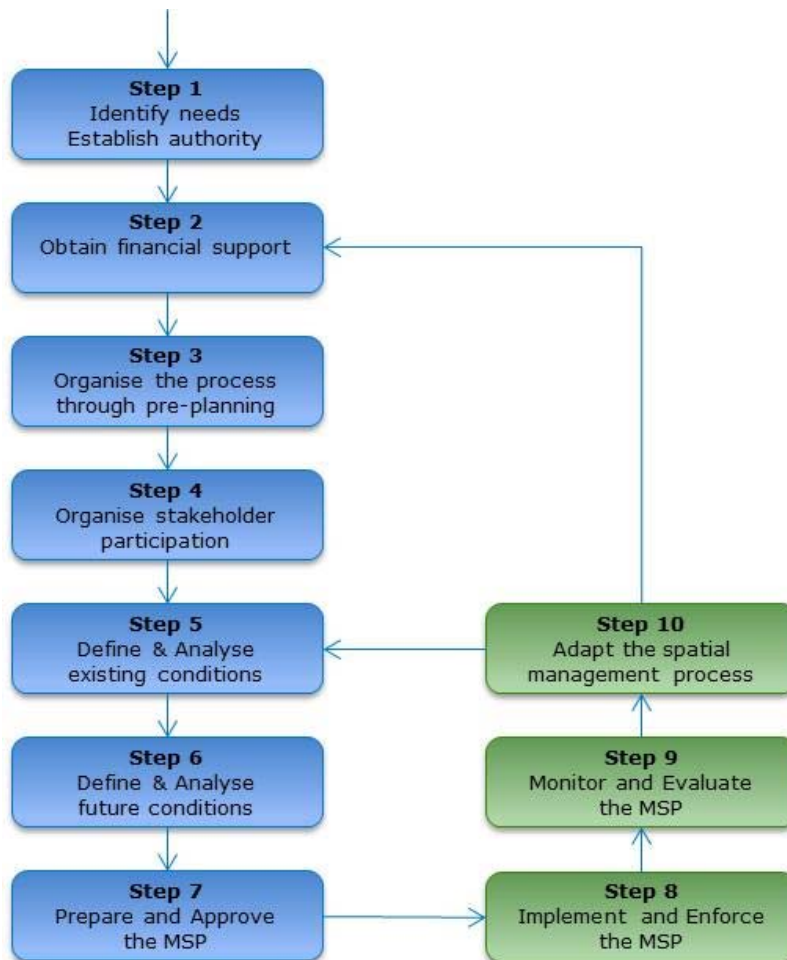


Figure 1 *The UNESCO 10-step approach (Flow chart provided courtesy of UNESCO)*

The contents of the steps are described below. As the maritime authority is not normally the MSP-leading authority, in each step, the role and contribution of the maritime authority is highlighted in a separate box.

Step 1 – Identify the need and establish an authority

An Administration should identify or establish a leading MSP authority or authorities. The leading authority should co-ordinate the link between other (national as well as international) Administration’s agencies with an interest in MSP.

Maritime Authorities Contributions and Work
Identify national authorities in charge of the MSP process. Organize the link between maritime authorities and MSP lead authorities.

Step 2 – Obtain financial support

The leading authority should recognise the resources, such as financial, personnel, equipment, survey and other appropriate data, which will be needed to participate in this process.

Maritime Authorities Contributions and Work
Identify national authorities in charge of the MSP process. Recognize the need to budget and identify resources to work on MSP Project.



Step 3 - Organise the process through pre-planning

The leading authority needs to ensure proper capacity or desired skills. It may co-ordinate with other national representatives as appropriate to ensure that all MSP issues are covered and supported according to current requirements. This should include developing a work plan that identifies key work products and resources such as information and data needed to complete the output of the planning on time.

In addition, the leading authority may identify public educational issues and stakeholders to include in the planning process.

Maritime Authorities Contributions and Work
Organize the co-ordination between maritime authorities and maritime stakeholders.
Organize GIS data sets to share navigation information.

Step 4 – Organise stakeholder participation

The leading authority should organise planning meetings that involve the appropriate stakeholders. Especially in cross-border situations involvement should be organised at an early stage. A cross section of stakeholder expertise should be considered. The planning meetings’ agendas will indicate which stakeholders to include and how they will be involved in the MSP process. The output is expected to be a plan indicating who, when and how to involve stakeholders throughout the MSP process.

Maritime Authorities Contributions and Work
Define with MSP Lead authority through whom, when and how the maritime authorities will contribute.

Step 5 – Define and analyse existing conditions

Current information such as AtoN, VTS, radionavigation and communication capability, traffic routes and AIS tracking, previous risk assessments, hydrographical and meteorological information, should be gathered. In addition, gaps in data/information should be identified and taken action on where new studies are required. Analysis of current information will identify existing and possible conflicts and synergies among waterway users. Outputs are expected to include an inventory, and maps of important biological and ecological areas in the marine management area.

Maritime Authorities Contributions and Work
Share data with MSP Lead authorities.
Identify studies required to improve data.
Identify possible conflicts, synergies, among users.

Step 6 – Define and analyse future conditions

The MSP process should ensure that future safety of navigation issues is identified. Risk assessments will need to be conducted and possible mitigations identified. Mitigations may include: spatial/temporal separations, new routes, changes to AtoN / VTS strategy, or the need for new resources such as coastal monitoring emergency response capability.

The leading authority should identify possible costs and benefits for each proposed scenario and how the MSP will be monitored in the future.

Finally, the plan should be co-ordinated with neighbouring national maritime authority and comply with international conventions, regulations and guidelines, where possible.

Outputs should include:



- a trend scenario illustrating how the MSP area will look if present conditions continue without new management interventions;
- alternative spatial sea use scenarios illustrating how the management area might look when human activities are redistributed based on new goals and objectives;
- a preferred scenario that provides the basis for identifying and selecting management measures in the spatial management plan (Step 7).

Maritime Authorities Contributions and Work
<p>Identify future needs.</p> <p>Review future scenarios and give advice on their consequences for future aid to navigation management, VTS, maritime safety, costs and benefits.</p> <p>Ensure compatibility of plans with neighbouring national maritime administrations.</p>

Step 7 – Prepare and approve the MSP

The MSP lead authority should identify the best options for the MSP including risk mitigation and cost issues. The plan should be communicated to all stakeholders and identify any pre-implementation issues that will need to be addressed. These may include public relations, commissioning equipment/materials, and engaging the appropriate personnel. The plan will then be finalised, reviewed and approved.

Outputs are expected to include:

- an identification and evaluation of alternative management measures for the spatial management plan;
- identification of criteria for selecting alternative management measures;
- a comprehensive management plan, including, if needed, a zoning plan.

Maritime Authorities Contributions and Work
<p>Identify best options for approving the preferred plan including risk mitigation and costs issues.</p> <p>Communicate the plan to all internal stakeholders.</p> <p>Confirm that external stakeholders will take part in charge of the maritime aids modification caused by their new activities which will have to be compatible with maritime safety needs.</p>

Step 8 – Implement and enforce the MSP

The leading authority will ensure the promulgation of the MSP. At this step, the MSP should be executed, including issues of regulatory changes, notifications, step-by-step implementation and enforcement activities. Project management techniques should be utilised to ensure that the implementation is timely, efficient and well-co-ordinated with other authorities, agencies and stakeholders. Monitoring activities of the plan should be activated during this stage.

The output is expected to be a clear identification of actions required to implement, ensure compliance with and enforce the spatial management plan.

Maritime Authorities Contributions and Work
<p>Plan actions required to implement MSP and to insure compliance between maritime safety activities and MSP.</p> <p>Program budget, organize and coordinate internal and external resources to work on MSP implementation for maritime safety.</p> <p>Activate monitoring tools for MSP on maritime safety.</p>



Step 9 – Monitor and evaluate the MSP

Monitoring activities as defined should be carried out to assess and evaluate the effectiveness of the plan. During this stage, periodic progress reports should be published about the performance of the plan, and any problems identified and analysed.

Outputs should include:

- a monitoring system designed to measure indicators of the performance of marine spatial management measures;
- information on the performance of marine spatial management measures that will be used for evaluation;
- periodic reports to decision makers, stakeholders, and the public about the performance of the marine spatial management plan.

Maritime Authorities Contributions and Work

Monitoring for periodic reports: identify costs, benefits, improvements generated by activities in compliance with the MSP.

Monitoring of reported incidents and effectiveness of mitigating measures.

Step 10 – Adapt the spatial management process

All information gained during the entire implementation of the MSP should be used to amend the existing plan to ensure continuous improvement of the plan. When necessary, step 2 is revisited for additional financial support.

Outputs should include:

- proposals for adapting management goals, objectives, outcomes and strategies for the next round of planning;
- identification of applied research needs.

Maritime Authorities Contributions and Work

Use monitoring stage analysis and identify the new needs for future improvement.

4 MARITIME SPATIAL DATA INFRASTRUCTURE TOGETHER WITH GEOGRAPHICAL INFORMATION SYSTEMS

Good decisions require good data. This is particularly true in potentially contentious situations. Information from non-official sources, or not validated by the proper authority, can be useful and should not be ignored. However, it is essential that all information necessary for proper decision making is available in a useable format and with a known quality.

A Maritime Spatial Data Infrastructure (MSDI) is a very helpful asset in providing all data necessary for the MSP. It ensures that maritime authorities are able to easily collect appropriate marine geographic data which can be brought together and shared between the marine and maritime agencies.

One of the best ways to manage, analyse and display geographic data is through a Geographical Information System (GIS). A GIS integrates hardware, software, and data, and can capture the three-dimensional aspects of marine data as well as temporal aspects, such as how oceanographic processes or human activities change throughout the year. Also, in trans-boundary MSP, which usually engages a large amount of geographic information, a GIS can be a powerful tool in the management and treatment of this information. It allows exchange of information within and between countries and provides the means for the combination of information layers and visualisation of possible spatial conflicts. A GIS can, therefore, be the basis for a common



system of information in a spatial planning process, representing the spatial extent, time and frequency of maritime activities, as well as the distribution and conditions.

The MSP authority probably uses a GIS to support the planning process. The maritime or AtoN authority has an important role to identify and determine the contents of its GIS with a view towards having the data and capabilities to support and aid the MSP process. The IALA guidance on the use of Geographic Information Systems (GIS) by Aids to Navigation (AtoN) Authorities provides useful information. The MSP authority may make its data accessible to all parties involved through a web service, thus assuring that everyone has the same input.

4.1 DATA REQUIREMENTS

In general, spatial data should always be accompanied by the following metadata:

- data owner, responsible body;
- source of the data;
- date of validity / last update;
- quality of data (reliability, accuracy);
- geographic projection or coordinate system, chart datum.

When exchanging data with organisations, departments or other bodies nationally or internationally, the metadata highlighted above is essential to ensure that all stakeholders use the same starting point for their analyses and planning.

In 2007, the EU approved Directive 2007/2/EC, to provide for an Infrastructure for Spatial Information in the European Community (INSPIRE) to establish ‘an infrastructure for spatial information in Europe to support Community environmental policies, and policies or activities which may have an impact on the environment.’ It provides a harmonised means of describing various spatial elements needed by other policies and initiatives. One of the areas covered by the INSPIRE Directive is Transport links, including the maritime domain.

Geographical information that aligns with standards contained in the IHO’s developing S-100 Geospatial Information Registry will be increasingly helpful for Marine Spatial Planning, noting that IALA is working on two S-100 domains, VTS and AtoN.

4.2 CONTENT OF A GIS

The GIS should comprise layers for all relevant uses or functions in the planned area. The relevant maritime authority must determine the minimum navigational data that should be portrayed in a GIS.

A checklist of possible relevant data is provided in ANNEX C. As the MSP also addresses the future, it is important to include expectations or scenarios for the developments in seaborne transport and ship traffic. Additional traffic for construction and maintenance of offshore installations should also be considered.

4.3 ANALYSES SUPPORTED BY GIS

When all necessary data has been incorporated in a GIS, analyses may be carried out to reveal possible conflicts between area uses. Examples include:

- distance between wind farm areas and shipping routes (from AIS data);
- probability of ship collisions (produced using risk model);
- oil spill probability vs. ecological sensitivity.

In addition, the GIS supports in the evaluation of effectiveness of mitigating measures under consideration.

5 RISK MANAGEMENT

Within the context of this Guideline, 'Risk Management' refers to the strategic risk management connected to policy making and planning processes. In IALA guidance on risk management, the (maritime) risk management process is described in depth based on the break down as defined in Figure 2. In this guidance the aspects particularly relevant to MSP will be highlighted.

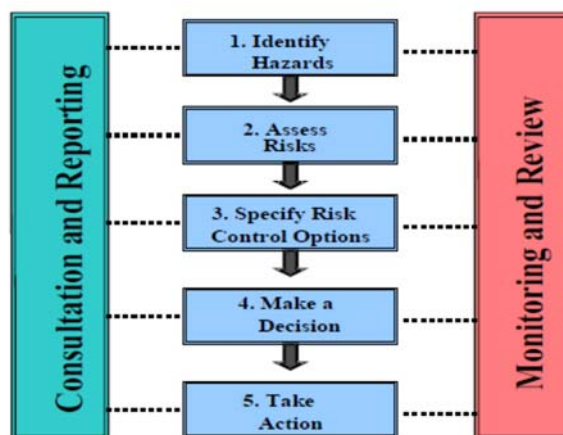


Figure 2 Risk Management process scheme, from [Guideline on risk management]

The risk assessment for a Spatial Plan should take into account all hazards that can be identified in this planning phase. Existing use and granted permits determine the starting point and possibly impose boundary conditions. Risk control options at this stage are on the Spatial Plan level. In general, development of structures must not impair the safe usage of Traffic Separation Schemes, Inshore Traffic Zones, recognised sea-lanes, approaches and safe access to anchorages, harbours and places of refuge.

As detailed plans, for example of OREI, are submitted, a more detailed risk assessment must be made for each initiative and may give rise to risk control measures at a more local level.

The risk assessment for offshore facilities, e.g. OREI, starts in the project phase which, through the location, design and layout of the facility, aims to reduce the safety risks as much as technically possible and economically viable. The PIANC report on Interaction between offshore wind farms and maritime navigation, which details the risks pertaining to wind farms specifically and provides guidance for design, may be of great help in this process.

The initial risk assessment is an overall assessment based on the present knowledge of the project and of the maritime environment (including vessel movements and future scenarios) or taking into account worst-case scenarios for the detailed lay-out. It is essential that the risk assessment is updated as the detail of the project is further developed.

5.1 RISK ASSESSMENT

The assessment of the risk of major hazards should be in accordance with IALA guidance on Risk Management and follow recognised methods for risk assessment e.g. the IALA risk management toolbox or the IMO adopted Formal Safety Assessment methodology (FSA). Coastal States are obliged to provide Aids to Navigation in accordance with the volume of traffic and the degree of risk.

A structured and systematic risk assessment methodology such as PAWSA (which is part of IALA's Risk Management Toolbox, see IALA guidance on risk assessment) or FSA can be used to assist:

- in the identification of risks introduced by the facility;
- in the evaluation of new measures for maritime safety and protection of the marine environment;



- in making a comparison between existing and possibly improved measures, with a view to achieve a balance between the various technical and operational issues, including the human element;
- in making a comparison between maritime safety or the protection of the marine environment and costs.

0 presents a list of spatial demands of other functions and some specific risks that may arise from the interaction between these functions and navigation. In the evaluation, attention should be paid to future scenarios of shipping (traffic density, routes, technological developments such as autonomous vehicles, etc.), effects of climate change, demographical developments, etc.

5.2 RISK ACCEPTANCE

When deciding on the acceptability of risks, it is useful to distinguish between different types of risk, by means of the nature of the consequences involved.

5.2.1 RISKS TO PEOPLE

The safety of people not involved in the process or activity that causes the risk (Third Party Risk) is expressed in individual risk and societal risk. A MSP usually addresses sea areas with no human inhabitants and a low density of people passing by. Hence, both the societal and individual risk levels usually are very low. Nevertheless, the safety of maritime traffic can be affected which also has consequences for people.

5.2.2 RISKS TO THE ENVIRONMENT

The risks to the environment have to be studied and, dependent on the case, a thorough Environmental Impact Assessment may have to be carried out. Typical environmental effects are emission of noise, light and possibly harmful substances. The entire lifecycle of an installation, including decommissioning should be regarded. Also, altering shipping routes could have an impact on the environment (e.g. carbon emission).

5.2.3 RISKS TO PROPERTY AND ASSETS

In addition to the monetary value and inconvenience of the potential loss, the value that stakeholders would pay for this loss and the value that stakeholders would gain from the intended facilities, should be taken into consideration.

5.2.4 RISKS TO BUSINESS

The potential risks to business and loss of reputation of ports and harbours (lower numbers of vessels visiting due to increased risk) which may be subjected to the negative effect of the intended facilities, should be taken into consideration. On the other hand some business may also benefit from the intended facilities, such as fish breeding within wind farm areas.

5.3 RISK MITIGATION

Risk should be mitigated by a balanced approach, ensuring that the MSP process makes adequate provision for all related activities required. In Step 9 of the process described in section 3, the effectiveness of measures in place is evaluated, aiming at adjustment of the measures but also contributing to future projects.

On a case-by-case basis, national Competent Authorities may consider:

- establishing approved IMO routing measures, e.g.:
 - TSS;
 - traffic lanes and other routing measures;
 - Exclusion or Safety Zones and Areas to be Avoided;
 - separation areas, in order to prohibit or restrict vessels from entering or leaving areas of offshore structures;



- establishing additional or repositioning existing AtoN;
- establishing or extending VTS.

Offshore structures should be adequately marked in accordance with IALA guidance on the Marking of Man-made Offshore Structures. In some cases, the offshore structures may be used to accommodate radar scanners or VHF relay stations to improve VTS coverage. Potentially, VTS outside national territories may contribute to safety of navigation in international waters populated with offshore installations.

6 DEFINITIONS

The definitions of terms used in this IALA Guideline can be found in the International Dictionary of Marine Aids to Navigation (IALA Dictionary) and were checked as correct at the time of going to print. Where conflict arises, the IALA Dictionary should be considered as the authoritative source of definitions used in IALA documents.

7 ACRONYMS

AIS	Automatic Identification System
AMSIS	Australian Maritime Spatial Information System
ARM	Aids to Navigation Requirements and Management Committee (IALA)
AtoN	Aid(s) to Navigation
DfT	Department for Transport (UK)
DG	Directorate General (EC)
DTI	Department of Trade and Industry (UK)
DW	Deep Water (route)
EC	European Commission
EEZ	Exclusive Economic Zone (Defined in UNCLOS)
EU	European Union
FPSO	Floating Production Storage Offloading
FSA	Formal Safety Assessment
GIS	Geographic Information System
GMDSS	Global Maritime Distress and Safety System
GOC	Global Ocean Commission
GPSR	General Provisions on Ship's Routeing (IMO)
HFO	Heavy Fuel Oil
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities - AISM
IAW	in accordance with
IHO	International Hydrographic Organization
IMO	International Maritime Organization
IPPC	Integrated Pollution Prevention and Control
MBS	IALA Maritime Buoyage System
MCA	Maritime and Coastguard Agency (UK)
MGN	Marine Guidance Note(s) (UK)
MPA	Marine Protected Area(s)
MSDI	Maritime Spatial Data Infrastructure
MSI	Maritime Safety Information



MSP	Marine/Maritime Spatial Planning - not to be confused with Maritime Services Portfolio (as used in e-Navigation)
N/A	Not applicable
NM	nautical mile
OREI	Offshore Renewable Energy Installation
PAWSA	Ports and Waterways Safety Assessment (IALA)
PIANC	The World Association for Waterborne Transport Infrastructure
PNT	Position, Navigation and Timing
RoRo	Roll-on/roll-off
SAR	Search and Rescue
S-100	Geospatial Information Registry (IHO)
TPEA	Trans boundary Planning in the European Atlantic
TSS	Traffic Separation Scheme (IMO)
UK	United Kingdom
UKC	Under Keel Clearance
UNCLOS	The United Nations Convention on the Law of the Sea
UNESCO	United Nations Educational Scientific and Cultural Organization
VHF	Very High Frequency (30 MHz to 300 MHz)
VTS	Vessel Traffic Services
WG	Working Group
WOC	World Ocean Council

8 REFERENCES

The following table lists some guidance documents recommended for review to support MSP development efforts or subtopics like the acceptable distance between wind farms and shipping routes.

	Document title	Purpose
[1]	Marine Spatial Planning, a step-by-step approach toward Ecosystem-based planning, UNESCO 2009	Aimed primarily at those responsible for the spatial planning and management of marine areas
[2]	The Shipping Industry and Marine Spatial Planning – a professional approach, The Nautical Institute 2013	Aimed at mariners and maritime professionals who should play a role in MSP, and MSP professionals that want to better understand maritime stakeholders' requirements.
[3]	Marine Planning Handbook, National Ocean Council 2013	Provide information and guidance to regions that choose to establish regional planning bodies and develop marine (spatial) plans.
[4]	Directive 2014/89/EU	Establishing a framework for marine spatial planning
[5]	Interaction Between Offshore Wind Farms And Maritime Navigation, PIANC 2016 MarCom WG 161.	The final report of the WG will provide an approach, guidelines and recommendations to assess the required manoeuvring space in the vicinity of offshore windfarms and the minimal distance between shipping lanes and sea areas far offshore windfarms, in order to ensure a minimal risk level for navigation.
[6]	Offshore Renewable Energy Installations Guidance on UK Navigational Practice, Safety and Emergency Response Issues (MGN 543), MCA 2016	Highlights issues that need to be taken into consideration when assessing the impact on navigational safety and emergency response caused by offshore renewable energy installation developments. Includes a 'shipping route' template.



	Document title	Purpose
[7]	Offshore Renewable Energy Installations Guidance to Mariners Operating In The Vicinity Of UK Wind Farms (MGN 372), MCA 2005	Highlights issues that need to be taken into account when planning and undertaking voyages in the vicinity of offshore renewable energy installations.
[8]	Guidance On The Assessment Of The Impact Of Offshore Wind Farms, Methodology for Assessing the Marine Navigational Risks of Offshore Wind Farms, DTI 2005	Makes recommendations on how to conduct a Risk Assessment for an offshore wind farm development



ANNEX

TO

IALA GUIDELINE G1121

ON

**NAVIGATIONAL SAFETY WITHIN MARINE SPATIAL
PLANNING**



ANNEX A SPATIAL DEMANDS

Whereas the existing guidelines and directives stress the need to incorporate all uses and functions in the planning and management of the sea area, it is useful to have a basic understanding of the specific spatial requirements for those functions. The following is a starter partly derived from the 2013 MSP workshop. In some cases, co-use is possible, but there may also be specific risks involved.

Table 1 *Specific spatial requirements*

Function	Spatial demands	Considerations	Relation with shipping	Specific risks involved
Shipping	Fairways, Routes, TSS Ports, anchorage area. Pilot de- and embarkation areas.	Safety distances; harmonisation between adjacent countries. Planning phase design guidelines. Vessel traffic monitoring and planning. Refuge harbours. Ice and weather.	N/A	
Commercial Fishing	Fishing areas, variable in time Access to fishing areas and landing harbours		Avoid fishing activities in fairways, routes and TSS.	Level of attention hampered by fatigue and fishing activities
Aquaculture	Fish farming. Mussel and oyster farming, etc. Seaweed farming		Area co-use usually not possible. Aquaculture will be deployed of safety distance from fairways, routes and TSS. Marking of aquaculture IAW IALA recommendation O-139.	Drifting off-station Visibility for submarines:(sonar on corners)
Recreation and tourism	Routes for recreational craft; areas for regattas. Fishing, Diving. Kitesurfing areas etc.	Touristic attractiveness of objects or activities		



Function	Spatial demands	Considerations	Relation with shipping	Specific risks involved
Environment	Marine Protected Areas (MPA) Natura 2000	The EU Marine Directive 2008	Environmental risk studies Access to MPA for maintenance of AtoN	Outflow of bunker or cargo oil
Energy	Renewable energy areas (wind, wave, tidal generators). Test sites for OREI. Oil and gas platforms	Construction & Maintenance traffic, helicopter landing areas The energy sector's use of the sea involves both the production and transfer of energy Facilities of energy production (cables, pipelines, offshore constructions). National interests in relation to other coastal states	(limited) co-use may be considered Safety distance to fairways, routes, TSS and marking of offshore facilities IAW. IMO GPSR and IALA O-139 Consider to establish a safety zone of (max) 500 meters ² around offshore constructions (e.g. oil and gas platforms) IAW UNCLOS	Damage to ship, structure and environment after allision Floating blade of damaged turbine Aviation lights Marking of abandoned structures UKC over subsea structures Visibility of floating and subsea structures
Radio communication, radar etc.	Navigation, VTS, Meteorological, airport and military radars VTS and MSI communication, VHF and AIS, etc.	Especially wind farms may interfere with radio and radar signals. Safety of navigation, SAR, VTS may be affected		
Cultural history	Ship wrecks (with historical value) The seabed is home to a cultural heritage that tells a story covering everything from shipping to the fishing industry		Marking of wrecks close to fairways, routes and TSS IAW IALA MBS	

² Note that the "safety zone" addressed here refers to a zone that is prohibited for all traffic, not the distance between a shipping route or TSS and a structure.



Function	Spatial demands	Considerations	Relation with shipping	Specific risks involved
Defence	Military restricted areas. Military exercise areas		Avoid waterways close to military areas Co-ordination of military exercises and operations close to waterways	
Extraction and storage of materials	Mining of geological resources. Carbon capture and storage		Co-use may be possible Marking by AtoN of designated area IAW IALA Recommendations	



ANNEX B LINKS TO RELEVANT SOURCES

GOC (Global Ocean Commission)

The Global Ocean Commission, an independent body of international leaders based at Somerville College (Oxford, UK) with the aim of reversing the degradation of the ocean.

<http://www.globaloceancommission.org>.

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Guideline on Risk Management

Guideline on the use of Geographic Information Systems (GIS) by Aids to Navigation (AtoN) Authorities

Recommendation on the Marking of Man-Made Offshore Structures

IHO (International Hydrographic Organization)

The International Hydrographic Organization is an intergovernmental consultative and technical organization that was established in 1921 to support safety of navigation and the protection of the marine environment.

IMO (International Maritime Organization)

IMO Maritime Knowledge Centre (2012) – International Shipping Facts and Figures – Information Resources on Trade, Safety, Security, Environment.

(United Nations Conference on Trade and Development (2012). Review of Maritime Transport (2012)).

<http://www.imo.org/en/KnowledgeCentre/ShipsAndShippingFactsAndFigures/Statisticalresources>

Amendment to the General Provisions on Ships' Routing (resolution A.572(14)) on establishing multiple structures at sea

Assessment Framework for Defining Safe Distances between Shipping Lanes and Offshore Wind Farms

UNESCO (United Nations Educational Scientific and Cultural Organisation)

'MSP a step-by-step approach'

<http://www.unesco-ioc-marinesp.be/goto.php?id=ac1dd209cbcc5e5d1c6e28598e8cbbe8&type=docs>

more documentation and example cases for each MSP step can be found on <http://www.unesco-ioc-marinesp.be/>

PIANC (the World Organisation for Waterborne Transport Infrastructure)

PIANC, a non-profit and non-political organisation, is the forum where professionals around the world join forces to provide expert advice on cost-effective, reliable and sustainable infrastructures to facilitate the growth of waterborne transport.

PIANC Working Group WG161 report on 'Interaction between offshore wind farms and navigation' (to be published). This report details the design principles to assess safe distances between shipping routes and wind farms with respect to collision risk, radar interference, etc.

The Nautical Institute

The Nautical Institute is an international representative body for maritime professionals involved in the control of sea-going ships.

Marine Spatial Planning

<http://www.nautinst.org/download.cfm?docid=9423102B-A083-4C8D-94B6BB215544BB42>



WOC (World Ocean Council)

The World Ocean Council brings together the multi-sectoral ocean business community to catalyze global leadership and collaboration in ocean sustainability and 'Corporate Ocean Responsibility' – see <http://www.oceancouncil.org>

EU

Policy documents

- the EU Integrated Maritime Policy;

The Integrated Maritime Policy seeks to provide a more coherent approach to maritime issues, with increased coordination between different policy areas. It focuses on:

- issues that do not fall under a single sector-based policy e.g. 'blue growth' (economic growth based on different maritime sectors);
- issues that require the co-ordination of different sectors and actors e.g. marine knowledge;

Specifically, it covers these cross-cutting policies;

- blue growth;
- marine data and knowledge;
- maritime spatial planning;
- integrated maritime surveillance;
- sea basin strategies;
- http://ec.europa.eu/maritimeaffairs/policy/index_en.htm.

- the EU MSP Directive 2014

DIRECTIVE 2014/89/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 23 July 2014 - establishing a framework for maritime spatial planning

<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0089&from=EN>

Projects

- SEANERGY 2020

A comprehensive overview of the laws, conventions and agreements that influence MSP in Europe is given by the EU project Seanergy 2020. This was an EU funded project – Intelligent Energy Europe programme – and ran from May 2010 to April 2012. It was coordinated by the European Wind Energy Association.

The project provided an in-depth analysis of the national and international Maritime Spatial Planning (MSP) practices, policy recommendations for developing existing and potentially new MSP for the development of offshore renewable power generation, and promoted acceptance of the results. The international instruments are distinguished from EU and regional instruments in the report. The perspective of the report is that of an OREI developer.

<http://www.seanergy2020.eu/publications-and-results/national-maritime-spatial-planning-regimes-wp2/>

- Trans boundary Planning in the European Atlantic (TPEA)

TPEA Good Practice Guide. Liverpool: University of Liverpool Almodovar, M. et al., 2014.



Lessons for Cross- Border MSP. This good practice guide is the outcome of a project co-funded by the European Commission (DG Mare), TPEA, which ran from December 2012 to May 2014. The aim of the project was to demonstrate approaches to trans boundary maritime spatial planning in the European Atlantic region.

http://www.tpeamaritime.eu/wp/wp-content/uploads/2014/11/TPEA_bestpract_34_download.pdf.

National sources

- marine planning portal;
(UK) A consultative tool for viewing and commenting upon information for MSP
<http://www.4coffshore.com/offshorewind/>.
- Australian Maritime Spatial Information System – AMSIS
<http://www.ga.gov.au/marine/jurisdiction/amsis.html>;
- UK Maritime and Coastguard Agency (MCA)
 - The Shipping Template;
See MGN 371 Offshore renewable energy installations
<http://webarchive.nationalarchives.gov.uk/20140609050314/https://www.gov.uk/government/publications/mgn-371-offshore-renewable-energy-installations-oreis>.
 - Draft interim guidance for mariners operating in the vicinity of wind farms
http://webarchive.nationalarchives.gov.uk/20080613013029/http://www.redesigngroup.org/draft_interim_guidance.pdf;
 - Guidance on the assessment of the impact of offshore wind farms - DTI / MCA / DfT / BMT
http://webarchive.nationalarchives.gov.uk/20130605183043/http://www.dft.gov.uk/mca/mcga07-home/shipsandcargoes/mcga-shipsregsandguidance/mcga-windfarms/offshore-renewable_energy_installations/guidance-on_the_assessment_of_the_impact_of_offshore_wind_farms.htm.
- Geoportal and links for MSP in Norway
<http://kart.kystverket.no/>;
- Geoportal and links for MSP in Denmark
<http://kort.msdi.dk/>.
- Geoportal and links for MSP in France;
Ministry of ecology, sustainability and energy
<http://www.geolittoral.equipement.gouv.fr>.
- National Ocean Council.
Marine Planning Handbook
http://www.whitehouse.gov/sites/default/files/final_marine_planning_handbook.pdf.



ANNEX C CATEGORISATION OF GIS LAYERS FOR MSP

The purpose of this annex is to provide a starting list of GIS thematic layers that may be useful in spatial planning, primarily from a navigational perspective.

Basic area definition:

- legally relevant areas: Borderlines, 12 NM zones, EEZ, continental shelf;
- bathymetry;
- ports;
- TSS, DW routes.

Vessel traffic

- traffic density:
 - projected on a route network, number of passages / year;
 - differentiating ship types and sizes;
 - AIS data;
 - density of non-route committed traffic;
 - expected density in 10-20 year;
 - traffic for construction and maintenance;
 - anchoring areas, grade of utilisation, expected developments.
- transport flows:
 - transport routes of crude and HFO, quantity/year;
 - ferry and RoRo lines (frequency, number of pax).
- traffic services
 - VTS area;
 - GMDSS coverage
 - pilot embarkation/debarkation areas;
 - resilient PNT (coverage, accuracy);
 - fishing areas and access routes.

Offshore infrastructure

- oil and gas
 - platforms – existing, planned, decommissioning date;
 - FPSO;
 - safety areas;
 - helicopter clearance areas;
 - pipelines.
- wind energy



- wind farms, positions of individual turbines;
- base stations;
- cables.
- wave energy;
- tidal energy;
- aquaculture.

Ecology

- Marine Protected Areas;
- Natura2000 areas;
- ecological sensitive areas.

Other

Examples include:

- (historical) ship wrecks;
- military exercise areas.