FIVE ESTUARIES OFFSHORE WIND FARM

10.17 APPLICANT'S RESPONSE TO ACTION POINTS

Application Reference:	EN010115
Document Number:	10.17
Revision:	A
Pursuant to:	Deadline 1
EcoDoc Number:	005396979-01
Date:	October 2024

Revision	Date	Status/Reason for Issue	Originator	Checked	Approved
A	Oct-24	Deadline 1	VEOWF	VEOWF	VEOWF

CONTENTS

1 FIRST ROUND OF HEARINGS

1.1 COMPULSORY ACQUISITION HEARING 1 (CAH1)

No.	Description	Deadline	Response
1	Amend the Land Plans [APP-008] to make it expressly clear that the land currently shaded blue is proposed to be the subject of powers seeking both Temporary Possession and Acquisition of Rights powers.	D2	The Applicant has submitted 2.3 Land Plans – Onshore – Revision B at Deadline 1 to address this point.
2	Undertake a review of the Land Plans [APP-008], Book of Reference (BoR) [APP-026], Statement of Reasons (SoR) [APP-030] and draft Development Consent Order (dDCO) [APP-024] to ensure that the depiction of Permanent Rights Acquisition and Temporary Possession powers shown on the Land Plans is consistent with all of the references to Permanent Rights Acquisition and Temporary Possession stated in the BoR, SoR and dDCO.	D2	This review has been carried out. Minor revisions have been made to the SoR and dDCO as submitted at deadline 1.
3	Provide a clarification for what is stated in paragraph 5.3.3 of the SoR [APP-030].	D2	The Applicant has submitted 4.3 Statement of Reasons - Revision B at Deadline 1 to address this point.
4	Submit an estimate of the onshore landtake for the proposed Five Estuaries Offshore Wind Farm as a standalone development (ie excluding North Falls from the scheme world).	D2	The Applicant will respond to this at Deadline 2.
5	Submission of a Technical Note relating to the onshore Temporary Possession powers sought. This Technical Note should include: > An explanation of the expected sequencing arrangements for undertaking the proposed onshore works (ie whether from one end to	D2	The Applicant will provide this technical note at Deadline 2.

No.	Description	Deadline	Response
	the other end of the cable corridor, a discrete sectional basis or some other basis); and > An estimate of the typical duration for the Temporary Possession required to undertake trenching, duct installation and cable pulling works by reference to an appropriate linear distance.		
6	Submission of a Technical Note explaining the technical/engineering parameters (by reference to any relevant regulations or guidance) for the proposed onshore cable corridor and the substations. This note should include: > any geometry limitations for installing cables; > an explanation for why the proposed Five Estuaries and North Falls projects would each need two cable trenches with three power cables per trench (as shown in the Coordination Document [APP-263]) and why cable sharing would not be possible (ie what would determine the number of cables and their layout); > an explanation for why cable pulling for the proposed Five Estuaries and North Falls projects would need to be undertaken separately as opposed to a single work; > an explanation for why the proposed Five Estuaries and North Falls projects would each need their own onshore substations and/or why a single substation site could not be shared; > an explanation of any difference in technical requirements for the Five Estuaries and North Falls projects, as alluded to but not explained in	D2	The Applicant will provide this technical note at Deadline 2.

No.	Description	Deadline	Response
	the second bullet point in paragraph 3.2.10 of the Coordination Document [APP-263]; and > an explanation for why a third onshore National Grid Electricity Transmission substation would be required to serve the proposed wind farms.		
7	Submission of a Technical Note explaining the process for connecting the proposed substation for Five Estuaries to National Grid Electricity Transmission's proposed East Anglia Connection Node substation (EACN). This note should explain: > which project would be responsible for undertaking the works within the EACN site to connect Five Estuaries to EACN and why that would be the case; and > the expected sequencing for undertaking the works necessary to physically connect Five Estuaries to the proposed EACN relative to the wider construction of the EACN.	D2	The Applicant will provide this technical note at Deadline 2.

1.2 ISSUE SPECIFIC HEARING 1 (ISH1) – ENVIRONMENTAL MATTERS

No.	Description	Deadline	Applicant response
1	Submission of copies of the speaking notes for the summaries provided for each Agenda Item.	D1	The Applicant has included these with the 10.16 Applicant's Summaries of Oral Submission, submitted at Deadline 1.
2	Submission of an update setting out whether it has engaged with NatureScot	D1	The Applicant has not engaged with NatureScot to date. NatureScot were not identified as a statutory consultee under Schedule 1 of The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (the 'APFP Regulations') for Section 42 consultation and were not consulted by PINS on the scoping report. No Scottish sites were identified through the HRA screening as having potential for a likely significant effect, and therefore NatureScot were also not included in the consultation on the RIAA.
3	To advise at which Examination deadline an update will be provided relating to securing capacity at the Kittiwake compensatory nesting structure in Gateshead	D1	The Applicant will provide an update to the Outline Kittiwake Implementation and Monitoring Plan (KIMP) [APP-053] at Deadline 2 which will include any progress on securing the capacity at the Gateshead nesting structure. The Applicant has recently had a productive meeting with Dogger Bank South regarding this topic and expects progress to be made over the course of the Examination.
4	Submission of a technical note explaining how the Maximum Design Scenario (MDS) has been determined in the Environmental Statement (offshore) for: > Cable crossings > Sediment deposition	D2	The Applicant will provide this technical note at Deadline 2.

No.	Description	Deadline	Applicant response
	> Construction impacts on seabed morphology > Boulder clearance and Pre Lay Grapnel Run > Fluidized material (50% assumption).		
5	Submission of a technical note explaining the nature of the decommissioning activities and the justification for assuming that the noise created during decommissioning would be similar to construction	D2	The Applicant will provide this technical note at Deadline 2.
6	Provide values for the number of vessels using the Sunk Traffic Separation Scheme East.	D1	The Applicant notes that the main commercial routes presented in Section 11 of the Navigational Risk Assessment (NRA) [APP-240] were identified based on long-term vessel traffic dataset, winter and summer 2022 vessel traffic survey data, and consultation (full details of these datasets is provided in Section 5.1 of the NRA [APP-240]. From a review of the main commercial routes which utilise the Sunk TSS East, the breakdown of traffic volumes is provided in the table 3.1.

<table>
<tr><th>No.</th><th>Description</th><th>Deadline</th><th>Applicant response</th></tr>
<tr><td></td><td></td><td></td><td>Table 3.1: Breakdown of Sunk TSS East traffic volumes

<table><tr><th>TSS Lane</th><th>Average vessels per day</th></tr><tr><td>Eastbound</td><td>5-6</td></tr><tr><td>Westbound</td><td>3</td></tr><tr><td>Total</td><td>8-9</td></tr></table>
In summary, an average of between eight and nine vessels per day utilise the Sunk TSS East.</td></tr>
<tr><td>7</td><td>Provide update figure 9.5 in Volume 2, Chapter 9: Shipping and Navigation [APP-078] to clarify the north and south routes of route 4 (4a and 4b).</td><td>D1</td><td>The ExA sought clarity on the nature of Route 4 as identified in Figure 11.2 of the NRA [APP-270] noting that in the following Table 11.1, this route is described as Route 4a and Route 4b. The Applicant has created an updated version of the described figure which identifies the two variants of Route 4 as they are described in Table 11.1 of the NRA [APP-270]. This is presented in Figure 6.1 in Appendix 1.

The information provided in Table 11.1 of the NRA [APP-270] remains valid; in particular, Route 4a operates in both the northbound and southbound directions and Route 4b operates in the southbound direction only. This is further evidenced by the routes’ respective approaches to/from the Off North Hinder TSS (see Section 2.6), with Route 4a separating to utilise both lanes of the TSS and Route 4b utilising only the southbound lane.</td></tr>
</table>

No.	Description	Deadline	Applicant response
8	Provide a technical note on the background to the COLLRISK modelling.	D1	The Applicant notes that quantitative risk assessment within the NRA [APP-270] was primarily undertaken using Anatec's COLLRISK modelling suite. The COLLRISK modelling suite incorporates the following models: > Vessel to vessel collision; > Vessel to structure powered allision; and > Vessel to structure drifting allision. The COLLRISK software conforms to the Maritime and Coastguard Agency's (MCA) Methodology for Assessing Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI) (MCA, 2021). In particular, Annex D3 of the guidance document sets out how developers must demonstrate that assessment techniques are suitable for application purposes including through: > Tuning of parameters; > Consistency checks; > Behavioural reasonableness; > Sensitivity analysis; and > Comparison with the real world. The COLLRISK software is used worldwide for assessing risk associated with offshore structures including offshore wind farms (OWF), oil and gas installations, and drilling rigs, and has been utilised for various consented OWF applications within UK waters. On this basis it is considered accepted by the MCA and other key stakeholders as a suitable means by which to

No.	Description	Deadline	Applicant response
			quantitatively assess collision and allision risks to vessel traffic due to the presence of OWFs.
9	Provide the third party documents referenced in Section 17 of the NRA [APP–240], ie the MARIN study, PIANC guidance, MGN 654 and COLREGs	D1	The Applicant acknowledges that guidance provided in several third-party documents is applied to support the navigation corridor safety case between the northern array area and the East Anglia Two OWF. These documents have been included in Appendix 5. A summary of how guidance documents have been applied to support the navigation corridor safety case is set out in Appendix 2.
10	Submission of an updated version of the outline Navigation Installation Plan addressing points raised on managing interactions between vessels	D2	The Navigation Installation Plan (NIP) [APP-252] is being revised at the time of writing based on ongoing consultation with relevant stakeholders including the Port of London Authority (PLA), Harwich Haven Authority (HHA), and Sunk Vessel traffic Services (VTS). This includes a workshop being held in London on 4th October 2024. The Applicant intends to submit a revised NIP into the Examination at Deadline 2.
11	Provide a plan showing all routeing related navigational features, including pilot boarding stages and anchorages, and their relationship to one another and the proposed offshore development.	D2	The ExA requested a plan is produced showing all routeing related navigational features and their respective relationships. This request was also included in the ExA's draft written questions (dWQ1) [PD-008] as question NS.1.01. The Applicant has prepared two figures to address this request, each of which shows the offshore Order Limits in the context of routeing related navigational features which are shown on

No.	Description	Deadline	Applicant response
			United Kingdom Hydrographic Office (UKHO) Admiralty charts. These are presented below as follows in Appendix 3: > Figure 2.1 – full view with larger-scale features labelled and inset window included to provide context for Figure 2.3; and > Figure 2.2 – detailed view within and in proximity to the Sunk Inner Precautionary Area based on the inset window from Figure 2.2.
12	Advise at what stage of the project's development, specialist input on farming/ agricultural land use was first sought by the Applicant.	D1	The Applicant has set out further detail on specialist input on farming / agricultural land in Appendix 4.
13	Provide confirmation that a road safety audit brief has been sent to National Highways and Essex County Council Highways.	D1	The Applicant can confirm that the road safety audit brief for the Bentley Road / A120 Junction was sent to National Highways and Essex County Council on 1 October 2024.
14	Submit a note on Abnormal Indivisible Load (AIL) including: > Different categories of AIL > Where/how each category is considered in > Environmental Statement and controlled in > Construction Traffic Management Plan > Tracking and routing	D2*	The Applicant will provide this technical note at Deadline 2 or sooner if possible.

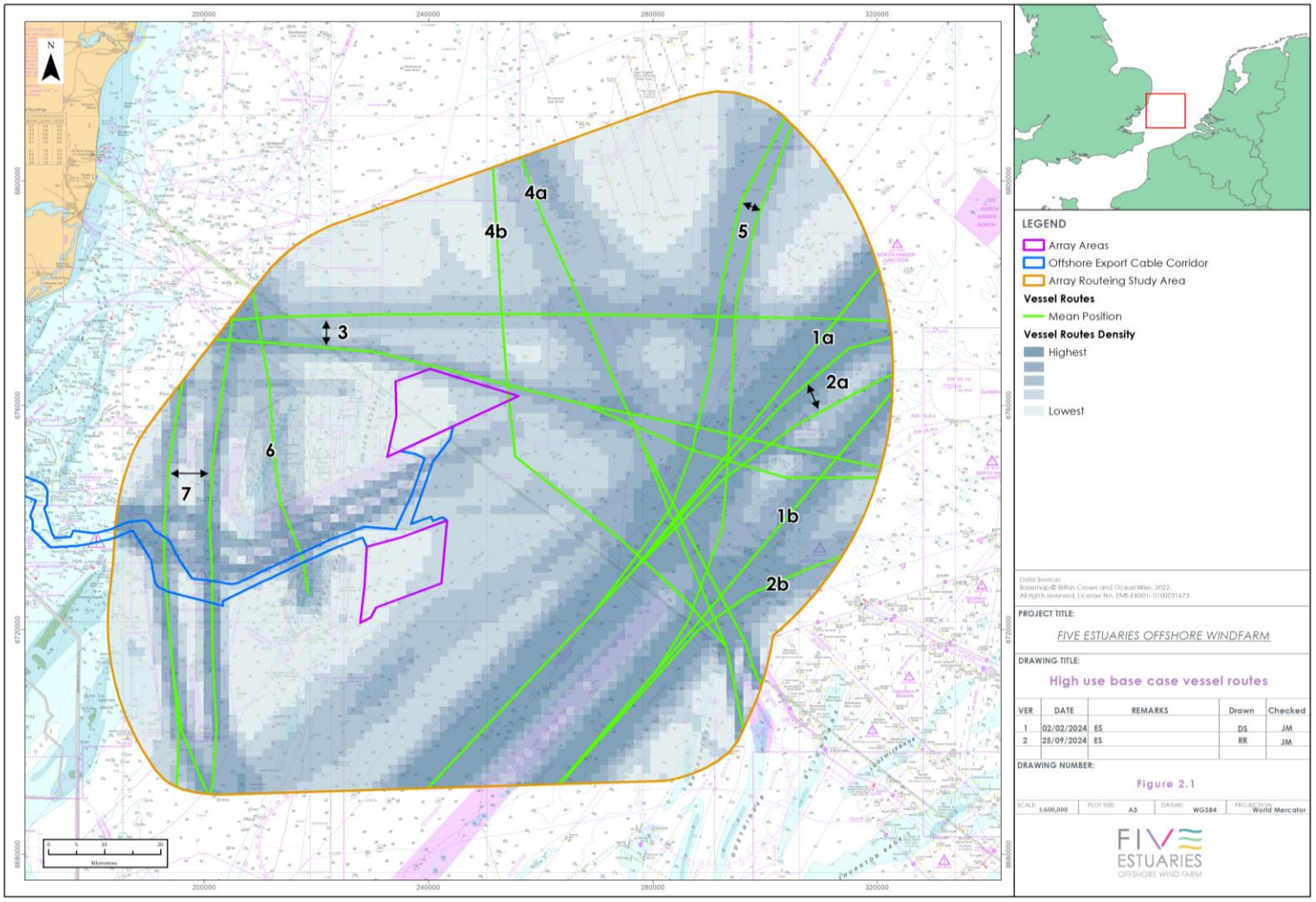
No.	Description	Deadline	Applicant response
	> AIL Assessment for Transformers **[but noting to be prioritised above other technical notes and shared with relevant authorities asap]*		

1.3 ISSUE SPECIFIC HEARING 2 (ISH2) - DCO

No.	Description	Deadline	Applicant response
1	Submission of an update to the draft Development Consent [APP-024].	D1	The Applicant has submitted 3.1 draft Development Consent Order – Revision B as part of Deadline 1.
2	Provide a full written justification for seven year time limits for: exercising Compulsory Acquisition powers (Article 22); and commencing the Proposed Development (Requirement 1 in Schedule 2)	D1	To avoid repetition the Applicant has set out its full case in its Summary of Oral Submissions (Document 10.16) at paragraphs 3.2.14 onwards and 3.2.23 onwards.
3	Reviewing the aftercare provisions included within the outline Landscape and Ecological Management Plan [AS-006]	D2	The Applicant is reviewing the aftercare provisions and will respond to this at Deadline 2.

APPENDIX 1: RESPONSE TO ISH1 ACTION POINT 7

Figure 1.1: High use base case vessel routes



APPENDIX 2: RESPONSE TO ISH1 ACTION POINT 9

The table below provides the application reference associated with each document and detail as to the particular text relevant to the navigation corridor safety case. These documents have been appended in Appendix 5.

Summary of guidance documents applied to support navigation corridor safety case

Guidance Document	Relevant Section(s) in NRA [APP-270]	Relevant Text in Guidance
Marine Guidance Note (MGN) 654 (MCA, 2021)	Section 17.4	Section 4.6(g)(i) discusses vessel overtaking. Section 4.6(g)(iii) discusses the 20-degree rule. Annex 2 provides the Shipping Route Template.
Interaction between Offshore Wind Farms and Maritime Navigation (World Association for Waterborne Transport Infrastructure (PIANC), 2018)	Section 17.5 / Section 17.6	Section 4.2.1 subheader 'COLREG 8 – Action to Avoid Collision' discusses round turns in the event of a head-on encounter between two vessels. Section 3.2.2 subheader 'GPSR 6.10' outlines the calculation of number of vessels side by side for a routeing measure based on the overall number of users, based on a study by Maritime Institute Netherlands (MARIN).
Convention on the International Regulations for Preventing Collisions at Sea (COLREGs) (International Maritime Organization (IMO), 1972/77)	Section 17.7	Rules 9a, 9b, and 9c relate to navigation within a narrow channel or fairway.

APPENDIX 3: RESPONSE TO ISH1 ACTION POINT 11

Figure 2.1: Routeing related navigational features in proximity to VE (full view)

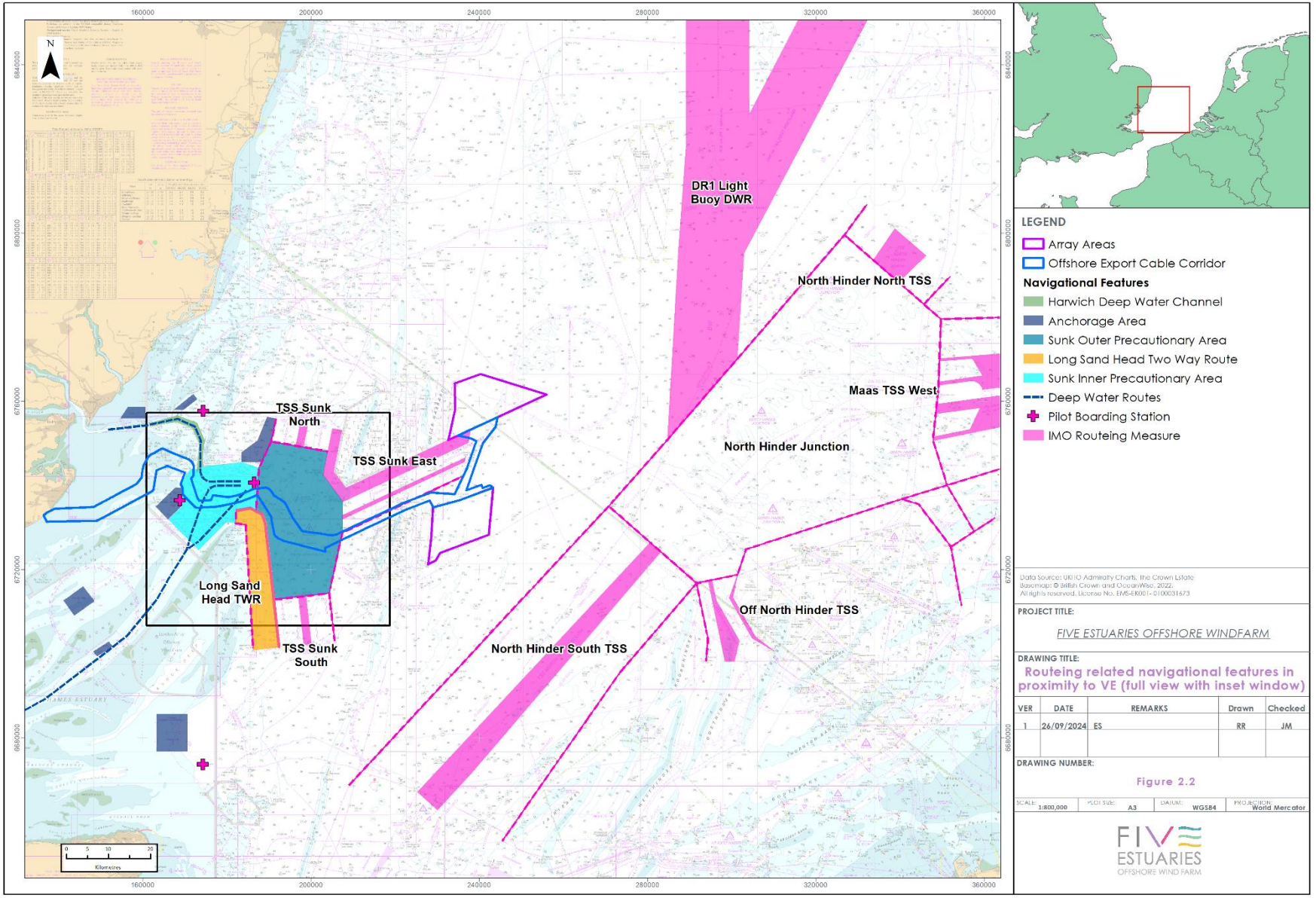
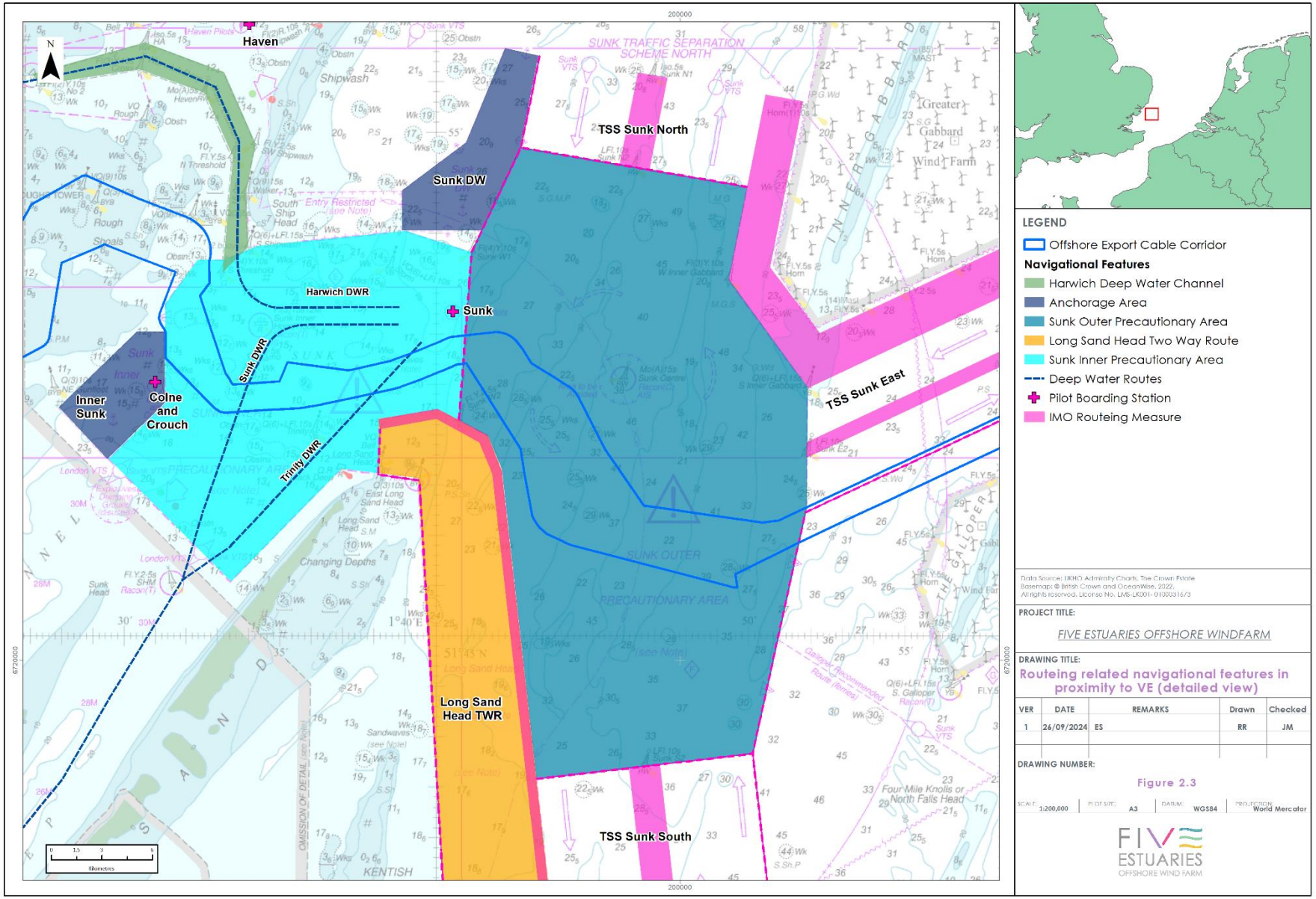


Figure 2.2: Routeing related navigational features in proximity to VE (detailed view)



APPENDIX 4: RESPONSE TO ISH1 ACTION POINT 12

Action Point: Advise at what stage of the project's development, specialist input on farming/ agricultural land use was first sought by the Applicant.

1.3.1 The importance of impacts on farming was recognised at the inception of the Five Estuaries Project, given the expected need to install onshore connection infrastructure through farm land.

1.3.2 Dalcour Maclaren was instructed to act as the land agent on behalf of the Applicant in 2019 to undertake land referencing and provide advice to the Applicant. Initial land referencing was carried out to ascertain land ownership of affected parties as potential route options and substation search areas were identified. After a hiatus, waiting for an updated National Grid connection point (see 6.1.4 Site Selection and Alternatives [APP-066]), the Project re-commenced in 2020. The Applicant, through its land agent, began liaising with landowners in November 2021. This work has supported the various stages of the site selection process – set out in 6.1.4 Site Selection and Alternatives [APP-066] .

1.3.3 The Applicant and North Falls Offshore Wind Farm agreed to engage with landowners jointly, offering joint face to face meetings with landowners for the wider route corridor from May 2022. This approach, as part of the wider coordination activities, sought to help reduce confusion for the landowners and reduce meeting fatigue. The purpose of these meetings was to introduce the Projects and answer any land interest queries, as well as to gather information on the types of business that operate throughout the route, proposed developments or any other obstacles from a lands perspective. In particular, landowners were asked questions about the following key topics:

- Drainage
- Irrigation
- Cropping and rotations
- Livestock
- Contracts held with suppliers
- Environmental subsidy schemes
- Development proposals for the land in question
- The impacts that the corridor and or cables would have on their day to day farming operations
- Any additional business / leisure uses such as shooting
- General feedback on the corridor.

1.3.4 Feedback gathered from these landowner meetings was fed back to the Applicant by the Applicant's agents in a 'landowner workshop' on the 7 September 2022, which was considered as part of the ongoing siting and routeing exercise and was held jointly with North Falls.

1.3.5 Further meetings were offered to all potentially affected landowners in February 2023 and further feedback was sought prior to the Five Estuaries statutory consultation in March 2023. The feedback from these meetings were then fed into a 'route change request workshop' on the 21 April 2023. Some examples of changes that were made to the project following feedback from landowners included.

- Removal of a Temporary Construction Compound option
- Realignment of cable route to allow more space between cable route and farm buildings where the landowner had plans to expand the farm in the future
- Commitment to HDDing under a landowner's land holding
- Realignment and removal of some O&M access routes
- Cable route refinement to avoid land that two landowners had plans to develop for alternative use.

1.3.6 Consideration of land use, ground conditions and landscape character (including farming practices) have been central to the design of the Project and have been considered throughout the different stages of the project development to date. From 2019, while the Project was in an early concept phase, Expert Topic Group (ETG) meetings were held with key statutory bodies (such as Environment Agency and Natural England) to discuss and agree the approach to surveys and assessments (see 5.2 Evidence Plan [APP-034]), this included the approach to land use, which included soils.

1.3.7 Further joint meetings with landowners were held towards the end of 2023 to continue engagement, share the refined project corridor, and encourage responses to Stage 3 Consultation [see 5.1 Consultation Report [APP-031]. This dialogue with landowners has continued with ongoing discussions and continued engagement on the Heads of Terms.

1.3.8 The Applicant used a number of consultants to support the development of the Project including through site selection. GoBe Consultants were appointed as the lead EIA consultant in 2019 with SLR Consulting as a subconsultant specialising in land use and ground conditions. The Applicant, with support from consultants, carried out a site selection process described in 6.1.4 Site Selection and Alternatives [APP-066], paragraph 4.12.20 sets out how the projects sought to balance a number of sometimes conflicting technical and environmental constraints. This included impact upon farming practices which was considered alongside impact on populations centres, critical infrastructure, environmental designations and archaeology along with technical considerations, such as bend radii for the cable circuits and feedback from stakeholders/landowners to help inform the export cable corridor. For example, paragraph 4.12.34 of 6.1.4 Site Selection and Alternatives [APP-066], sets out a number of reasons for discounting one of the alternative routes which were considered, which included *"More complex land use meant that a cable through this area had the potential to be more disruptive to more individual landowners".*

1.3.9 The site selection process included reviewing landowner feedback gathered by the land agent team and through the various stages of consultation [see 5.1 Consultation Report [APP-031], agri-environmental scheme information and provisional Natural England Agricultural Land Classification data maps. It is important to note that Best and Most Versatile agricultural land surrounds the location of the grid connection point, proposed substation location and onshore export cable corridor and is, therefore, largely unavoidable (see 6.3.5 Ground Conditions and Land Use APP-087).

1.3.10 Landowners' own use of land and proposals for future use were taken into account, including development proposals and consideration of land severance. This, and the information listed, was collated in both tabular form and on web-based map applications by the Applicant's land agent. It was then shared with both the Applicant and North Falls to support the route selection process, including micro-siting the final order limits within the original wider cable corridors. An example of this was a request from the land interest along Wolves Hall Lane where the PEIR corridor abutted the farmyard. It was requested that the corridor was moved away to allow for potential further expansion, and this was reflected in the final corridor design.

1.3.11 During the route refinement to inform the Order Limits submitted as part of this application the engineering team, the land team and the environmental consultants worked together to seek to minimise the amount of land that would be temporarily severed during construction

1.3.12 As with similar projects, it would be expected to scope land use, ground conditions and landscape character in to the assessment to account for the impacts of temporary and permanent land take and presence of Project infrastructure, meeting the requirements of NPS-EN5, IEMA Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (February 2022), Department for Environment, Food & Rural Affairs (DEFRA) Construction Code of Practice for the Sustainable Use of Soil on Construction Sites (2009), and Good Practice Guide for Handling Soils (Institute of Quarrying, 2021) which is an updated publication of the Defra 'Good Practice for Handling Soils', published in 2000. These topics were scoped into the EIA assessment at the Scoping phase in 2021 and have been assessed against the engineering design and updated in response to public and regulatory stakeholder feedback across all phases of the Project. The Applicant has not assessed the impact on individual farms through the EIA process.

1.3.13 Temporary disruption during construction considers the impact of trenching, machinery access, and cable installation on agricultural land. The use of a ducting to install the cables allows for the possibility of faster reinstatement and return to farming earlier than would otherwise be the case. Key concerns to agricultural land include soil compaction, soil drainage, temporary loss of agricultural land, and the reinstatement of soils to their original state. In regard to permanent land loss where infrastructure requires permanent easements or substation installations, the EIA evaluates the long-term loss of agricultural land. The EIA process also examines potential risks such as soil erosion, compaction from heavy machinery, and changes to soil structure, which can negatively impact long-term soil health and productivity.

1.3.14 The project design includes a series of mitigation strategies secured by the 9.21 Code of Construction Practice (CoCP) [APP-253] to ensure farming practice is considered during construction, these include:

- Developing a Soil Management Plan to ensure that topsoil is carefully removed, stored, and replaced after construction to maintain soil health and productivity. Soil handling methods will be specified to prevent compaction and preserve soil structure.
- Appointing an Agricultural Liaison Officer (ALO) to provide a point of contact for landowners and occupiers during construction.
- Where required, crossing points will be provided so that farming vehicles and livestock can cross the working width.
- Wherever possible, farmers and landowners will be kept informed by the ALO of any general disruption impacts via project updates prior to commencement of on-site activities to allow time for them to adapt or make informed decisions on their work practices.
- The applicant will seek to liaise with landowners to negotiate commercial terms including loss of ongoing payments or penalties relating to agri-environmental stewardship schemes for temporary land take requirements.

These measures have been reviewed and amended to align with recent discussions with the landowners. A revised CoCP has been submitted at Deadline 1 (9.21 Code of Construction Practice – Revision B).

1.3.15 SLR regenerative agriculture specialist joined the team in April 2024. This brings additional experience on a range of topics including those raised by landowners, such as minimising impacts to agricultural production along the cable route and soil protection measures to ensure that soils return to their previous condition.

1.3.16 It should be noted this approach is common through offshore wind farm development across the UK. Five Estuaries has used learnings from previous projects its shareholders, such as RWE, have been involved in and successfully constructed alongside industry best practice to develop its approach. These projects include the operational Galloper, Rampion and Triton Knoll OWFs.

APPENDIX 5: ADDITIONAL THIRD PARTY DOCUMENTS

Maritime & Coastguard Agency

MARINE GUIDANCE NOTE

MGN 654 (M+F)

Safety of Navigation: Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response.

Notice to Other UK Government Departments, Offshore Renewable Energy Developers, Offshore Transmission Owners, Port Authorities, Ship owners, Masters, Ships' Officers, Fishermen and Recreational Sailors.

This notice replaces Marine Guidance Note 543 and should be read in conjunction with the following MCA documents:

- *Marine Guidance Note 372 "Offshore Renewable Energy Installations (OREIs) - Guidance to Mariners operating in the vicinity of UK OREIs", and*
- *"Methodology for Assessing the Marine Navigational Safety Risks & Emergency Response of Offshore Renewable Energy Installations".*

Note: References contained in this document can be accessed via the MCA website at www.gov.uk/guidance/offshore-renewable-energy-installations-impact-on-shipping

Other useful websites include:

- www.gov.uk/beis
- www.thecrownestate.co.uk
- www.crownestatescotland.com
- www.legislation.gov.uk
- www.gov.uk/mmo
- www.gov.scot/marine-and-fisheries/
- https://naturalresourceswales.gov.uk
- www.daera-ni.gov.uk
- https://infrastructure.planninginspectorate.gov.uk
- www.un.org/depts/los
- www.kis-orca.eu
- www.iala-aism.org

Summary

This Marine Guidance Note highlights issues that need to be taken into consideration when assessing the impact on navigational safety and emergency response (search and rescue, salvage and towing, and counter pollution) caused by offshore renewable energy installation developments (wind, wave and tidal). It applies to proposals in United Kingdom internal waters, Territorial Sea and Exclusive Economic Zone.

Key Points

- The recommendations in this guidance note should be used, primarily, by OREI developers seeking consent to undertake marine works and in developing post-consent plans and documentation.
- The MGN intends to follow the consenting process and provide guidance at each stage.
- It provides updates in accordance with current practices; and
- The revision includes a reorganisation of the annexes to incorporate existing bespoke documents into the guidance, as follows:
  - **Annex 1**: Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations.
  - **Annex 2**: MCA's shipping template for assessing wind farm boundary distance from shipping routes.
  - **Annex 3**: NOREL paper on under-keel clearance - Guidance to Developers in Assessing Minimum Water Depth over Tidal Devices.
  - **Annex 4**: Hydrography Guidelines for Offshore Renewable Energy Developers.
  - **Annex 5**: Search and Rescue (SAR) and emergency response matters.
  - **Annex 6**: MGN Checklist.

1. Introduction:

1.1 Offshore Renewable Energy Installations (OREI) include offshore wind farms, tidal energy converters (including tidal range devices), wave energy converters and any associated infrastructure with the potential to affect marine navigation and emergency response, proposed in United Kingdom (UK) internal waters, Territorial Sea and Exclusive Economic Zone (EEZ).

1.2 Recommendations in this guidance note should be taken into consideration by all OREI developers seeking formal consent for marine works. Failure by developers to give due regard to these recommendations may result in objections to their proposals on the grounds of navigational safety or emergency response preparedness. Additional information on the process for consenting OREIs and the regulatory framework is available from the Department for Business, Energy & Industrial Strategy (BEIS), Marine Management Organisation (MMO), Natural Resources Wales (NRW), Marine Scotland and Department of the Environment, Agriculture and Rural Affairs (DAERA) [Northern Ireland] websites.

1.3 The considerations and criteria contained in this Marine Guidance Note (MGN) and its annexes are intended to address the navigational and emergency response impacts of OREIs proposed for UK sites. Their development necessitates the establishment of clear guidance to deal with potential adverse effects. The licensing and consent regimes must take account of local factors, national requirements and international standards which could influence the establishment of an OREI.

1.4 This guidance has been developed in consultation with BEIS, the devolved Government authorities for England, Scotland, Wales and Northern Ireland, mariners in the commercial,

military, fisheries and recreational sectors, relevant associations and port authority representatives, the General Lighthouse Authorities (GLA) and emergency response services.

2. Primary and Secondary Legislation with regard to OREIs and Navigation

2.1 The 2020 Energy White Paper sets out the Government's "ambition to have 40GW of offshore wind by 2030, a fourfold increase on today's installed capacity". The Energy Act 2004 (as amended) establishes a regulatory regime for OREIs beyond the Territorial Sea, in the UK's EEZ, and supplements the regime which already applies in the UK's internal and Territorial Sea. Sections 99 and 100 of the Act deal specifically with navigation and introduces a new section, 36B with the title "Duties in relation to navigation" into section 36 of the Electricity Act 1989 (as amended). Under section 36B of the Electricity Act 1989, sub-section (1), consent cannot be granted for an OREI which is likely to interfere with the use of "recognised sea lanes essential to international navigation". This expression directly refers to Article 60(7) of the United Nations Convention on the Law of the Sea, 1982 (UNCLOS) and the position is repeated in Section 2.6.161 of the National Policy Statement for Renewable Energy Infrastructure (EN-3).

2.2 The Merchant Shipping (Safety of Navigation) Regulations 2020 implements the Safety of Life at Sea (SOLAS) Convention Chapter V (Safety of Navigation). This applies to all vessels on all voyages. In some cases, areas of sea may be considered an essential area for navigation and of strategic importance for vessel operation and in accessing ports and harbours. Whilst not an IMO designated routeing measure, these might be an area of sea that is actively used by all vessel types, including large commercial and internationally trading vessels, supply routes, and ferry routes. Therefore, for the purposes of this document "sea lanes" are considered to be IMO-adopted routeing measures and potentially other sea/shipping routes transited by all vessel types[1].

2.3 Section 36B, sub-section (2) of the Electricity Act 1989 (as amended) provides that the decision to grant consent and any conditions placed on a consent must "have regard to the extent and nature of any obstruction of or danger to navigation which (without amounting to interference with the use of such sea lanes) is likely to be caused by the carrying on of the activities, or is likely to result from their having been carried on."

2.4 Shipping is recognised in the Marine Policy Statement 2011, Chapter 3.4, as "an essential and valuable economic activity in the UK" and that "increased competition for marine resources may affect the sea space available for the safe navigation of ships. Marine plan authorities and decision makers should take into account and seek to minimise any negative impacts on shipping activity, freedom of navigation and navigational safety and ensure that their decisions are in compliance with international maritime law". In addition, both the Marine and Coastal Access Act 2009, Part 4, Section 69, sub-section (1)(c) and the Marine (Scotland) Act 2010, Part 4, Section 27, sub-section (1)(a)(iii), provide for marine licence decisions to "have regard to the need to prevent interference with legitimate uses of the sea".

2.5 The MCA (through UK Technical Services Navigation) is a statutory consultee within the planning process for development consent and a primary advisor to the licensing authorities for issuing marine licences. The MCA provides advice and guidance to developers and other Government departments throughout the lifetime of an OREI on matters concerning navigational safety and emergency response.

[1] Table 10 of the Methodology document provides a list of example vessel types involved in navigation activities.

3. How and When the Recommendations Should be Used

3.1 This MGN is intended for the guidance of developers and others. Failure to accept the principles of the guidance may result in delays or objections from stakeholders within the licensing and consenting process. The recommendations should be taken into account by OREI developers and their contracted environmental and risk assessors in the preparation of Scoping Reports (SR), Navigational Risk Assessments (NRA) and resulting EIA Reports, and in any required post-consent documents.

3.2 The recommendations should be used to evaluate all navigational possibilities, which could be reasonably foreseeable, by which the siting, construction, extension, operation and de-commissioning of an OREI could cause or contribute to an obstruction of, or danger to, navigation or emergency response. They should also be used to assess possible changes to traffic patterns and the most favourable options to be adopted, including those of operational site monitoring.

3.3 In terms of navigational priority, these recommendations do not encourage a differentiation to be made between any types of seagoing watercraft, operations, or mariners.

3.4 It is recognised that all OREI projects are at varying stages of planning and development, both pre-consent and post-consent, therefore proposals on meeting the principles of this guidance for undertaking marine works will be assessed on a 'case by case' basis.

3.5 The recommendations contained therein apply to all sites, whether within the jurisdiction of port/harbour limits or in open sea areas. However, port/harbour authorities may require developers to comply with their own specific criteria and/or local regulations and directions. In addition, where proposals within port/harbour limits could affect navigation or emergency planning or response, the port/harbour authority will be under an obligation to review its safety management system following the issue of consent to the developer, in accordance with the Port Marine Safety Code. Evaluating the impact of OREI schemes on existing port/harbour activities should be carried out in consultation with the relevant port/harbour authority and the wider port community. Such reviews should be undertaken by the developer as part of the Environmental Impact Assessment and the outcome addressed in the resulting EIA Report.

3.6 OREI developers should evaluate the impacts of their projects and comply with the recommendations during all phases of:

(1) planning;
(2) construction;
(3) operation; and,
(4) decommissioning.

4. Planning Stage – Prior to Consent

4.1 Early engagement with MCA and relevant navigational stakeholders e.g. during the scoping stage, is key for early identification of potential areas of concern that may require close attention. Developers are required to produce a NRA in the planning stage as part of their application for development consent. The MCA's *"Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI)"* (hereafter known as the 'Methodology document') provides guidance for producing an NRA, including a template. It is based on IMO Formal Safety Assessment

and the latest version is available on the MCA's website. Any substantial changes to the project that impacts on shipping and navigation may require relevant NRA updates.

4.2 Potential navigational or communications impacts or difficulties caused to mariners or emergency response services, using the site area and its environs, should be assessed. Assessments should be made of the consequences of ships deviating from normal routes to avoid proposed sites, including smaller vessels e.g. domestic, coasters, recreational or fishing vessels, entering shipping routes with larger vessels. Special regard should be given to evaluating situations which could lead to safety of navigation being compromised e.g. an increase in 'end-on' or 'crossing' encounters, reduction in sea-room or water depth for manoeuvring, leading to choke points, etc.

4.3 Issues that could contribute to a marine casualty leading to injury, death or loss of property, either at sea or amongst the population ashore, or damage to the marine environment, should be highlighted as well as those affecting emergency response. Consultation with national search and rescue authorities should be initiated as early as possible and consideration given to the types of aircraft, vessels and equipment which might be used in emergencies. This should include the possible use of OREI structures as emergency refuges and any matters that might affect emergency response within or close to the OREI.

4.4 An MGN checklist is available on the MCA website as an aid for developers when completing and submitting their NRA to ensure all guidance has been considered and addressed.

4.5 Developers are responsible for ensuring that formally agreed co-ordinates and subsequent variations of site perimeters and individual OREI structures are made available, on request, to interested parties at relevant project stages, including application for consent, development, array variation, operation and decommissioning. This should be supplied as authoritative Geographical Information System (GIS) data, preferably in Environmental Systems Research Institute (ESRI) format. Metadata should facilitate the identification of the data creator, its date and purpose, and the geodetic datum used. For mariners' use, appropriate data should also be provided with latitude and longitude coordinates in WGS84 (ETRS89) datum.

4.6 NRA – Traffic Survey[2]

a. An up to date, traffic survey of the proposed development area concerned should be undertaken within 12 months prior to submission of the EIA Report. This should include all the vessel and craft types found in the area and total at least 28 days duration but also take account of seasonal variations and peak times in traffic patterns and fishing operations. AIS data alone will not constitute an appropriate traffic survey; radar, manual observations, other data sources (e.g. for fishing and recreation) and stakeholder consultation will ensure those vessels that are not required to carry and operate AIS are included, and it provides an appropriate representation of the base line marine traffic.

b. However, to cover seasonal variations, peak times or perceived future traffic trends, the survey period may be extended to a maximum of 24 months. For all OREI developments, subject to the planning process, the survey may be undertaken within 24 months prior to submission. If the EIA Report is not submitted within 24 months an additional 14 day continuation survey data may be required for each subsequent 12-month period. Should there be a break in the continuation surveys, a new full traffic survey may be required and the time period starts from the completion of the initial 28 day survey period.

[2] See Methodology document Annex B.

c. In the event of location specific issues being identified by the existing traffic survey and/or through consultation, additional surveys beyond the minimum outlined above may be required in order to support assessment of such issues.

d. These variations should be justified in consultation with the relevant GLA, UK Chamber of Shipping, representative recreational (e.g. RYA) and fishing vessel organisations and, where appropriate, port/harbour and navigation authorities. While recognising that site-specific factors need to be taken into consideration any such survey should include but may not be limited to an assessment of the cumulative and individual effects of the following:

i. Proposed OREI site relative to areas used by any type of marine craft.

ii. Numbers, types and sizes of vessels presently using such areas.

iii. Non-transit uses of the areas, e.g. fishing, day cruising by leisure craft, commercial passenger vessels undertaking visits to the OREI, racing, aggregate dredging, personal watercraft etc.

iv. Whether these areas contain shipping routes used by coastal, deep-draught or international scheduled vessels on passage.

v. Alignment and proximity of the site relative to adjacent shipping routes.

vi. Whether the nearby area contains prescribed routeing schemes or precautionary areas.

vii. Proximity of the site to areas used for anchorage (charted or uncharted), safe haven, port approaches and pilot boarding or landing areas.

viii. Whether the site lies within the limits of jurisdiction of a port and/or navigation authority.

ix. Proximity of the site to existing fishing grounds, or to routes used by fishing vessels to such grounds.

x. Proximity of the site to offshore firing/bombing ranges or ordnance dumping grounds and areas used for any marine military purposes either presently or in the past.

xi. Proximity of the site to existing or proposed submarine cables and pipelines, offshore oil / gas platforms, marine aggregate dredging, marine archaeological sites or wrecks, Marine Protected Area or other exploration/exploitation sites. This should include projects in the planning process, in addition to those consented.

xii. Proximity of the site to existing or proposed OREI developments, in co-operation with other relevant developers, within each round of lease awards.

xiii. Proximity of the site relative to any designated areas for the disposal of dredging spoil.

xiv. Proximity of the site to any types of aids to navigation and/or Vessel Traffic Services (VTS) in or adjacent to the area and any impact thereon.

xv. Researched opinion using appropriate computer simulation techniques with respect to the displacement of traffic and, in particular, the creation of ‘choke points’ in areas

of high traffic density and nearby planned or consented OREI sites not yet constructed.

xvi. With reference to xv. above, the number and type of incidents to vessels which have taken place in or near to the proposed site of the OREI to assess the likelihood of such events in the future and the potential impact of such a situation.

xvii. Proximity of the site to areas used for recreation which depend on specific features of the area

e. Developers are advised to discuss their traffic survey proposals prior to making any commitments in carrying out the survey – see Section 3 of the Methodology document for further information on scope and depth of assessment.

d. A review of the Navigational Risk Assessment should be carried out post-consent and prior to construction commencing to validate the EIA Report. This may include additional traffic survey data or if there are any changes to plans that could impact navigation e.g. construction methodology.

4.7 NRA – Predicted Effect of OREI on traffic and Interactive Boundaries

a. In late 2004 the Greater Wash wind farm developers group sought guidance from the Maritime and Coastguard Agency on the inter-relationship of wind farms to shipping routes so that they could take early recognition of the factors involved when planning a turbine layout within their allocated water space. The template in Annex 2 is the result.

b. The template combines the simulated radar reception results of the North Hoyle electromagnetic trials with published ship domain theory to better interpret the inter-relationship of marine wind farms and shipping routes. The resultant template also informs the assessments made as part of the consenting process.

c. There may be opportunities for the interactive boundaries to be flexible where, again, for example, vessels may be able to distance themselves from turbines to provide more comfort without significant penalty, or where turbines could be distanced from shipping nodal points. Domains have been derived from a statistical study of ship domains based on radar simulator performance, and traffic surveys in the North Sea, but it is recognised that larger, high speed, hazardous cargo and passenger carrying vessels may have larger domains.

d. Traffic surveys would also establish any route traffic bias where mariners may naturally turn to starboard to facilitate passing encounters in accordance with the IMO International Regulations for Preventing Collisions at Sea, 1972 (COLREG). Additionally, marine traffic surveys would identify vessel type or category which may consequently require larger domains to ensure that the following factors can be taken into consideration in determining corridor widths:

i. Compliance with the best practices of seamanship and principles to be observed in keeping a navigational watch including the composition of the watch,

ii. The manoeuvrability of vessels with special reference to stopping distance and turning ability in the prevailing conditions,

iii. Provisions that may be required with mechanical failure of vessels involved and level of support services,

iv. The state of visibility, wind, sea and tidal stream, and the proximity of navigational hazards,

v. The traffic density including concentrations of fishing vessels or any other vessels,

vi. The draught in relation to the available depth of water and the existence of submarine cables and obstructions,

vii. The effect on radar detection of the sea state, weather and other OREI sources of interference.

e. In the approaches to ports and harbours this is particularly relevant. This additional information would influence where boundaries need to be established.

f. When larger developments provide corridors between sites to allow safe passage of shipping a detailed assessment will be required to establish the minimum width of the corridor. The assessment of the required sea room (corridor width) will be undertaken on a case-by-case basis and should take into account not only the requirements of the traffic survey but also the general location, sea area involved and nearby structures and installations. It will not always be possible to make a course that is planned, and experience shows that in heavy sea conditions it is much harder to stop or turn the vessel around. Deviations from track by as much as 20°, or more, are common and must be considered. This deviation is used as the baseline for calculating corridor widths contained in the windfarm shipping route template.

Clearly, marine traffic survey information is required to inform such boundaries. Where turbines appear along both sides of a shipping corridor, the width requirement will be proportional to corridor length, based on a 20-degree course deviation.

g. The following factors should be applied when considering the width of a shipping corridor through an array, between two turbine arrays or between an array and shore and how far turbines should be from an established shipping route. The assessment of the required sea room must take into account the general location and sea area involved. The bridge awareness, availability of engines for immediate manoeuvre and readiness to use anchors will all vary when the vessel is on a general sea passage, as opposed to in areas of recognised constrained operation, for example port approaches and rivers.

i. Size, manoeuvring characteristics and volume of the vessels expected to transit the proposed lanes.

(1) Standard turning circles for vessels are worked on six times the ship's length. This is a particularly good assumption when vessels on ocean or deep-sea passage will not have the same manoeuvrability as when engines and systems are prepared for port approach.

(2) Requirements for stopping in an emergency must be considered, for example following a steering gear failure a crash stop, the quickest way to stop a vessel's movement, for a large tanker may still be up to 3km.

(3) The Netherlands made an assessment of sea room requirements using data supported by the PIANC assessment for channel design and the PIANC *Interaction Between Offshore Wind Farms and Maritime Navigation* (2018) report. In general, they strive for an obstacle free, or buffer, zone of 2nm between wind farms and shipping routes.

(4) The possibility of ships overtaking cannot be excluded and should be taken into consideration. Consequently, the assumption should be that four ships should safely be able to pass each other.

(5) Between overtaking and meeting vessels, a distance of two ship's lengths is normally maintained as a minimum passing distance. This is based on the experience gained from ships' masters and deep-sea pilots operating in the North Sea and has been verified by simulation trials carried out in the Netherlands (based on 400m length vessels).

ii. Provisions for possible mechanical failure of transiting vessels, bearing in mind the availability of support services.

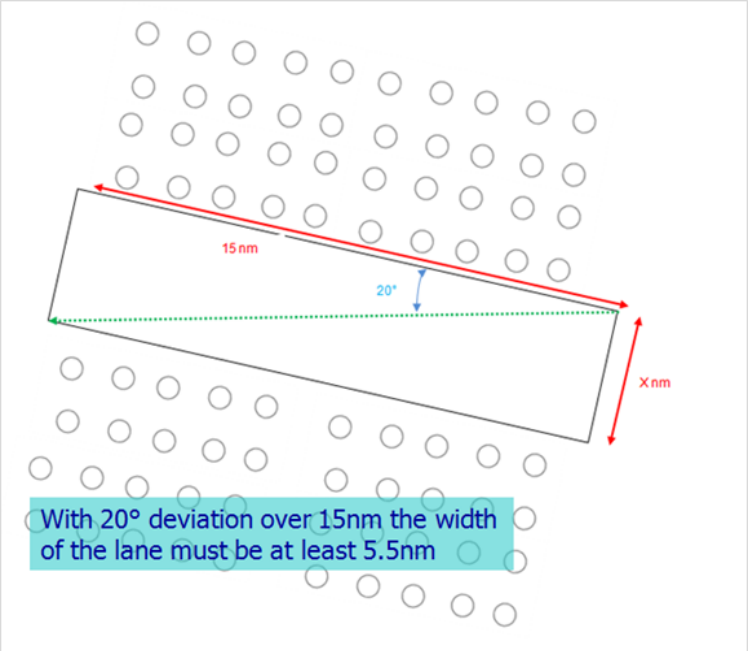
(1) Engine failure whilst using a transit lane might necessitate emergency or unplanned anchoring, restricting available sea room for other vessels.

(2) Dependant on depth of water the swinging circle of very large vessels, when anchored, must be calculated to assess the sea room required.

iii. Constraints of weather, sea and tidal conditions that may be expected in the location.

(1) Unlike inshore and estuary areas, when on passage in exposed sea areas, for example offshore in the North Sea, it will not always be possible to make good a planned course. Experience also shows that in heavy sea conditions it is much harder to turn the vessel around and may not be possible to achieve a dead stop and deviations from track are common. Therefore 20° or more, are common (as determined from the traffic assessment of the NRA) and must be considered in developing corridors through OREIs.

(2) For example:



(3) In tidal areas, the navigable width of a channel or route, for example, between an OREI and the shore, may be significantly reduced at low water.

iv. Other traffic, for example concentrations of fishing vessels, that will affect available sea-room to manoeuvre.

(1) Concentrations of fishing vessels, or leisure traffic, will create requirements for manoeuvre and course alteration by other through traffic and also restrict sea room in the shipping lane. The risk of further vessel to vessel conflict will be consequently increased.

(2) Displacing a group of traffic into space utilised by other users where available sea room is already confined, must be considered. For example, where leisure traffic is forced to use the same sea space as much larger and faster commercial vessels.

v. Existence of submarine cables and obstructions. The existence of submarine cables or other seabed obstructions may affect the ability of a vessel to anchor safely away from other traffic and this may be another consideration when assessing sea room requirements.

vi. Radar interference. Dependant on the proximity to wind turbine towers, and the location of radar scanners aboard the vessel, some vessels may experience degradation of the radar display by false echoes. It may be possible that this will reduce the ability of the bridge team to identify other vessels, including crossing vessels at the extremities of the lanes, which may require avoiding action. It is common to find that the radar instrumentation is then often adjusted to reduce the unwanted interference which can have the effect of reducing actual target acquisition.

h. IMO Routeing Measures. In some circumstances it may be requested, or necessary, to introduce, extend, expand or remove an IMO routeing measure as a result of an OREI. In this instance a proposal must be submitted in discussion with the MCA for consideration by the UK Safety of Navigation (UKSON) committee and subsequent recommendation to and approval by the IMO.

4.8 NRA - OREI Structures

a. It should be determined whether any features of the OREI, including auxiliary platforms outside the main generator site, mooring and anchoring systems, inter-device and export cabling, could pose any type of difficulty or danger to vessels underway, performing normal operations, including fishing, anchoring and emergency response. Such dangers would include air clearances of wind turbine blades above the sea surface, changes to charted depth due to tidal turbines, the burial depth of cabling, lateral movement of floating wind or tidal turbines etc.

b. Recommended minimum safe (air) clearances between sea level conditions at mean high water springs (MHWS) and rotor blades on fixed foundation wind turbines, or auxiliary platforms, stipulate that they should be suitable for the vessels types identified in the traffic survey but not less than 22 metres, unless developers are able to offer evidence that risks to any vessel type with air drafts greater than the requested minimum air drafts being provided are minimised. Depths, clearances and similar features of other OREI types which might affect marine safety should be determined on a case-by-case basis, for example, floating foundation wind turbines must allow for the degrees of motion (pitch, roll, yaw, heave, surge and sway), as appropriate.

c. There is no standard clearance figure that can be used to establish the safe clearance over underwater turbine devices. Rather, developers will need to demonstrate an evidence based, case-by-case approach which will include dynamic draught modelling in relation to

charted water depth to ascertain the safe clearance over a device. The following approach should be adopted:

i. To establish a minimum clearance depth over devices, the developer needs to identify from the traffic survey and data sources the deepest draught of observed traffic. This will then require modelling to assess impacts of all external dynamic influences giving a calculated figure for dynamic draught. A 30% factor of safety for under keel clearance (UKC) should then be applied to the dynamic draught, giving an overall calculated safe clearance depth to be used in calculations.

ii. The Charted Depth reduced by safe clearance depth gives a maximum height above seabed available from which turbine design height including any design clearance requirements can be established.

iii. The MCA's "Under Keel Clearance Policy" paper (see Annex 3) should be closely followed throughout the Environmental Impact Assessment.

d. It should also be determined whether:

i. The structures could block or hinder the view of other vessels under way on any route.

ii. The structures could block or hinder the view of the coastline or of any other navigational feature such as aids to navigation, landmarks, promontories, etc.

In both cases, the impact must form part of the risk assessment.

4.9 NRA – Tides, Tidal Streams and Weather

It should be determined whether:

a. Current maritime traffic flows and operations in the general area are affected by the depth of water in which the proposed installation is situated at various states of the tide i.e. whether the installation could pose problems at high water which do not exist at low water conditions, and vice versa.

b. The set and rate of the tidal stream, at any state of the tide, has a significant effect the handling of vessels in the area of the OREI site.

c. The maximum rate tidal stream runs parallel to the major axis of the proposed OREI site layout, and if so, its effect on vessel handling and manoeuvring.

d. The set is across the major axis of the OREI layout at any time, and, if so, at what rate.

e. In general, whether engine and/or steering failure, or other circumstance could cause vessels to be set into danger by the tidal stream. This should include unpowered vessels and small low speed craft.

f. The structures themselves could cause changes in the set and rate of the tidal stream.

g. The structures in the tidal stream could be such as to produce siltation, deposition of sediment or scouring, affecting navigable water depths in the OREI area or adjacent to the area.

h. The site, in normal, bad weather, or restricted visibility conditions, could present difficulties or dangers to all vessels that might pass through or in close proximity to it.

i. The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer.

j. In general, taking into account the prevailing winds for the area, whether engine failure or other circumstances could cause vessels to drift into danger, particularly if in conjunction with a tidal set such as referred to above.

4.10 NRA – Access to and Navigation Within, or Close to, an OREI

It should be determined to what extent navigation would be feasible within or near to the OREI site itself by assessing whether:

a. Navigation within and /or near the site would be safe:

i. for all vessels, or
ii. for specified vessel types, operations and/or sizes.
iii. in all directions or areas, or
iv. in specified directions or areas.
v. in specified tidal, weather or other conditions.

b. Navigation in and/or near the site should be prohibited or restricted:

i. for specified vessels types, operations and/or sizes,
ii. in respect of specific activities,
iii. in all areas or directions, or
iv. in specified areas or directions, or
v. in specified tidal or weather conditions, or simply
vi. recommended to be avoided.

c. Where it is not feasible for vessels to access or navigate through the site, it could cause navigational safety, emergency response or routeing problems for vessels operating in the area, e.g. by causing a vessel or vessels to follow a less than optimum route or preventing vessels from responding to calls for assistance from persons in distress (as per SOLAS obligations).

d. Guidance on the calculation of safe distances of wind farm boundaries from shipping routes can be found in Annex 2 “MCA Template for assessing distances between wind farm boundaries and shipping routes”. Advice on the safe distances of other OREI developments from shipping routes may be obtained from MCA’s Navigation Safety Branch.

4.11 NRA - Search & Rescue, Maritime Assistance Service, Counter Pollution and Salvage Incident Response

a. The MCA, through HM Coastguard, is required to provide a Search and Rescue (SAR) and emergency response service within the sea area occupied by all offshore renewable energy installations in UK waters. To ensure that such operations can be safely and effectively conducted, certain requirements must be met by developers and operators.

b. A preliminary assessment on the potential impacts to SAR and emergency response with the introduction of the OREI must be carried out and included as a chapter in the NRA. Further information can be found in Chapter 3 of the Methodology document. Information on post-consent requirements can be found in section 6.8 of this MGN.

4.12 NRA - Hydrography

a. In order to establish a baseline, confirm the safe navigable depth, monitor seabed mobility and to identify underwater hazards, detailed and accurate hydrographic surveys are required of the development at the pre-consent stage:

   i. The site of the generating assets area shall be undertaken as part of the licence and/or consent application.
   ii. All proposed cable route(s).

b. The development may result in an alteration to maritime traffic patterns as vessels seek alternative passage around the installed generating assets area. Where this is the case, it may be considered necessary that a hydrographic survey of these alternate passages and their immediate environs extending to 500m be undertaken. MCA can provide guidance here if required.

d. All hydrographic surveys listed above should fulfil the requirements of the MCA's 'Hydrography Guidelines for Offshore Developers' in Annex 4.

e. Further hydrographic surveys are required during the post-consent and decommissioning stages (see sections 6.8 and 7 below).

4.13 NRA - Communications, Radar and Positioning Systems

To provide researched opinion of a generic and, where appropriate, site specific nature concerning whether:

a. The structures could produce radio frequency interference such as shadowing, reflections or phase changes, and emissions with respect to any frequencies used for marine positioning, navigation and timing (PNT) or communications including Global Maritime Distress Safety System (GMDSS) and Automatic Identification Systems (AIS), whether ship borne, ashore or fitted to any of the proposed structures. Consideration should be given to three scenarios:

   i. Vessels operating at a safe navigational distance (see Annex 2),
   ii. Vessels by the nature of their work necessarily operating at less than the safe navigational distance to the OREI, e.g. support vessels, survey vessels, SAR assets.
   iii. Vessels by the nature of their work necessarily operating within the OREI.

   Note: *GMDSS frequencies may not be subject to harmful interference, but for other frequencies, cases (ii) and (iii) may rely on agreed special measures where necessary.*

b. The structures could produce radar reflections, blind spots, shadow areas or other adverse effects, amongst others:

   i. Vessel to/from shore;
   ii. Vessel to vessel
   iii. VTS radar to/from vessel;
   iv. Anomalous radar beacon (Racon) reception by vessel; and,
   v. Search and Rescue and maritime surveillance aircraft to/from vessels and/or OREI structures

c. The structures and generators might produce sonar interference affecting fishing, industrial or military systems used in the area.

d. The site might produce acoustic noise which could mask prescribed sound signals.

e. The generators and the seabed cabling within the site and onshore might produce electromagnetic fields affecting compasses and other navigation systems.

4.14 NRA – Assessment of Risk[3]

a. The above NRA data and evidence gathering will feed into understanding the base case densities and types of traffic and estimating the level of baseline risks without the OREI in place and inherent risks associated with the introduction of the OREI. The Methodology document requires a hazard log to be developed listing the hazards caused or changed by the OREI and the predicted baseline and inherent risks associated with each hazard. The hazard log must also include residual risks to show the tolerability level of risk after risk mitigation measures have been implemented to reduce them to As Low as Reasonably Practicable (ALARP)[4].

4.15 NRA - Risk Mitigation[5]

a. Mitigation and safety measures will be applied to the OREI development appropriate to the level and type of risk determined during the Environmental Impact Assessment (EIA). The specific measures to be employed will be selected in consultation with the MCA's Navigation Safety Branch and will be listed in the developer's EIA Report. These will be consistent with international standards contained in, for example, the Safety of Life at Sea Convention, 1974 (SOLAS) - Chapter V, IMO Resolutions A.572 (14) and Resolution A.671 (16) and could include any or all of the following:

   i. Promulgation of information and warnings through notices to mariners and other appropriate maritime safety information (MSI) dissemination methods.

   ii. Continuous watch by multi-channel VHF, including Digital Selective Calling (DSC).

   iii. Safety zones of appropriate configuration, extent and application to specified vessels.

   iv. Designation of the site as an area to be avoided (ATBA).

   v. Provision of Aids to Navigation as determined by the General Lighthouse Authority.

   vi. Implementation of routeing measures within or near to the development.

   vii. Monitoring by radar, AIS, closed circuit television (CCTV) or other agreed means.

   viii. Appropriate means for OREI operators to notify, and provide evidence of, the infringement of safety zones or ATBA.

   ix. Creation of an Emergency Response Cooperation Plan with the MCA's Search and Rescue Branch for the construction phase onwards.

---

[3] See Methodology document Annex C and D.

[4] Descriptions of ALARP can be found in:
a) Health and Safety Executive (2001) 'Reducing Risks, Protecting People'
b) IMO (2018) MSC-MEPC.2/Circ.12/Rev.2 dated 9 April 2018, 'Revised Guidelines for Formal Safety Assessment (FSA) in the IMO Rule-Making Process'

[5] See Methodology document Annex E and G.

x. Use of guard vessels where appropriate.

xi. Update NRAs every two years e.g. at testing sites.

xii. Device-specific or array-specific NRAs.

xiii. Design of OREI structures to minimise risk to contacting vessels or craft.

xiv. Any other measures and procedures considered appropriate in consultation with other stakeholders.

b. The mention of the IMO/UNCLOS safety zones limited to 500 metres does not imply a direct parallel to be applied to OREIs. Section 95 of the Energy Act 2004 provides for the decision to grant safety zones around renewable energy installations. The Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007 (SI 2007 No. 1948) provides the regulatory framework for establishing safety zones to OREIs in the UK. It allows for 500m safety zones around wind turbines during construction, extension, major maintenance or decommissioning and 50m safety zones during operation. If developers wish to submit an application to either BEIS or the appropriate marine licensing authority where applicable, it must be accompanied with safety case and supporting evidence showing justification for the safety zone(s) and how it will be managed. The decision whether the safety zone(s) is granted will be made following a consultation with relevant stakeholders. For further guidance, please see DECC's document titled "Applying for Safety Zones Around Offshore Renewable Energy Installations".

5. Development Consent

5.1 The MCA will expect all appropriate aspects of this MGN and the Methodology document to be considered and adequately addressed through the MGN Checklist and submitted as part of the consent application. Any aspects missing or inadequately addressed to the satisfaction of MCA may result in delays or objection to an application.

5.2 In order to make an application, developers should aim to get agreement from all relevant navigation stakeholders for ensuring risks are assessed as ALARP and that risk mitigation measures are agreed.

6. Post-consent – construction and operation phases

6.1 In the UK all vessels have freedom to transit through OREIs, subject to any applied safety zones, and their own risk assessments, which should take account of factors such as vessel size, manoeuvrability, environmental factors and competency of the Master and crew. MGN 372 (or subsequent update) provides further guidance on navigation in and around OREIs.

6.2 Layout Design

a. MCA has statutory obligations to provide Search and Rescue (SAR) services in and around OREIs in UK waters, using both SAR helicopters and emergency response vessels. The MCA also has responsibilities to ensure the safety of navigation is maintained and to address the risks to mariners who may wish to transit an offshore renewable development or find themselves in the vicinity of a development in an emerging situation or in adverse weather conditions.

b. Turbine layouts of every offshore renewable energy project with floating and/or surface piercing devices and structures must be designed to allow safe transit through OREIs by SAR helicopters operating at low altitude in bad weather, and those vessels (including rescue craft) that decide to, or must, transit through them. Multiple lines of orientation provide alternative options for passage planning and for vessels and aircraft to counter the environmental effects on manoeuvring i.e. sea state, tides, currents, weather, and visibility. OREI structures (turbines, substations, platforms, and any other structure within the OREI site) that are aligned in straight rows and columns are considered the safest layout arrangement by UK navigation stakeholders and the MCA contracted SAR helicopter pilots. Developers should therefore carry out a further site-specific assessment, which builds on previous assessments, to identify the proposed locations of individual structures.

c. In compliance with safety of navigation and search and rescue requirements in the UK, developers of every offshore renewable energy project with floating and/or surface piercing devices should undertake a thorough appraisal of the safety benefits afforded by two consistent lines of orientation and, based on this, either implement such layouts or, where appropriate, consider alternatives. The MCA will not consider any layout proposals with just one line of orientation, without supporting documentation which fully justifies the proposed layout to the satisfaction of MCA. A layout with zero lines of orientation will not be acceptable to the MCA.

d. The layout assessment should start with a layout option with at least two consistent lines of orientation (which may include perimeter turbines with smaller spacing than internal turbines) and then be refined as appropriate for the project. The assessment should consider the potential impacts the proposed locations may have on navigation and SAR activities. Where a project proposed one line of orientation, this should be discussed with MCA and a safety justification must be prepared to support this reduction and submitted to the MCA for consideration.

e. The safety justification should build on work conducted as part of the Navigation Risk Assessment and the mitigations identified as part of that process. It should include a risk comparison between one and two (or more) lines of orientation, the reasons why two lines is not proposed and present sufficient information to enable the MCA to adequately understand how the risks to navigation and SAR associated with the proposed layout have been reduced to ALARP.

f. Liaison with the MCA is encouraged as early as possible following the outcome of the site-specific layout assessment, and to discuss any potential improvements which can be made to the proposed layout, where considered necessary. Where a project proposes just one line of orientation, this discussion should include any potential secondary lines, and additional risk mitigation measures that may be required as a result.

g. Micrositing should be carried out in such a way which has the least impact on the overall layout within agreed distances. Any requirement to locate structures beyond agreed distances should be discussed with MCA on a case-by-case basis.

h. Where multiple OREI sites have adjacent boundaries less than 1nm apart, including extensions to existing sites, due consideration must be given to the requirement for lines of orientation that allow a continuous passage for vessels and/or SAR helicopters through both sites, whilst still maintaining plans for at least two lines of orientation as appropriate to the site-specific nature of that site. Adjacent sites, as used in this section, will be assessed on a case-by-case basis.

i. Each layout design will be assessed on a case-by-case basis and once agreed formal acceptance will be provided collectively by both MCA's Technical Services Navigation and HM Coastguard.

6.3 Marine Navigational Marking

It should be determined:

a. How the overall site would be marked by day and by night throughout construction, operation and decommissioning phases, taking into account that there may be an ongoing requirement for marking on completion of decommissioning, depending on individual circumstances. Aids to Navigation (AtoN) will be determined (and sanctioned) by the relevant General Lighthouse Authority (GLA) (Trinity House, Northern Lighthouse Board or Commissioners of Irish Lights).

b. How individual structures and fittings on the perimeter of and within the site, both above and below the sea surface, would be marked by day and by night.

c. If the specific OREI structure would be inherently radar conspicuous from all seaward directions (and for SAR and maritime surveillance aviation purposes) or would require special radar reflectors or target enhancers.

d. If the site would be marked by additional electronic means e.g. Racons.

e. If the site would be marked by an Automatic Identification System (AIS) transceiver, and if so, the data it would transmit.

f. If the site would be fitted with audible hazard warning in accordance with IALA recommendations.

g. If the structure(s) would be fitted with aviation lighting, and, if so, how these would be screened from mariners or guarded against potential confusion with other surface navigational marks and lights (see Annex 5).

h. The proposed site and/or its individual generators must comply in general with markings for such structures, as required by the relevant GLA in consideration of IALA guidelines and recommendations. There is an expectation that working lights and the ID lighting will not interfere with Aids to Navigation or create confusion for the Mariner navigating in or near the OREI.

i. The Aids to Navigation specified by the GLAs are being maintained such that the 'availability criteria', as laid down and applied by the GLAs, is met at all times. Separate detailed guidance is available from the GLAs on this matter.

j. The procedures that need to be put in place to respond to casualties to the aids to navigation specified by the GLAs, within the timescales laid down and specified by the GLAs.

6.4 Identification Marking

a. Individual ID markings should conform to a "spreadsheet" format, e.g. lettered on the horizontal axis, and numbered on the vertical axis. The ID marking should be sequential, aligned with 'SAR lanes' (line of orientation for search and rescue purposes) and begin with the OREI name designator code, then the row/column numbering starting with the letter 'A' and then the turbine number. To avoid confusion, the letters 'O' and 'I' should not be used to avoid confusion with the numbers 0 and 1. The detail of this will depend on the shape,

geographical orientation and potential future expansion of each OREI development. The ID marking must be discussed with the MCA who will advise on any specific requirements for each development, taking into account any difference between internal and periphery turbine alignment.

b. The ID marking of substations should be considered in line with the above and there should be a clear differentiation between the substation and the turbine.

c. ID numbers must be clearly readable by an observer stationed three metres above sea level at a distance of at least 150 metres from the turbine. Each ID number plate shall be illuminated by a low intensity light visible from a vessel thus enabling the structure to be detected at a suitable distance to avoid a collision. Lighting for this purpose must be hooded or baffled so as to avoid unnecessary light pollution or confusion with navigation marks.

6.5 Mooring Arrangements

a. Floating devices, including those suspended in the water column, must have suitable mooring arrangements for the environmental conditions to ensure the device(s) remains on station and does not become a navigation hazard through failure of its moorings. The Health and Safety Executive (HSE) and MCA have developed a combined guidance document that should be followed: *Regulatory expectations on moorings for floating wind and marine devices.* This is available from the MCA website and provides information on:

i. Safety Management Systems
ii. Design
iii. Hardware
iv. Installation
v. Operation
vi. Monitoring
vii. Third Party Verification

b. MCA will expect evidence of compliance with the *Regulatory expectations on moorings for floating wind and marine devices* demonstrated through the report and third-party verification.

6.6 Traffic Monitoring

a. There is a requirement for OREI operators to monitor and review the impact their activities have on the safety of navigation during the construction and operation phases.

b. The main purpose of vessel traffic monitoring is to be able to ensure the Navigation Risk Assessment (NRA) for the project is accurate for the construction and operation phase; that the predictions made in the NRA with regards to the traffic patterns are accurate, and to ensure the mitigation measures are effective and remain fit for purpose.

c. This should be carried out using AIS data and where practical, feedback should also be sought from commercial Masters, fishing vessel skippers, work boat crews and recreational sailors/users who regularly operate in and around different OREI sites to get realistic information on their experiences in different conditions.

d. The MCA would expect the opportunity to discuss any changes identified as part of this monitoring, since the submission of the NRA.

6.7 Cable Burial and Protection

a. It should be determined at what depth below the seafloor export cables are buried to ensure there are no changes to charted depths. If burial is not possible, for example due to underwater features and/or seabed ground conditions export cables should be suitably protected (e.g. by rocks or other such suitable mattress placements) to mitigate the risks to vessels. Any consented cable protection works must ensure existing and future safe navigation is not compromised. Consequently, the MCA would be willing to accept up to 5% reduction in surrounding charted depths referenced to Chart Datum, unless developers are able to demonstrate that any identified risks to any vessel type are satisfactorily mitigated.

b. Under no circumstances should depth reductions compromise safe navigation. Therefore, consideration should be given to areas of critical depths in relation to under keel clearance where any reduction in depth will increase risk to safe navigation, such as in IMO routeing measures, mobile seabed, approaches to ports etc, and developers must discuss the tolerability of any changes to depths with MCA.

6.8 Hydrography

a. In order to confirm the seabed has been returned as close to its original profile and to identify underwater hazards, namely exposed cables and any protection measures, detailed and accurate hydrographic surveys are required of the cable route(s) in the post-construction phase. This should be carried out in accordance with the guidelines in Annex 4.

6.9 Search and Rescue Requirements

a. As part of the post consent requirements, developers must address the requirements and guidance of the *Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for Search and Rescue (SAR) and Emergency Response* – Annex 5.

b. Based on lessons learned from OREI developments, the MCA has provided a SAR checklist for developers to record decisions made regarding the information contained in this document. The content of the SAR checklist is intended to be a live document and will apply throughout the lifecycle of the development. It will be used by the MCA to ensure actions agreed pre-consent and pre-construction, are correctly implemented. The actions will not all be completed when the checklist is agreed.

c. This SAR checklist is available to download from the MCA website and developers are expected to complete it as part of meeting their marine licence condition requirements. This is in addition to the MGN checklist required separately as part of the development consent process.

d. An agreed Hub Emergency Response Cooperation Plan (ERCoP) must be in place prior to construction commencing and a template, which includes guidance for completion, is available to download from the MCA website. The ERCoP must be updated or replaced with a new version for the operational phase of the OREI.

e. The offshore renewable energy industry is advancing and evolving, and requirements and guidance may therefore have to change in light of experience and lessons learned from emergencies and SAR incidents.

7. Decommissioning

7.1 The requirements for decommissioning offshore renewable energy installations are derived from the Energy Act 2004, Sections 105 to 114 and further guidance can be found in the BEIS publication *Decommissioning of offshore renewable energy installations under the Energy Act 2004* published in March 2019 and Marine Scotland's publication *Offshore Renewable Energy: decommissioning guidance* published in November 2019.

7.2 To minimise risks to mariners and SAR Operations there is an expectation that all infrastructure above the seabed and the sea surface will be removed. In the time between when the installation ceases to be operational and its removal, appropriate mitigation measures as per section 4.15 must be applied.

7.3 An agreed and updated ERCoP must be in place prior to the removal of any offshore infrastructure.

7.3 In order to confirm the seabed has been returned as close to its original profile once all, or some, of the infrastructure has been removed as required, a hydrographic survey is required of the cable route(s) and the installed generating assets area in accordance with the guidelines in Annex 4.

8. New and Emerging Technologies

8.1 It is recognised that the OREI industry is constantly evolving and its associated technology and procedures are developing. This means that there is an increasing demand on the UK's territorial seas and the EEZ and the MCA wishes to ensure that the increased use of those resources is managed in such a way that any risks that might impact on safety and pollution of the marine environment is kept to as low as is reasonably practicable.

8.2 The MCA continues to work with other regulators, navigation stakeholders and developers in achieving this goal. Regular meetings are held under the auspices of the Nautical and Offshore Renewable Liaison Group (NOREL) at which technical and consenting issues are discussed, and if necessary, referred to the Technical Working Group. Agreed recommendations and guidance is periodically agreed by NOREL and the MCA reserves the right to vary or modify the recommendations in this document based on experience or in accordance with internationally recognised standards in the interest of safety of life at sea and protection of the marine environment.

More Information

UK Technical Services Navigation
Maritime and Coastguard Agency
Bay 2/20
Spring Place
105 Commercial Road
Southampton
SO15 1EG

Tel: +44 (0) 20 3817 2554
e-mail: navigationsafety@mcga.gov.uk

General Inquiries: infoline@mcga.gov.uk

MCA Website Address: https://www.gov.uk/mca

File Ref: MNA/053/010/0626

Published: April 2021
Please note that all addresses and
telephone numbers are correct at time of publishing

Safer Lives, Safer Ships, Cleaner Seas

Printed on material containing minimum 75% post-consumer waste paper

An executive agency of the Department for Transport

Annex 1

Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI)

The MCA's "Methodology" document provides the recommended risk assessment methodology to use when preparing a Navigation Risk Assessment (NRA) for an OREI as part of the Shipping & Navigation chapter of a development consent application. It is based on the International Maritime Organization's Formal Safety Assessment guidelines and its principles can be applied to all OREIs of all sizes.

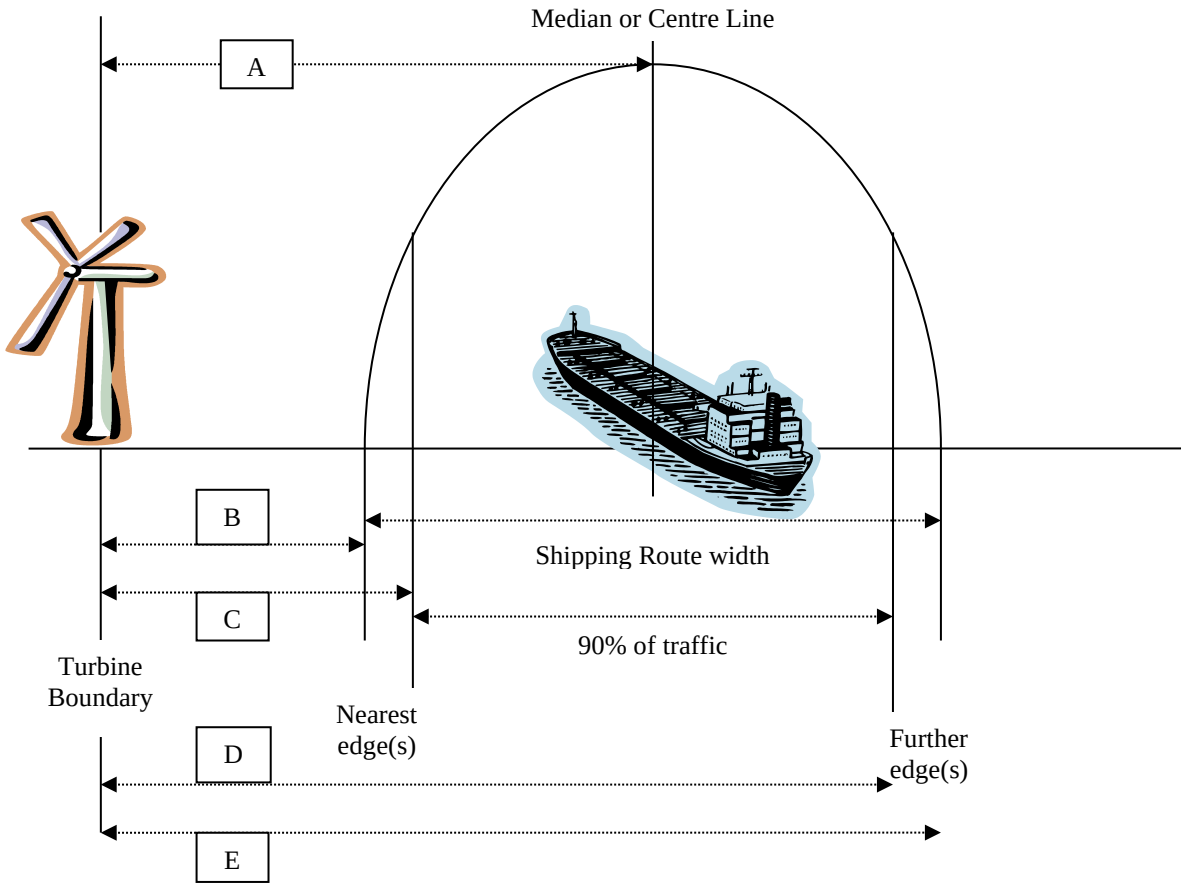
The document provides recommendations on the structure and contents of a NRA, including the identification of hazards and risk controls and a declaration that the risks associated with the OREI are As Low As Reasonably Practicable (ALARP) and tolerable.

The document is available to download from the MCA website.

Annex 2

INTERACTIVE BOUNDARIES

The below templates can be used for assessing distances between wind farm boundaries and shipping routes – see paragraph 4.7[6]



Precisely where an interactive boundary should lie requires similarly flexible definition and agreement. See diagram above where:

A = Turbine boundary to the shipping route median or centre line
B = Turbine boundary to nearest shipping route edge or IMO routeing measure boundary
C = Turbine boundary to nearest shipping 90% traffic level*
D = Turbine boundary to further shipping 90% traffic level*
E = Turbine boundary to further shipping route edge

(* = or another % to be determined)

[6] The Nautical Institute and World Ocean Council guidance document titled *The Shipping Industry and Marine Spatial Planning* may be useful to read in conjunction with this Annex: https://www.nautinst.org/uploads/assets/uploaded/299f934f-ee69-492e-8ada51abf26e8b19.pdf

WIND FARM SHIPPING ROUTE TEMPLATE

The wind farm "Shipping route" guidance template below is to be used as guidance and approval of distances between wind farm boundaries and shipping routes is on a case by case basis with MCA and relevant navigation stakeholders. It is important to recognise that the template is not a prescriptive tool but needs intelligent application and advice will be provided on a case-by-case basis.

Distance of turbine boundary from shipping route (90% of traffic, as per Distance C)[7]	Factors for consideration	Risk	Tolerability
<0.5nm (<926m)	X-Band radar interference Vessels may generate multiple echoes on shore-based radars	**VERY HIGH**	**INTOLERABLE**
0.5nm to <1nm 926m to <1852m	Mariners' Ship Domain (vessel size and manoeuvrability)	**HIGH**	**TOLERABLE IF ALARP** **Additional risk assessment and proposed mitigation measures required** * Descriptions of ALARP can be found in: a) Health and Safety Executive (2001) 'Reducing Risks, Protecting People' b) IMO (2018) MSC-MEPC.2/Circ.12/Rev.2 dated 9 April 2018, 'Revised Guidelines for Formal Safety Assessment (FSA) in the IMO Rule-Making Process'
1nm to <2nm 1852m to <3704m	Minimum distance to parallel an IMO routeing measure, as per Distance B. S-Band radar interference ARPA affected (or other automatic target tracking means)	**MEDIUM**	
2nm to 3.5nm (3704m – 6482m)	Preferred distance to parallel boundary of an IMO routeing measure, as per Distance B[8] Compliance with COLREG becomes less challenging	**LOW**	
>3.5nm (>6482m)	Minimum separation distance between turbines on opposite sides of a route	**LOW**	**BROADLY ACCEPTABLE**
>5nm (>9260m)	Adjacent wind farm introduces cumulative effect Minimum distance from TSS entry/exit	**VERY LOW**	**BROADLY ACCEPTABLE**

[7] Distance from an IMO Routeing Measure is measured from the routeing boundary i.e. Distance B.

[8] The Netherlands assessed sea room requirements using data supported by the PIANC assessment for channel design and the PIANC Interaction Between Offshore Wind Farms and Maritime Navigation (2018) report. In general, they strive for an obstacle free, or buffer, zone of 2nm between wind farms and shipping routes.

Annex 3

Under Keel Clearance Policy Paper, NOREL, May 2014

Guidance To Developers in Assessing Minimum Water Depth over Tidal Devices[9]

Purpose
The purpose of this paper is to provide guidance to developers in determining an appropriate margin of safety for vessels transiting over tidal devices and their associated structures.

This Paper is intended to assist discussions between developers and MCA and represents guidance only. Developers are free to deviate from the approach where they consider it necessary, can present a sound argument for doing so and/or offer mitigation measures.

Additionally, it is intended that this paper assists developers in identifying suitable locations for underwater devices when considered in the context of available water depth, vessels and craft that transit the area. However, it is not intended that this paper removes the need for developers to consult with the relevant regulator and advisors.

This UKC guidance addresses the worst case scenario, each specific development will have its own unique characteristics and will therefore be assessed on a case by case basis.

Background
Traditionally, the (minimum) under keel clearance was calculated as one of the factors required to provide safe passage for a vessel. Once known, this would allow the most viable route to be planned taking into account a vessel's size, draught and nature of cargo. Many vessel transits occur in the confined waters of ports and harbours where a minimum clearance can be defined and controlled. Many ports use whichever is the greater of a defined figure or 10% of a vessel's draught as the minimum under keel clearance.

Transits of areas of limited water depth in relation to a ship's draught and available width of navigable water are undertaken with caution, at reduced speed, with engines ready for immediate manoeuvre, watertight doors closed, bridge manning increased and in port areas, tug assistance for larger vessels. These precautions are taken because, despite the application of a minimum under keel clearance, the likelihood of grounding on immediately adjacent shallows is increased.

When calculating compliance with this requirement, the Master considers the effects of squat, heeling and other dynamic forces on the vessel. Tidal predictions will also be taken into account and transits planned to take advantage of tidal height.

Outside ports and other confined waters, the minimum under keel clearance used is at the discretion of the Master and quite often forms part of Ship Owner/Operator, Charterer or Insurer's policies/requirements.

Ensuring safe transit
In open waters, a larger minimum under keel clearance allowance will be used to account for the vessel's dynamic movement in a seaway and other external factors leading to subsequent changes in draught. Generally transits will be planned for any state of tide.

[9] This guidance can also be applied to wave energy devices.

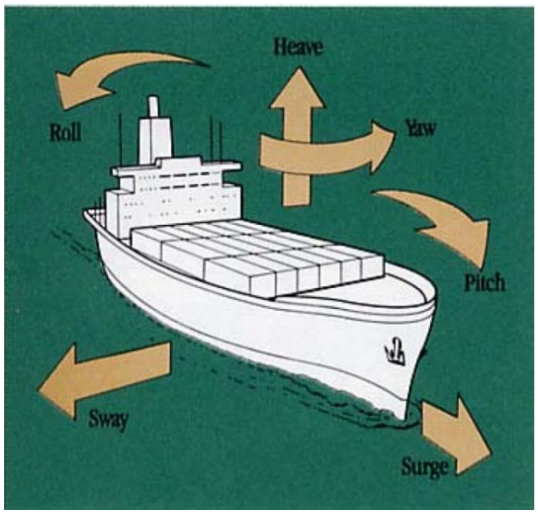


Figure 1: Vessel movements in a seaway

Available depth of water is affected by height of tide. There is a significant difference in some locations between Neap and Spring tide heights and range. Tidal heights can be affected by meteorological conditions which can on occasions mean that the actual tide height is less than the predicted height of tide.

The sea state has a significant impact with swell and sea waves causing reduced depths in the trough of a wave. Pitching and rolling along with vertical heave increases the draught of a vessel, as does the heeling of a vessel by the wind, sea and sharp rudder movements.

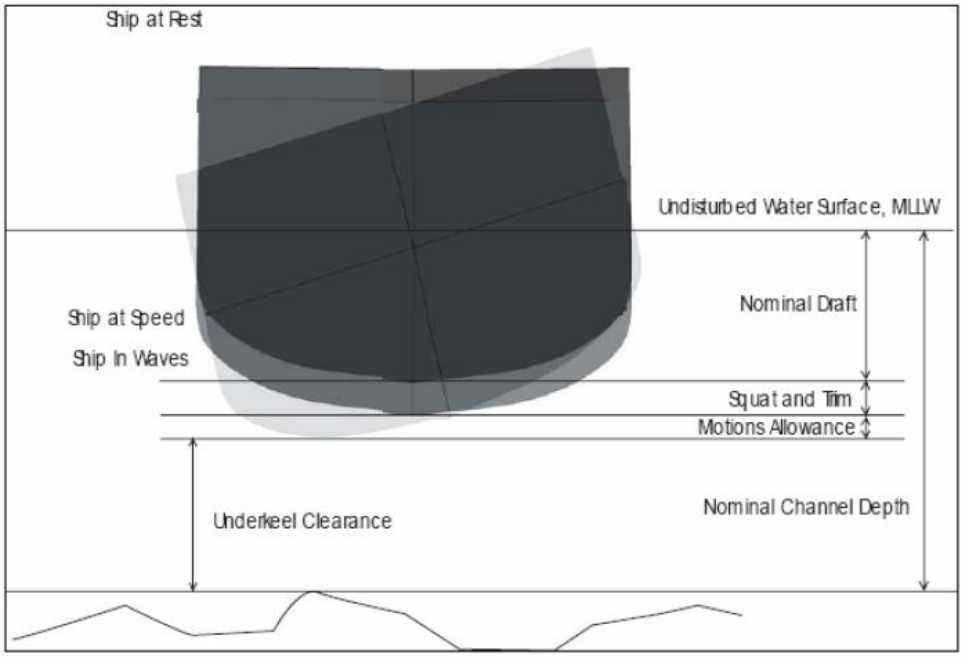


Figure 2: Effects of vessel dynamic movements on under keel clearance

Vessels create significant pressure variations around them as they pass through the body of water. These pressure variations are causal factors in vessel squat, bank effect, and interaction between vessels. The impact on these pressure variations on wave, tidal and similar devices is unknown and therefore advice from individual manufacturers should be sought.

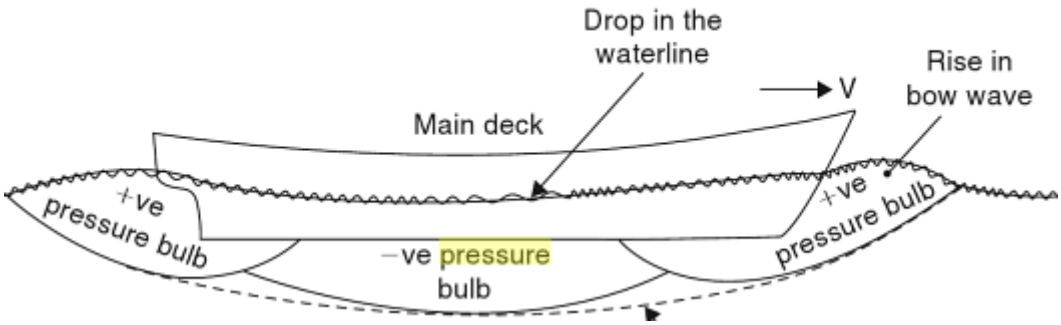


Figure 3: Vessel pressure variations (reproduced from Derret "Ship Stability for Masters and Mates")

Guidance for determining safe depth of water over wave, tidal and similar devices

Where there is no safe and reasonable deviation for marine traffic using the area, under keel clearance (UKC) over tidal turbines or other man made under water obstructions must allow for the safe transit of vessels at all states of tide.

This transit must be safe; this means that it must protect the vessel, its crew and cargo along with the wave, tidal turbine or other under water structures associated with them.

Two key factors need to be considered in determining UKC:

(i) The height of the device including its vertical safety margin. Two aspects to be considered; the position of the sea bed in relation to chart datum (CD) and the minimum vertical safety margin (M required above the device to ensure vessel transits do not damage and/or are detrimental to the device (e.g. the effects of interaction between a vessel and the device).

(ii) The draught of vessels transiting above the device. In Figure 4 the draught (Dd) is the maximum dynamic draught of the vessel and includes suitable allowances for the factors discussed under the heading 'Ensuring safe transit'.

When considered collectively, these two factors should ensure that there is no increase in likelihood of a vessel grounding (or in this case, striking an underwater device).

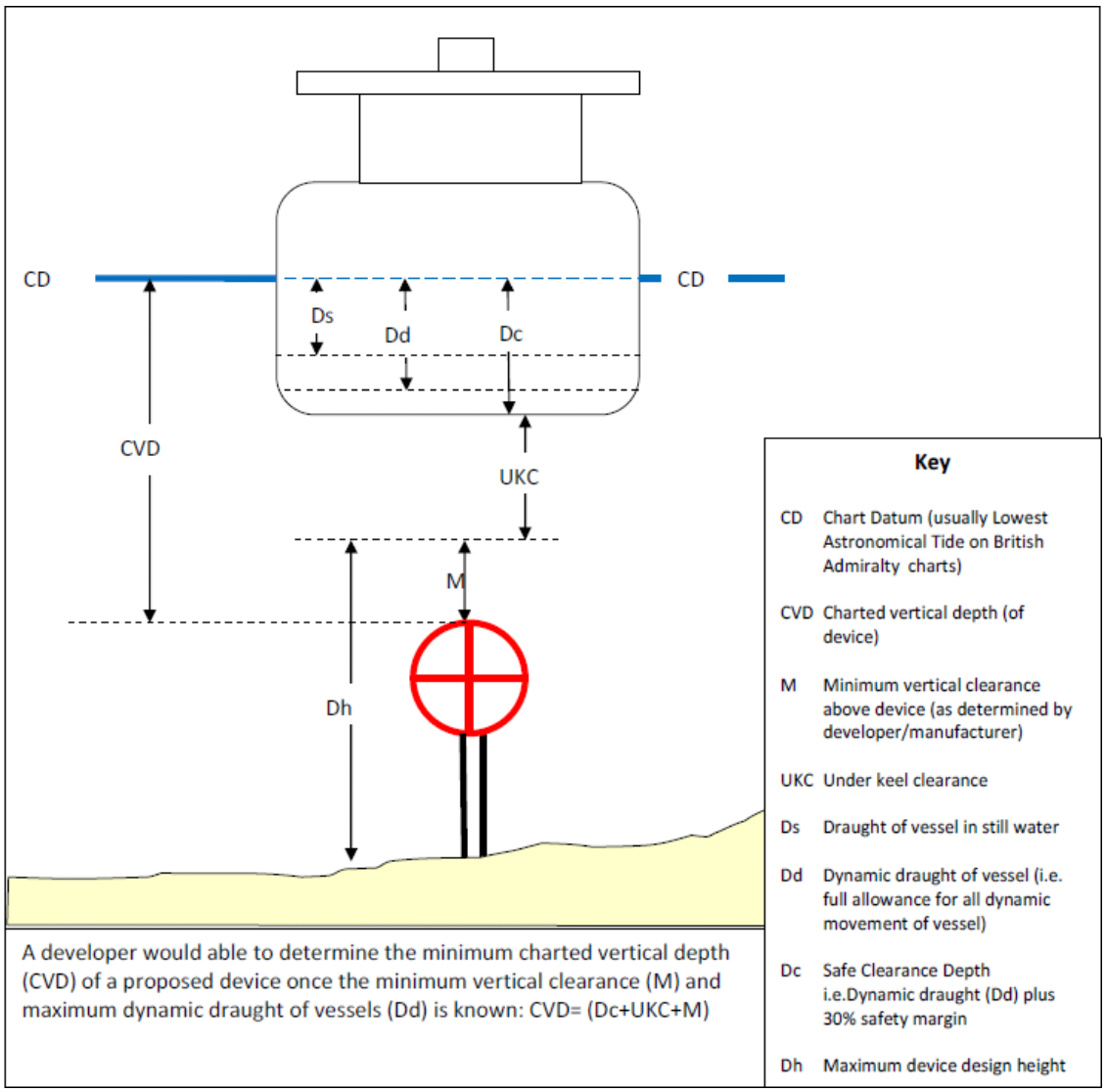


Figure 4: Illustrative view of a vessel passing over an underwater wave, tidal or similar device with the key heights and measurements

Each location will be unique and must be considered for the characteristics of sea, weather and swell. Traffic using the area must be thoroughly understood and the generic characteristic of vessels whether small, medium or large and their behaviour in expected sea states should be documented.

Based on this analysis, the maximum worst case dynamic draft can be calculated along with the least depth of available water.

OREI operators have no control over the transit time of vessels and therefore will not know what the tide state is during transit. To take account of this, their calculations should be based from chart datum and consider the worst case scenario transit at Low water (which for calculation purposes can be considered as the charted depth).

Assessment Criteria

In assessing minimum clearance depth over devices, using Figure 4 as the source data, the developer needs to establish a figure for Charted Vertical Depth (CVD) i.e. the minimum depth of water over the device, the following process should be adopted.

Establish, from traffic survey the deepest draft of observed traffic (Ds), this will require modelling to assess impacts of all external dynamic influences giving a calculated figure for dynamic draught (Dd).

A 30% factor of safety for UKC should then be applied to the dynamic draught, giving an overall safe clearance depth (Dc) to be used in calculation,

Charted Depth reduced by safe clearance depth (Dc) gives a maximum height above seabed available from which turbine design height (Dh) including any design clearance requirements (M) can be established.

This simple formula will give a minimum depth over the device against a calculated worst case scenario.

Conclusion

Taking account of the issues identified within this paper, it is clear that there is no standard figure that can be used to establish the safe clearance over underwater devices. Rather, developers will need to demonstrate an evidence based, 'case by case' approach which will include dynamic draught modelling to ascertain the safe water depth taking into consideration the guidance contained in this document.

Annex 4

Hydrography Guidelines for Offshore Developers

All hydrographic surveys should provide full seafloor coverage that meets the requirements of IHO S44ed5 Order 1a. Particular attention should be given to horizontal and vertical sounding accuracy, together with target detection requirements and, we would request that all data and reports are passed on to the UKHO for the update of the UK's nautical charts and publications.

The full details can be found in The Hydrography Guidelines for Offshore Developers and the Post Construction Hydrography Guidelines for Offshore Developers available from the MCA website.

Annex 5

Search & Rescue, Maritime Assistance Service, Counter Pollution and Salvage Incident Response

OREI developers must fulfil the requirements of the MCA's guidance document "*Offshore Renewable Energy Installations: Requirements, Advice and Guidance for Search and Rescue and Emergency Response"* which includes design, equipment and operational requirements.

A completed SAR checklist and a Hub Emergency Response Co-operation Plan (ERCoP) are required to be in place for the construction, operation and decommissioning phases of any OREI. The SAR checklist is a record of discussions regarding the requirements, recommendations and considerations outlined in the above document and should be agreed by the developer and MCA on a case-by-case basis. The content of the SAR checklist will apply throughout the life of the OREI and will be used by the MCA to ensure actions agreed pre-construction and are correctly implemented.

Templates of the SAR checklist and Hub ERCoP are available from the MCA website.

Annex 6

MGN Checklist

A checklist document has been produced as an aid for developers to confirm the guidance in this MGN has been addressed within a Navigation Risk Assessment and/or Environmental Impact Assessment as required for development consent decisions.

Full details and the template can be found on the MCA website. It should be noted a completed checklist is required to accompany the Navigation Risk Assessment and/or shipping and navigation chapter in an EIA Report.

INTERNATIONAL MARITIME ORGANIZATION

E

SUB-COMMITTEE ON NAVIGATION, COMMUNICATIONS AND SEARCH AND RESCUE
7th session
Agenda item 3

NCSR 7/INF.15
12 November 2019
ENGLISH ONLY
Pre-session public release: ☒

ROUTEING MEASURES AND MANDATORY SHIP REPORTING SYSTEMS

Report from the World Association for Waterborne Transport Infrastructure (PIANC) on Interaction between offshore wind farms and maritime navigation

Submitted by France and the Netherlands

SUMMARY

Executive summary:	This document presents a report from the World Association for Waterborne Transport Infrastructure (PIANC) on Interaction between offshore wind farms and maritime navigation (MarCom WG Report No 161 – 2018)
Strategic direction, if applicable:	Other Work
Output:	OW 4
Action to be taken:	Paragraph 2
Related documents:	Resolutions A.572(14) and MSC.419(97); NCSR 7/3/4

Introduction

1 This document provides, in the annex, a report from the World Association for Waterborne Transport Infrastructure (PIANC) on the interaction between offshore wind farms and maritime navigation (MarCom WG report No 161, 2018). Document NCSR 7/3/4 provides the background of this report.

Action requested of the Sub-Committee

2 The Sub-Committee is invited to note the information provided.

***

ANNEX
MarCom WG 161 report - 2018

PIANC

MarCom WG Report n° 161 - 2018

INTERACTION BETWEEN OFFSHORE WIND FARMS AND MARITIME NAVIGATION

The World Association for Waterborne Transport Infrastructure

PIANC

The World Association for Waterborne Transport Infrastructure

PIANC REPORT N° 161

MARITIME NAVIGATION COMMISSION

INTERACTION BETWEEN OFFSHORE WIND FARMS AND MARITIME NAVIGATION

2018

PIANC has Technical Commissions concerned with inland waterways and ports (InCom), coastal and ocean waterways (including ports and harbours) (MarCom), environmental aspects (EnviCom) and sport and pleasure navigation (RecCom).

This report has been produced by an international Working Group convened by the Maritime Navigation Commission (MarCom). Members of the Working Group represent several countries and are acknowledged experts in their profession.

The objective of this report is to provide information and recommendations on good practice. Conformity is not obligatory and engineering judgement should be used in its application, especially in special circumstances. This report should be seen as an expert guidance and state-of-the-art on this particular subject. PIANC disclaims all responsibility in the event that this report should be presented as an official standard.

PIANC Secrétariat Général
Boulevard du Roi Albert II 20, B 3
B-1000 Bruxelles
Belgique

[redacted]

VAT BE 408-287-945

ISBN 978-2-87223-250-5

TABLE OF CONTENTS

LIST OF FIGURES

1 GENERAL ASPECTS

1.1 Scope

This report provides an approach, guidelines and recommendations to assess the required *manoeuvring space for ships in the vicinity of offshore wind farms (OWF) and the minimum* recommended distance between shipping lanes and sea areas for OWF in order to ensure a minimal risk to navigation. The report specifically addresses issues with OWF but these are a subset of Offshore Renewable Energy Installations (OREI) and some of the recommendations will have a wider application to other OREI.

This report:

- provides references to international conventions and regulations
- provides guidelines to define an appropriate safe distance to navigation for different situations
- describes the electromagnetic radiation effect on radio navigation and radio communication systems
- indicates mitigating measures to be taken into account for the safe navigation of shipping
- covers emergency situations that may occurred within or close to an OWF

This report is intended as a guide for the Marine Spatial Planning (MSP) of any Coastal State covering the identification of wind farm areas and the design, planning, construction, operation and dismantling of a wind farm.

1.2 Introduction

1.2.1 Terms of Reference

1.2.1.1 Historical Background – Definition of the Problem

Increased activity within Europe's marine waters has led inevitably to growing competition for maritime space. Competing claims from a range of activities, including fisheries, leisure navigation and locations allocated for military exercises, old ammunition dumps, navigation and anchoring areas, oil and gas exploitation, sand extraction and wind and wave energy generation are accompanied by increased pressure on vital marine ecosystems and habitats. Without the means to coordinate a common approach to the allocation of maritime space among different sectors, the problems of overlap and conflict between sectors and individual stakeholders is evident. There are also cross-border issues as developments in the maritime area of one country may well have impacts for another. The relatively new notion of Marine Spatial Planning has emerged as a means of resolving conflicts over maritime space.

In order to increase the amount of electrical energy produced by environmentally friendly means, some coastal states have decided that a significant part of the total yearly consumption has to be produced at sea. Production areas are preferably located as close as possible to the shore in order to achieve low transmission costs. For those areas which are situated between or near shipping lanes, there is a potential conflict between shipping and the production areas.

Offshore Wind Farms (OWFs) have specific issues where they are in conflict with traditional activities such as navigation. Particular aspects of OWFs that need to be considered are:

- OWFs are situated in open sea, where mariners do not expect to encounter obstacles
- OWFs have parts both under and above the water surface
- OWFs have fixed parts and moveable parts (the turbine blades)
- OWFs are individual constructions, formed into an array
- OWFs are interconnected with electrical and data transmission cabling
- OWFs are strategic energy infrastructure, making them sensitive to damage
- OWFs generate invisible perturbations in the form of electromagnetic radiation

When a sea area for the production of energy of considerable size is located close to a navigation route junction or converging area of ships' routeing or in any other way in the vicinity of ship's routeing systems or shipping lanes, it is necessary to maintain the risk to shipping at a minimum but certainly not higher

than the present level of risk. In some countries navigation within the borders of an OWF is allowed; in that case crossing traffic can be expected to emerge from the wind farm. **In particular, when an OWF is located at the starboard side of a shipping lane, the Collision Regulations (COLREGs) state that vessels in the shipping lane must give way to vessels emerging from the OWF.**

1.2.1.2 Objective and Product of the Study

In order to ensure that a sea area for the production of energy from water, currents or wind, will not interfere with sea lanes essential to international navigation or other navigation activities and will not cause problem to electronic navigation aids, the Working Group has developed a set of recommendations and guidelines to assess sufficient manoeuvring space and the minimal distance between navigation and the offshore installations, to ensure that the risk to shipping is acceptable.

The sufficient manoeuvring space and minimal distance will depend on various situations and criteria as:

- Traffic density
- Ships routeing systems/precautionary areas
- Radar and VTS
- Size of ships including manoeuvring characteristics
- Recreational activities
- Fishing activities
- Available width of the [established] traffic lane
- Crossing traffic incoming from starboard in front of a wind farm
- Crossing traffic emerging from the wind farm
- Crossing traffic incoming from starboard behind a wind farm
- The possibility of fishing vessels or other small craft being present in the area between wind farms and traffic lanes
- Weather conditions (wind and waves)
- Tidal current conditions
- The positioning of anchorage areas
- Areas for (dis)embarkation of pilots
- Effects of wind farms on the ship's radar display

The Working Group has considered international rules such as the Collision Regulations and the General provisions on ships routeing, etc.

1.2.1.3 Methodology

The approach taken by the Working Group has been to:

- review the actual practice of setting distances between shipping and OWFs to date by consultation with stakeholders
- collect available background information and review the approach taken
- give considerations for determining the safe distance for different situations, according to the various uses of the sea, the size of the vessels, the layout of the shipping routes, anchorages, pilot stations, etc.
- review of recent developments in design tools (such as risk assessments and simulation techniques) in order to assess the appropriate manoeuvring space and minimal distance between shipping and OWF in order to achieve safe navigation
- develop risk-based considerations, recommendations and guidelines for assessing the sufficient manoeuvring space and the minimal distance between shipping and areas for OWFs, in order to ensure a minimal risk level for navigation

1.2.2 Structure of the Report

The structure of this report can be summarised as follows:

Chapter 1: General Aspects
Chapter 2: Identification of Interactions & Difficulties

Chapter 3: Legal Background
Chapter 4: Navigation Constraints, Collision Avoidance and Marine Navigational Marking
Chapter 5: Electromagnetic Radiations (EMR)
Chapter 6: Emergency Procedures
Chapter 7: Guidelines and Recommendations to Assess the Required Safety Distances in Vicinity of Offshore Wind Farms

1.2.3 Related PIANC Reports

The following PIANC report is also relevant to the design and operation of approach channels:

PIANC Report N°121	Harbour Approach Channels. Design Guidelines	2014

1.2.4 Members of the Working Group

The Working Group comprised membership from PIANC some of whom are also members of IALA. WG 161 consisted of the following members:

- Capt. Jean-Charles Cornillou, WG 161 Chairman, 'Centre for Studies and Expertise on Risks, Environment, Mobility and Country Planning' (Cerema), France
- Gonzalo Montero, WG 161 Secretary, 'Engineering, Resources & Development, S.L.' (ENRED), Spain
- Raul Atienza, WG 161 Alternate Secretary, 'SIPORT XXI S.L.', Spain
- Wim Hoebee, Port of Rotterdam, the Netherlands
- Marc Huygens, DEME, Belgium
- Geert Mertens, 'Power at Sea', Belgium
- George Detweiler, United States Coast Guards, United States of America
- Hans Karl von Arnim, BSH, Germany
- Mike Pinkney, Ove Arup and Partners, United Kingdom
- Johan Eriksson, Swedish Maritime Administration, Sweden
- Jarkko Hirvelä, Finnish Transport Agency, Finland
- Haruo Yoneyama, Port and Airport Research Institute (PARI), National Institute of Maritime, Port and Aviation Technology, Japan

1.2.5 Meetings

A total of 8 meetings of the WG were held during the course of the project in Brussels, Madrid, Rotterdam, Saint-Germain-en-Laye, Le Havre.

1.2.6 Acknowledgements

The following individuals and organisations also contributed substantially to the successful completion of this report:

- Francis Zachariae, IALA Secretary-General
- Capt. Phil DAY, Chairman IALA ARM Committee, Northern Lighthouse Board, UK
- Capt. Roger Barker, Chairman IALA ARM Committee WG 1, Trinity House Lighthouse Service, United Kingdom
- David Patraiko, Nautical Institute, United Kingdom
- David Edwards, Chairman IMO/ICAO JWG on the harmonisation of SAR procedures, United States Coast Guards, United States of America
- Capt. Mohammed Kahn, Maritime Coast Guard Agency, United Kingdom
- Dr Krzysztof Bronk, National Institute of Telecommunications, Poland
- Matthieu Zekar, geographer, teacher in charge of research, National Maritime Academy Le Havre, France
- Jochen Ritterbusch, BSH, Germany

2 IDENTIFICATION OF INTERACTIONS

This chapter describes Marine Spatial Planning (MSP) and Maritime Emergency Planning (MEP) as main management tools to identify interactions between OWF and maritime navigation. From this general description, chapters 3, 4 and 5 provide detailed information and methodology.

2.1 Marine Spatial Planning (MSP)

2.1.1 What is Marine Spatial Planning

Marine Spatial Planning (MSP) is defined by UNESCO as a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives that are typically specified through the political process. MSP is an element of sea use management.

Historically, MSP has been driven by the need to preserve ecological zones and was started as a management approach for nature conservation in the Great Barrier Reef Marine Park over 30 years ago. More recently, it has been adopted in the more crowded seas of European countries and several countries in Asia, including China and Vietnam, are now using MSP to achieve both economic and environmental objectives.

In 2006, UNESCO held the first International Workshop on MSP and in 2009 they published a step-by-step approach to MSP from establishing authority, through to monitoring and evaluation. The process of establishing MSP as recommended by UNESCO is shown in Figure 1. (taken from 'Marine Spatial Planning – A step by step Approach, toward Ecosystem-based Management', UNESCO).

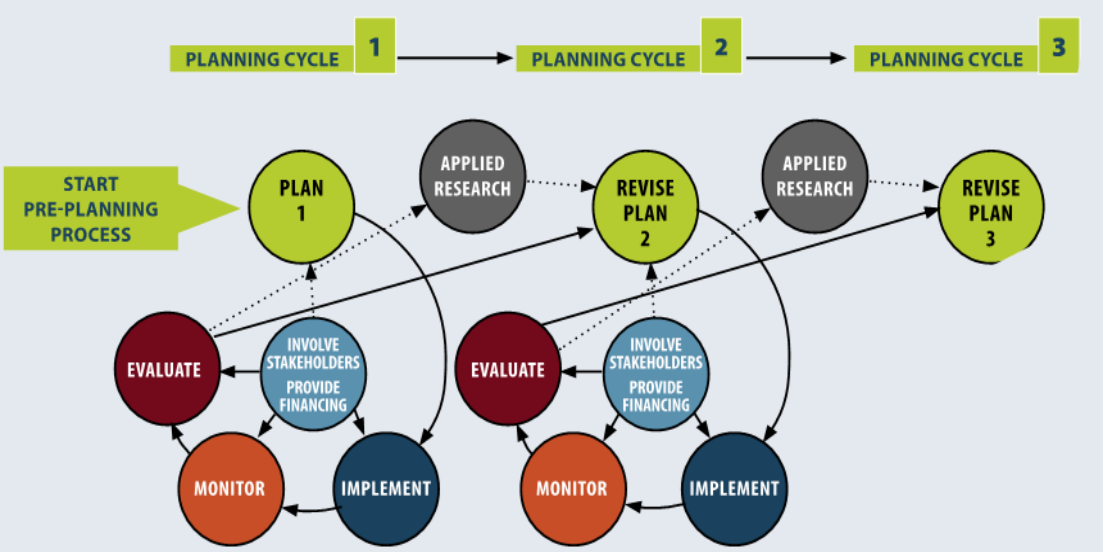


Figure 1: MSP Process – As envisioned by UNESCO

Therefore, MSP:

- is the responsibility of each maritime state
- extends over its EEZ (Exclusive Economic Zone) which is normally the lesser of 200 NM from the shore or the centreline of a strait between two countries
- is ecosystem-based
- takes a holistic view of the human activities in the area
- is place-based or area-based
- is an adaptive and iterative process following a number of planning cycles

In 2014, the EU published a directive (2014/89/EU) requesting all European maritime Member States to establish MSPs by 31 March 2021[1]. The Directive suggests that member states should consider:

- aquaculture areas
- fishing areas
- installations and infrastructures for the exploration, exploitation and extraction of oil, of gas and other energy resources, of minerals and aggregates, and for the production of energy from renewable sources, **including OWF**
- maritime transport routes and traffic flows
- military training areas
- nature and species conservation sites and protected areas
- raw material extraction areas
- scientific research
- submarine cable and pipeline routes
- tourism
- underwater cultural heritage

Since the United Nations Convention on the Law of the Sea (UNCLOS, 1982) states that the uses of ocean space are closely interrelated and need to be considered as a whole, MSP can also be seen as a logical way of structuring a country's rights and obligations over its EEZ as defined by UNCLOS. The legal background is fully described in Chapter 3.

Although all MSPs are based on the same international laws and most follow the UNESCO guidance, not all MSPs have the same basis. MSPs are the responsibility of each maritime State. Plans are based on the State's policies. These are not all the same and will probably change with time. For instance, in the North Sea there are a number of MSPs drawn up by the different coastal States. Germany has a policy that Special Areas of Conservation are a 'no-go' area for development whereas in the United Kingdom, they are not. The different policies can affect the MSP activities in adjacent waters. Government policy may support the deployment of one industry over another, i.e. offshore renewables above the interests of the Commercial Fishing Industry. Policy drivers will change the outputs of the MSP and will change over time.

2.1.2 Which Part of MSP Do We Cover?

Part of the responsibility of those tasked with setting up MSPs is to inform all interested parties and consult with the relevant stakeholders and authorities, and the public concerned, at an early stage in the development of the MSP including an OWF.

Maritime Authorities are one of the key stakeholders in any consultation process and should be engaged at all stages through from setting the policy on which MSPs are established, through to defining, implementing monitoring, evaluating and revising the MSPs.

IALA developed guidance for AtoN Authorities on the use of Marine Spatial Planning within its AtoN Requirements and Management (ARM) Committee. The final IALA documents on this subject are:

- IALA Recommendation R1010 – 'The Involvement of Maritime Authorities in Marine Spatial Planning (MSP)'
- IALA Guideline G1121 – 'Navigational Safety within Marine Spatial Planning'

Marine Spatial Planning should therefore not only be seen as a national or cross-border issue but should also take into consideration international navigational interests. It will contribute to facilitate engagement in the process and inter-stakeholder co-operation at local, national and international level.

---

1 *Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning*

2.2 Maritime Emergency Planning (MEP)

In order to cover a complete risk analysis when performing a Maritime Spatial Planning (MSP), it is recommended that the State authority responsible for maritime safety around OWF coordinate a **Maritime Emergency Plan** (MEP).

MEP is a similar process to MSP covering all risks identify within the scope of the MSP. MEP can be defined as follows:

Maritime Emergency Planning (MEP) is the process of risks analysis and contingency planning within a Marine Spatial Plan (MSP)[2].

2.2.1 Contingency Planning

Whatever the cause of an accident or disaster there are well-known general guidelines to responding through an emergency management system. Contingency planning consists of 5 phases: planning, prevention, preparedness, response and recovery.

Figure 2: The 5 phases in contingency planning [adapted from FEMA]

Planning ① – Identify potential risks causing an emergency

Effective risk management allows identification of a project's strengths, weaknesses, opportunities and threats. By planning for unexpected events, the organisation or project can be ready to respond if they arise. Risk management has to be done as a first step in the emergency planning.

Prevention ② – Mitigate future emergencies or minimise their effects

This phase includes any activities that prevent an emergency, reduce the likelihood of occurrence, or reduce the damaging effects of unavoidable risks. Mitigation activities should be considered long before an emergency happens, but also after an emergency has been resolved (to learn lessons and reduce the chance of re-occurrence) [FEMA, 1998].

Preparedness ③ – Preparing to handle an emergency

This phase includes developing a contingency plan before an event occurs including actions that will improve chances of successfully dealing with an emergency. For instance, drafting a detailed

2 *The concept of MEP was generated by WG 161*

emergency response flow chart for each identified risk, organizing emergency drills, training staff of involved emergency response parties, evaluating planning and taking corrective actions where needed. All these preparedness activities take place before an emergency occurs [FEMA, 1998].

Response ④ – Responding safely to an emergency

This phase includes actions taken to save lives and prevent further property damage in an emergency situation. Response is putting your preparedness plans into action. Response activities take place during an emergency [FEMA, 1998].

Recovery ⑤ – Recovering from an emergency

After an emergency and once the immediate danger is removed, the recovery phase activities will be implemented. Recovery includes actions taken to return to a normal or an even safer situation following an emergency. Plainly, recovery takes place after an emergency [FEMA, 1998].

Many of the Contingency planning phase graphics like in Figure 2 show overlap of adjacent phases. This acknowledges that critical activities frequently cover more than one phase, and the boundaries between phases are seldom precise. Most sources also emphasise that important interrelationships exist among all the phases. For example, 'mitigating' risk by decreasing the possibility of occurrence will reduce the problems in the 'responding' phase [Baird, 2010].

2.2.2 What Kind of Emergency Do We Cover?

At sea, and in particular around OWF, we can order risks by their nature of consequences on:

- **People**: all accidents affecting health, safety and security of persons with search and rescue (SAR) as the most important respond.
- **Planet**: all accidents affecting the environment with pollution control as a primary focus.
- **Property**: all accidents affecting properties, in particular ships and wind turbines, with salvage as the main emergency respond.
- **Profession**: all accidents affecting business and threatening the liability and reputation of any socio-economic activities.

On 18 June 2015, IMO adopted MSC-MEPC.2/Circ.12/Rev.1 revised guidelines for formal safety assessment (FSA) for use in the IMO rule-making process. These guidelines can also be used in the MEP process. Formal Safety Assessment (FSA) is a structured and systematic methodology, aimed at enhancing maritime safety, including protection of life, health, the marine environment and property, by using risk analysis and cost-benefit assessment. FSA may be useful in those situations where there is a need for risk reduction but the required decisions regarding what to do are unclear, regardless of the scope of the project. In these circumstances, FSA will enable the benefits of proposed changes to be properly established, so as to give a clearer perception of the scope of the proposals and an improved basis on which they take decisions.

In the case of OWF, the State authority responsible for maritime safety should:

- develop 'stress tests' crisis management tools, in the spirit of exercises developed within the France-United Kingdom agreement 'MANCHEPLAN' to combine resources for Search and Rescue (SAR) operation and in particular for major disaster management
- include in emergency plans the concept of major industrial risks by testing scenarios involving a merchant ship subjected to damage

Although the MEP would normally follow the MSP, for larger projects the MEP should be an integral part of the MSP.

9 steps of the Maritime Emergency Planning (MEP) can be identified:

1) Area analysis around the future wind farm

1. Provision of risk reduction study, by the developer of OWF, for the benefit of the State authority
2. Definition of the distances separating the OWF from other marine infrastructures, maritime safety infrastructures and trade routes leading to it
3. Summary of planned maritime activities after commissioning the OWF

2) Study of a scenario of crisis and implementation of resistance testing

4. Simulation of emergencies after commissioning the OWF
5. Identification of key operational roles of the emergency management system (Search and Rescue, salvage, towing response, etc.)
6. Simulation of emergency scenarios including those that could lead the emergency management system to operate in degraded mode (incidents involving a large vessel, dangerous cargo, etc.)
7. Evaluation of the ability to contain the emergency
8. Identification of related functions that might assist in managing the emergency (monitoring of navigation, emergency anchorage, port services, VTS, etc.)

1. Nautical Recommendations

9a Level 1: Recommendations for changing operational procedures for:

- emergency prevention
- emergency management
- contingency planning

Then, if necessary:

9b Level 2: Recommendations for changes to equipment, infrastructure and regulations.

3 LEGAL BACKGROUND

This section discusses the most important international provisions, regulations and guidelines for marine spatial planning related to safe distances to multiple offshore structures, such as wind farms.

3.1 International References

3.1.1 UN (UNCLOS)

The United Nations Convention on the Law of the Sea (UNCLOS), also called the Law of the Sea Convention or the Law of the Sea treaty, is the international agreement that resulted from the third United Nations Conference on the Law of the Sea (UNCLOS III), which took place between 1973 and 1982. The Law of the Sea Convention defines the rights and responsibilities of nations with respect to their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources. The Convention, concluded in 1982, replaced four 1958 treaties. UNCLOS came into force in 1994.

In this respect, Member States and private companies planning offshore wind farms have to comply with UNCLOS for the use of the sea.

3.1.2 UNESCO (MSP)

UNESCO – the United Nations Educational, Scientific and Cultural Organisation – is responsible for coordinating international co-operation in education, science, culture and communication. Between November 2007 and May 2009, UNESCO developed a guide that provides a ‘Step-by-Step Approach for Marine Spatial Planning towards Ecosystem-based Management’. The guide was presented at the International Marine Conservation Congress [IMCC, 2009] in Washington DC. The guide uses a clear, straightforward step-by-step approach to show how marine spatial planning can be set up and applied toward achieving ecosystem-based management. Most steps are illustrated with relevant examples from the real world.

3.1.3 IMO (SOLAS, COLREGs, GPSR, ...)

IMO – the International Maritime Organisation – is the United Nations specialised agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships. As a specialised agency of the United Nations, IMO is the global standard-setting authority for the safety, security and environmental performance of international shipping. Its main role is to create a regulatory framework for the shipping industry that is fair and effective, universally adopted and universally implemented.

International Convention for the Safety of Life at Sea (SOLAS), 1974 was adopted on 1 November 1974 and entered into force on 25 May 1980. The SOLAS Convention in its successive forms is generally regarded as the most important of all international treaties concerning the safety of merchant ships.

The Convention on the International Regulations for Preventing Collisions at Sea (1972), as amended (COLREGs), is published by the IMO. The COLREGs set out, among other things, the ‘rules of the road’ or navigation rules to follow by ships and other vessels at sea to prevent collisions between two or more vessels. COLREGs is detailed in chapter 4.2.1 for the concept design of OWF and the estimation of the safety distance between the traffic lanes and an OWF, in order to help OWF developers and planners to understand the risk of collision.

The General Provisions on Ships’ Routeing (GPSR) aim for improving the safety of navigation in converging areas and in areas where the density of traffic is heavy or where freedom of movement of shipping is inhibited by restricted sea room, the existence of obstructions to navigation, limited depths or unfavourable meteorological conditions.

3.1.4 ITU (RR)

The International Telecommunication Union (ITU), based in Geneva, co-ordinates and standardises the operation of telecommunication networks and services and advances the development of communications technology. The Radio Regulations (RR) is an intergovernmental treaty text of the ITU. The first Radio Regulations were concluded in Berlin in 1906 as the Radiotelegraph Service Regulations. The RR cover both legal and technical issues. The Regulations serve as a supranational instrument for the optimal international management of the spectrum.

The Radio Regulations define:

- the allocation of different frequency bands to different radio services
- the mandatory technical parameters to be observed by radio stations, especially transmitters
- procedures for the co-ordination (ensuring technical compatibility) and notification (formal recording and protection in the Master International Frequency Register) of frequency assignments made to radio stations by national governments
- other procedures and operational provisions

3.1.5 ICAO (ICA Convention Annex 14)

The International Civil Aviation Organisation (ICAO) is an UN specialised agency, created in 1944 upon the signing of the Convention on International Civil Aviation (Chicago Convention).

ICAO works with the Convention's 191 Member States and global aviation organisations to develop international Standards and Recommended Practices (SARPs) which States reference when developing their legally-enforceable national civil aviation regulations.

There are currently over 10,000 SARPs reflected in the 19 Annexes to the Chicago Convention which ICAO oversees.

The ICAO Annex 14 sets out the fundamental rules and requirements for Airport Design and Operations, which States undertake to apply through national laws. These rules are also applicable for wind farms in relation to aviation.

3.2 International Recommendations

This section discusses the most important international provisions, regulations and guidelines for marine spatial planning related to safe distances to multiple offshore structures such as wind farms. The section focuses on those regulations that are definitive for the minimum distance from the border of a shipping route (or anchorage) to an area with multiple objects (e.g. wind turbines).

Points to note:

- 80 % of all disasters at sea are caused by human error. It is therefore realistic to keep certain margins when considering a safe distance
- This section is not applicable to areas with multiple objects in shallow waters, where shipping traffic inside such area is not possible
- When the provisions and regulations were designed, multiple structures such as wind farms did not yet exist. However, the existing provisions and regulations provide sufficient guidance to argue a safe distance to such arrays.

The following internationally established, regulations and guidelines are applicable for this purpose:

- United Nations Convention on the Law of the Sea (UNCLOS)
- General Provisions on Ships' Routeing (GPSR) of the International Maritime Organisation (IMO)
- Standards for ship manoeuvrability

The relation of these provisions and regulations with the minimum distance to areas with multiple objects will be discussed.

3.2.1 UNCLOS

United Nations Convention on the Law of the Sea (UNCLOS)

Extract from UNCLOS article 21:

Laws and regulations of the coastal State relating to innocent passage

The coastal State may adopt laws and regulations, in conformity with the provisions of this Convention and other rules of international law, relating to innocent passage through the territorial sea, in respect of all or any of the following:
(a) the safety of navigation and the regulation of maritime traffic;
(b) the protection of navigational aids and facilities and other facilities or installations;

In conformity to UNCLOS Article 21.1 a):
Any State may take any action on safety issues of navigation.

In conformity to UNCLOS Article 21.1 b):
This implies that the coastal State shall adopt provisions for the 'protection of equipment and systems with navigation and other equipment or facilities' to ensure the right of innocent passage to all ships in accordance with Article 171 of UNCLOS. Those measures may include for instance the protection of vessel traffic services radars, aids to navigations, radionavigation or radio communications systems.

Extract from UNCLOS Article 60:

1. In the exclusive economic zone, the coastal State shall have the exclusive right to construct and to authorize and regulate the construction, operation and use of:

(a) artificial islands;

(b) installations and structures for the purposes provided for in article 56 and other economic purposes;

(c) installations and structures which may interfere with the exercise of the rights of the coastal State in the zone.

4. The coastal State may, where necessary, establish reasonable safety zones around such artificial islands, installations and structures in which it may take appropriate measures to ensure the safety both of navigation and of the artificial islands, installations and structures.

5. The breadth of the safety zones shall be determined by the coastal State, taking into account applicable international standards. Such zones shall be designed to ensure that they are reasonably related to the nature and function of the artificial islands, installations or structures, and shall not exceed a distance of 500 meters around them, measured from each point of their outer edge, except as authorized by generally accepted international standards or as recommended by the competent international organization. Due notice shall be given of the extent of safety zones.

6. All ships must respect these safety zones and shall comply with generally accepted international standards regarding navigation in the vicinity of artificial islands, installations, structures and safety zones.

7. Artificial islands, installations and structures and the safety zones around them may not be established where interference may be caused to the use of recognized sea lanes essential to international navigation.

The 500-metre zone described in paragraph 6 is for 'protection of the structure' and is not meant as a safe distance for safe manoeuvring according the COLREGs.

Interference (paragraph 7, above) means, for example, limited ability to comply with the COLREGS. The COLREGS do not define how much space is required for this. However, with the knowledge of guidance provided to shipbuilders regarding maximum room for full round turns (Standards for Ship Manoeuvrability (MSC/Circ. 1053), there is an argument for the definition of a minimum distance.

3.2.2 IMO

A. General Provisions on Ships' Routeing

GPSR 1.1

The purpose of ships' routeing is to improve the safety of navigation in converging areas and in areas where the density of traffic is great or where freedom of movement of shipping is inhibited by restricted sea room, the existence of obstructions to navigation, limited depths or unfavourable meteorological conditions.

To demonstrate that the routeing measure improves safety, a Formal Safety Assessment (FSA) is recommended. This FSA can provide arguments for selecting a certain route and is based on a probabilistic risk assessment.

The master will make his own risk assessment when passing structures along this route, and will keep a certain distance, depending on the size of the vessel, status of the main engine, weather conditions, traffic, so he can act according the COLREGs. This risk assessment is deterministic, since the master does not want any accident at all.

If all masters are of opinion that the applicable routeing measure takes the vessel too close to multiple structures, they all shift to one side of the routeing measure, causing the density of shipping to increase at that side, which is not in line with the starting point of GPSR: to improve safety of navigation.

Therefore, demonstrating that a new routeing measure improves safety of navigation can be done by means of FSA. However, determining the safe distance to structures along that route should be done via a deterministic approach, using the rules and regulations which a master should follow.

GPSR 6.4

Course alterations along a route should be as few as possible and should be avoided in the approaches to convergence areas and route junctions or where crossing traffic may be expected to be heavy.

Bearing in mind that masters keep a safe distance to certain structures, again the structures should not be positioned in such a way that certain vessels will change course in order to reach that safe distance.

GPSR 6.8

Traffic separation schemes shall be designed so as to enable ships using them to fully comply at all times with the International Regulations for Preventing Collisions at Sea, 1972, as amended (COLREGs).

The safe distances to structures should be determined in such a way that a vessel can act according to the COLREGS at all times: i.e. also when sailing on the border of a routeing measure.

GPSR 6.10

Traffic lanes should be designed to make optimum use of available depths of water and the safe navigable areas, taking into account the maximum depth of water attainable along the length of the route. The width of lanes should take account of the traffic density, the general usage of the area and the sea-room available.

It is not easy to determine a safe width of a routeing measure. A guideline that has proved to be accurate, based on an AIS study by Maritime Institute Netherlands (MARIN), takes into account the:

- Number of vessels: based on AIS study, keeping in mind the future developments during the lifespan of the structures
- Maximum size of vessels: keeping in mind the future developments in ship size during the lifespan of the structures
- Number of vessels using the route, allowing 2 ship lengths per vessel:

< 4,400 vessels per year:	2 vessels side to side
> 4,400 vessels and < 18,000 vessels:	3 vessels side to side
> 18,000 vessels:	4 vessels side to side

Example: a traffic lane which accommodates 18,000 vessels per year with a maximum size of 400 meters should be at least 3,200 metres wide (= 4 x 2 x Length = 4 x 2 x 400 m).

This figure matches with most of the present traffic lanes (e.g. approach Rotterdam, TSS Maas West).

In section 3 (Responsibilities of Contracting Governments and recommended and mandatory practices) of the General provisions on ships' routeing, a new paragraph 3.13*bis* is added, as follows:

GPSR 3.13bis

In planning to establish multiple structures at sea, such as extensive concentrations of wind turbines, Governments should take into account, as far as practicable, the impact these could have on the safety of navigation. Traffic density and prognoses, the presence or establishment of routeing measures in the area, the manoeuvrability of ships and their obligations under the International Regulations for Preventing Collisions at Sea, 1972, as amended, should be considered when planning to establish multiple structures at sea. Sufficient manoeuvring space, e.g. for allowing evasive manoeuvres extending beyond the side borders of traffic lanes (i.e. separation zones or lines) of Traffic Separation Schemes, should be accommodated for ships making use of routeing measures near multiple structure areas.

In practice, Member States submit to IMO, at the Sub-committee on Navigation, Communications and Search and Rescue (NCSR), their ship's routeing proposals (ship's routeing Measures) such as Traffic Separation Schemes (TSS) in the high-density areas of navigation, such as the TSS that France proposed off Ushant, Casquets or Pas-de-Calais. The proposal for the TSS for the Pas-de-Calais/Dover Strait was submitted to IMO together with the United Kingdom. Other ship's routeing measures around OWF in the high sea or next to international ship's routeing measures already adopted by the IMO should also be submitted to the sub-Committee NCSR.

B. Standards for Ship Manoeuvrability

IMO resolution MSC.137(76) Standards for ship manoeuvrability and MSC/Circ.1053 explanatory notes for the standards for ship manoeuvrability are the IMO Standards for ship manoeuvrability. The Standards should be used to evaluate the manoeuvring performance of ships and to assist those responsible for the design, construction, repair and operation of ships.

The Standards were selected so that they are simple, practical and do not require a significant increase in trials time or complexity over that in current trials practice. The Standards are based on the premise that the manoeuvrability of ships can be adequately judged from the results of typical ship trials manoeuvres. It is intended that the manoeuvring performance of a ship be designed to comply with the Standards during the design stage, and that the actual manoeuvring characteristics of the ship be verified for compliance by trials. Alternatively, the compliance with the Standards can be demonstrated based on the results of full-scale trials, although the Administration may require remedial action if the ship is found in substantial disagreement with the Standards. Upon completion of ship trials, the shipbuilder should examine the validity of the manoeuvrability prediction methods used during the design stage.

The ‘manoeuvring characteristics’ addressed by the IMO Standards for ship manoeuvrability are typical measures of performance quality and handling ability that are of direct nautical interest. Each can be reasonably well predicted at the design stage and measured or evaluated from simple trial-type manoeuvres.

Turning Tests

A turning circle manoeuvre is to be performed to both starboard and port with 35° rudder angle or the maximum design rudder angle permissible at the test speed. The rudder angle is executed following a steady approach with zero yaw rate. The essential information to be obtained from this manoeuvre is tactical diameter, advance, and transfer (See Figure 3). Turning circle manoeuvre will be used in Chapter 4.2.1 to explain the concept design of the safety distance between a traffic lane and an OWF.

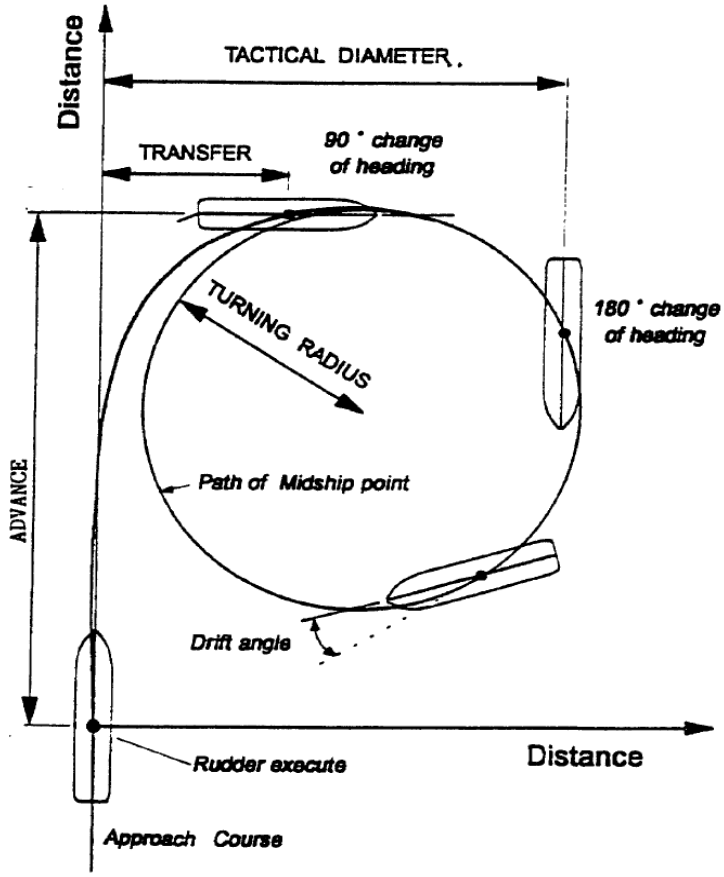


Figure 3. Definitions used on turning circle, extracted from IMO resolution MSC.137(76)

3.2.3 ICAO (ICA Convention Annex 14) and CAA

ICAO – International Civil Aviation Organisation

Particularly if airfields are located in the vicinity of the proposed site of a windfarm an aeronautical study should be carried out. Wind turbines may extend above the ‘obstacle protection surface’ (OPS) and hence adversely affect the safety of operations of airplanes in which case additional measures should be taken. A minimum distance for wind turbines to the runway of up to 15 kilometres may be required in order to prevent penetration of the obstacle protection surface.

The standards for wind turbines were developed at a time when the overall height (nacelle plus vertical blade) of wind turbines was less than 150 m. The advent of wind turbines of more than 150 m necessitates that these be addressed in revised standards.

In this respect proposals for changes in ICAO Annex 14 are in discussion, but have not been formalised at the date of this report. In discussion are amongst other things:

- simplification and clarification of Annex 14 Volume I on visual aids
- clarification on light intensity distribution
- marking and lighting of wind turbines over 150 m in height

The specification is restricted to structures with a height not greater than 315 m. It is considered that wind turbines higher than 315 m would require a different approach for protection.

CAA – Civil Aviation Authority (UK)

Offshore windfarm developers should check their plans with the (national) competent aviation authority and have their approval.

As an example in the UK (under the Civil Aviation Act), the Civil Aviation Authority (CAA) is responsible for providing advice about aviation safety. The main topics of CAA's policy on wind turbine developments are summarized below:

1. Wind turbine developments and aviation need to co-exist. However, safety of the air is paramount and will not be compromised.
2. Due to the complex nature of aviation operations, and the impact of local environmental constraints, all potential negative impact of proposed wind turbine developments on aviation operations must be considered on a case by case basis.
3. To provide timely advice to aviation and wind development stakeholders the publication of CAP 764 (CAA Policy and Guidelines on wind Turbines) is available on the CAA website: www.caa.co.uk/windfarms.

4 NAVIGATION CONSTRAINTS, COLLISION AVOIDANCE & MARINE NAVIGATIONAL MARKING

This section discusses the most important factors that must be considered in safety of navigation related to recommended distances to offshore wind farms (OWF).

4.1 Elements

4.1.1 Ships

The analysis of safety distances between shipping routes and OWF require a good description of the ships that may be navigating close to the OWF. In this respect all kinds of ships in the area should be considered:

- Commercial ships (goods and passengers)
- Fishing vessels
- Pleasure boats
- Supply vessels, tugboats, maintenance boats

The main characteristics of the ships must be defined in order to have a good description of the fleet. It is recommended to make a compilation of factors such as type of ship and goods carried (hazardous or not), main dimensions (length, beam, draught), manoeuvring characteristics (result of manoeuvring tests if available, number of propellers, rudders and thrusters), auxiliary systems such as tugs (in restricted areas or close to ports).

4.1.2 Marine Traffic

As a complement to the fleet description, it is important also to analyse the routes and the frequency of the ships since traffic density is an important parameter. This analysis will provide information about the real navigation areas and it is an important input to the risk analysis.

It is recommended to make a traffic survey of the area that includes all the vessel types found in the area and cover at least one year of information in order to account for seasonal variations in traffic patterns, fishing operations and recreational activities. In that respect, AIS data records are very useful for traffic analysis. This study must be complemented by a forecast of future traffic taking into account market trends, infrastructure investments in the area or changes in traffic routes.

One of the aims of this analysis should be to provide a good definition of the different actual shipping routes in the area. In this respect, TSS or marked channels shown on Nautical Charts may provide a first approximation but also, actual shipping lanes should be defined based on recorded traffic statistics.

Shipping routes are routes regularly used by ships, which are determined by geographical and hydrographic parameters. These routes cover long distances, particularly between two TSS and also include the approaches to the entrance channels of a port as well as passages between two ports.

The distance between a wind farm and a shipping route is defined as the distance between the physical boundary of the wind farm and the nearest edge of the shipping route or navigation channel.

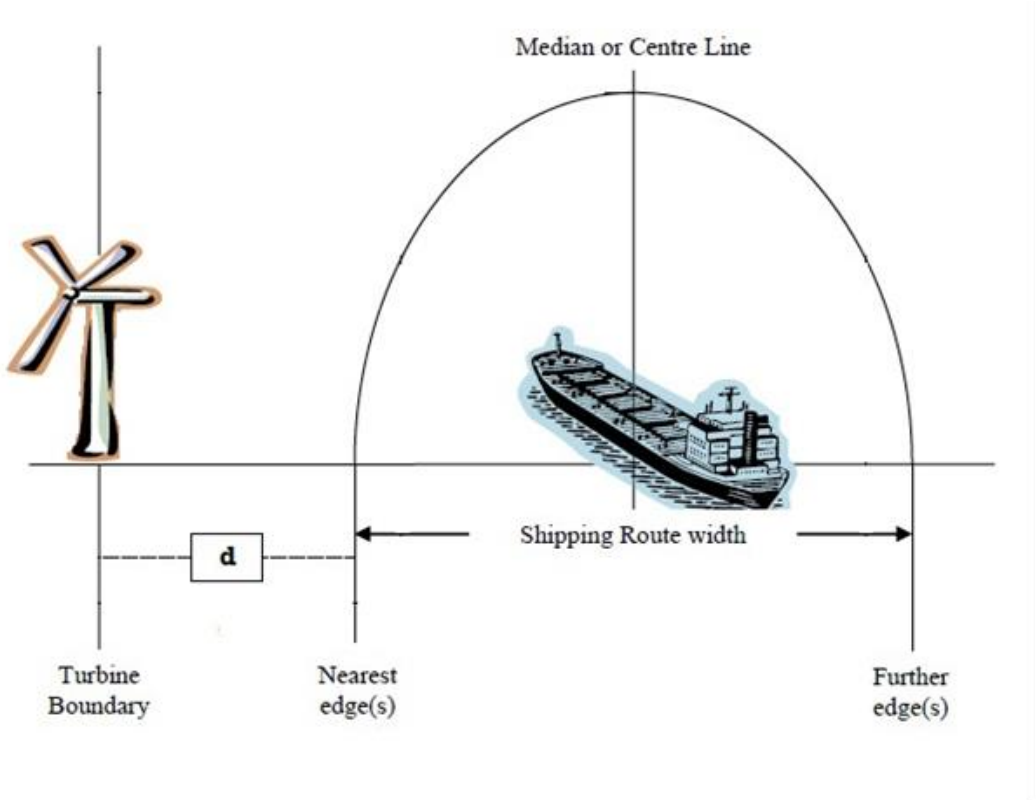


Figure 4: Distance between wind farm and shipping route

4.1.3 Geometric Configuration of the Water (Hydrographic)

A good description of the hydrographic conditions is also needed in order to identify the areas of interaction between navigation and wind farms installations. Nautical Charts include the most important information related to the hydrographic and marine environment and should be the first reference point for the study of the physical environment. In addition, a detailed bathymetric survey of the whole affected area (wind farm and navigation routes identified in previous section) is recommended.

The identification and description of navigation channels will provide good information for the analysis of the interaction areas. It is important to understand the behaviour of the ships in the vicinity of the wind farms. TSS (Traffic Separation Schemes), marked channels, approach channels or open water are examples of navigation areas that impose different behaviour on the navigation of the ships.

Combining bathymetry and navigation area descriptions it is possible to identify the interaction areas that should be analysed. It is important to bear in mind that these areas can be different depending on the ships considered. For example, a large vessel (with deep draught) might ground before entering the wind farm area while a smaller one may not. In another respect, TSS or marked channels impose more discipline on the ships and, in consequence, a lower probability of navigation out of them. Therefore, the analysis of the physical environment for navigation should be made considering the previous analysis of ships and marine traffic.

4.1.4 Aids to Navigation

The existence (or not) of Aids to Navigation (AtoNs) is another factor to take into account in the analysis of interaction between navigation and OWF. AtoN provide information to ships in order to assist them to maintain their desired position and route.

A compilation of the existing AtoNs should be made in order to complement the analysis of marine traffic and to get a good understanding of the restrictions to navigation. IALA distinguishes visual, sound and radio AtoNs. The study of existing AtoNs should be complemented with an analysis of the future

configuration of the area (after construction of the wind farm) including any proposal for new AtoNs for OWF marking and new channels or restrictions.

There is potential for a wind turbine to actively interfere with certain active AtoNs by producing its own low energy radio frequency (RF) signal. The problem at sea arises because there are many radio communications and radio navigation systems dedicated to safety at sea. These systems are based on terrestrial and satellite radio communications. Chapter 5 deals with this phenomenon in detail.

SOLAS V/13.2 states that: “In order to obtain the greatest possible uniformity in aids to navigation, Contracting Governments undertake to take into account the international recommendations and guidelines when establishing such aids”. Therefore, IALA recommendations O-139 on the Marking of Man-Made Offshore Structure should be followed.

4.1.5 Maritime and Atmospheric Conditions (Hydrodynamics)

For a good understanding of marine navigation is essential to have a good knowledge of hydrodynamic conditions in the area. Waves, winds and currents have a great influence in ships’ behaviour. Also, shallow water effects, such as the bank effect (the tendency for a vessel to stern to steer into a nearby shallow water bank), which might be most noticeable at low tide affect ships behaviour. Therefore, hydrodynamic studies should be performed to collect information and to provide a good description of the maritime conditions.

In the event of an accident, evasion manoeuvring or drifting events are very sensitive to the meteorological and ocean conditions. So, it is important to include these factors.

It is important, not only to provide an accurate characterization of the area, but also to identify the risk of bad weather or restricted visibility conditions that could present difficulties to the vessels that might pass close to the wind farm. Also, it is important to identify the local conditions that can cause collision in case of loss of control or power.

4.1.6 Pilotage, Escorting & Towing Requirements

A navigation area where pilotage is mandatory requires a different analysis from the point of view of manoeuvrability and traffic conditions. Where a pilot has the control of navigation, marine traffic will be more organised and there will be a higher degree of manoeuvring safety. In this case, recommended safety distances could be decreased, taking into account that marine traffic interactions are under tighter control.

A similar logic is applicable to areas where escorting or towing is required. These factors are especially relevant in detailed design stage but also can be relevant at the risk assessment stage.

Compulsory pilotage, escort or towing could also be used as mitigation or preventive measures if the need is identified in risk assessment.

Nevertheless, vessels should always be able to comply with the COLREGs as discussed in Chapter 3.2.2.

4.2 Processes in Safety Distance Estimation

The recommendations concerning safety distance between OWF and navigation should be in accordance with the elements described in the section above.

However, different levels of analysis can be performed depending on the aims and the phase of the project.

The philosophy of PIANC WG 121 considers the following two stages of design:

- **Concept Design** includes preliminary design of windfarm and navigation areas layout using data and formulae given in design guidelines together with other relevant data relating to ships and

environment. At the very first design stage only rough estimates of the safety distance are determined. The process is intended to be rapid in execution and not require excessive input data, so that alternative options (for trade-off studies) can be evaluated rapidly.

- **Detailed Design** is a more rigorous process intended to validate, develop and refine the Concept Design. The methods used in Detailed Design rely on numerical analysis (for example simulation) and therefore require more extensive and detailed input, as well as proper judgement and experience in the interpretation of their output. The outputs of the Detailed Design may be subjected to further checking for acceptability by means of marine traffic analysis, risk analysis and cost/benefit estimates. The results of these checks may lead to adjustments and a further cycle of Detailed Design.

In case of an existing OWF where the safety distance has not been taken into account, it is recommended to performance a Risk Assessment (see Section 4.2.3) that shall be approbed by the corresponding administrative authority of each country.

The safety requirements, on which bases existing OWF are build, are laid down in national or local developed safety criteria. If these criteria do not match with actual knowledge, the responsible administrations may decide to request an updated Risk Assessment (see Section 4.2.3) to be carried out to evaluate appropriate measures to reduce the risk of human life and natural resources.

4.2.1 Concept Design

The Concept Design stage is adequate for preliminary design using limited data and empirical formulae, together with data relating to ships and their environment. Concept design procedures estimate the safety distance in a conservative way, because general guidelines cannot assess all case-specific features and conditions.

In all cases the ColRegs are a good starting point for the estimation of safety distances. The main references to take into account are the following:

COLREG 2a) and b) – Responsibility

Nothing in these Rules shall exonerate any vessel, or the owner, master or crew thereof, from the consequences of any neglect to comply with these Rules or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

In construing and complying with these Rules due regard shall be had to all dangers of navigation and collision and to any special circumstances, including the limitations of the vessels involved, which may make a departure from the Rules necessary to avoid immediate danger.

The master is held responsible for having mitigating measures in place for unforeseen conditions such as a ‘Not Under Command’ situation. So, sailing very close to islands or multiple structures is not in accordance with the ‘ordinary practice of seamen’.

A study regarding ‘Not Under Command’ situations (AIS tracks in combination with Dutch Coast guard reports) shows that 90 % of the vessels drift for one hour– resulting in a drifting distance of 1.7 nautical Mile. This distance is a result of local conditions and should be evaluated for each situation.

COLREG 7c) – Risk of Collision

Assumptions shall not be made on the basis of scanty information, especially scanty radar information.

Because radar targets of vessels within an area with multiple structures tend to swap to the structures, a Closest Point of Approach (CPA) is hard to establish. Only when the vessel departs the areas can the CPA be determined. The time needed to identify and plot the vessel has been determined to be 6 minutes. If a service vessel exits the wind farm with a speed of e.g. 10 knots, crossing the course line of a passing vessel, the minimum distance needed to get a reliable CPA is 1.0 nautical miles.

AIS information is available, but a CPA based on AIS information should not be used to determine the risk for collision, since the speed input is based on absolute GPS and not on the speed through the water.

Wind farms cause radar interference in addition to the effect of swapping targets. The safe distance to avoid interference has been determined by deep sea pilots to be 0.8 NM and surveys have identified **a minimum distance of 1.5 NM** from a OWF is necessary to minimise the interference on ship born radar and the automatic radar plotting acquisition (ARPA, see chapter 5.2.5).

COLREG 15 – Crossing-Situation

When two power driven vessels are crossing so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way and shall, if the circumstances of the case admit, avoid crossing ahead of the other vessel.

COLREG 8 – Action to Avoid Collision

Action taken to avoid collision with another vessel shall be such as to result in passing at a safe distance. The effectiveness of the action shall be carefully checked until the other vessel is finally past and clear.

If the stand on vessel (i.e. the vessel with the other on her port side) does not act according the COLREGs, the give way vessel's last resort is a full round turn over starboard.

The required room for turns to starboard and port are shown in figures 5 and 6. The space for the round turn is determined as follows:

1) Start of the round turn. A round turn is not started right away. Normally one first deviates course, while observing the other vessel. This requires time. In the meantime, one deviates from the original track. The distance is normally taken as a minimum of 0.3 NM

2) The round turn itself is determined as described in the IMO Standards for Ship Manoeuvrability (IMO resolution MSC.137 (76) and MSC/Circ.1053):

- Para. 5.3.1: Turning ability: The advance should not exceed 4.5 ship lengths (L) and the tactical diameter should not exceed 5 ship lengths in the turning circle manoeuvre.
- Para. 1.2.3.5: Turning ability: Turning ability is the measure of the ability to turn the ship using hard-over rudder.

These requirements apply under controlled conditions during sea trials. It is reasonable to take an extra ships length to compensate for the fact that the Officer on Duty is not fully prepared for this manoeuvre. Therefore, the diameter of the round turn has been determined to be 6 ship's lengths.

3) The round turn should not bring the vessel closer than the 500-metre safety distance zone.

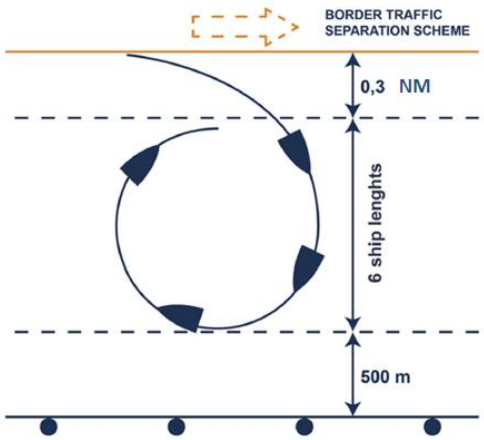


Figure 5: Required space between shipping route and a starboard side wind farm

A round turn could also be made over to port side, in case the starboard aft quarter is blocked due to an overtaking vessel for example. However, in that case the vessel will not first deviate to port, but start a round turn right away (see Figure 6).

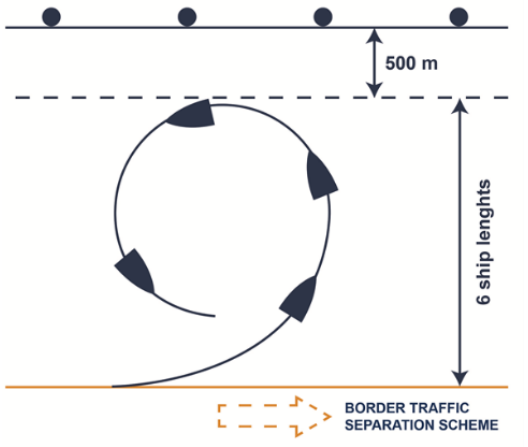


Figure 6: Required space between shipping route and a port side wind farm

Points to notice:

- It quite often happens that, after making a round turn, a Not Under Command situation occurs, due to mechanical problems (e.g. low-level alarm on oil levels, etc.)
- On many vessels, the Officer on Duty will hesitate to use hard rudder at once. One would be particularly cautious before starting such a turn on passenger ships and container vessels as it can result in significant damage to passengers, crew and cargo.
- Round turns are also made in case of a Man Over Board situation.

COLREG 10 h), I0, j)

A vessel not using a Traffic Separation Scheme shall avoid it by as wide a margin as is practicable.

A vessel engaged in fishing shall not impede the passage of any vessel following a traffic lane.

A vessel of less than 20 meters in length or a sailing vessel shall not impede the safe passage of a power-driven vessel following a traffic lane.

Fishing vessels and pleasure craft normally use the area next to the traffic lane. However, Figure 7 shows that there is little room left for sailing vessels that need to beat up against the wind for example.

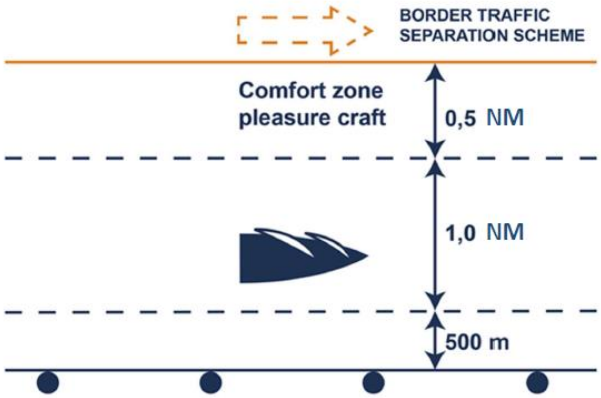


Figure 7: Required room to a TSS

Anchor Areas

There are no regulations that relate to anchorages.

However, safe anchorages should provide sufficient room to manoeuvre:

a) when the anchor is dragging
b) in the approach to an anchorage

A safety study for an offshore platform shows that the required space for a vessel to start her engines and manoeuvre when an anchor is dragging is 1.7 NM from the safety zone around a multiple structure. The same distance was found to be sufficient to provide manoeuvring space in the approach to the anchorage for all vessels making use of that particular area.

Again, this study is related to a specific area – different areas might require a separate study, but it does provide some indication of the required distances.

To Summarise

Based upon the guidelines, provisions and regulations as discussed above a **minimum distance between** a shipping route and a wind farm can be determined as follows:

- Starboard side of any route: 0.3 NM + 6 ship lengths + 500 metres
- Portside of any route: 6 ship lengths + 500 metres

4.2.2 Detailed Design

Detailed Design is a more rigorous process intended to validate, develop and refine the Concept Design. Operational aspects should be checked with reference to weather conditions, ship size and manoeuvring capacity, marine traffic, water areas, bathymetry, tug assistance, piloting, AtoN, etc. If the conditions are relatively simple and all the design criteria are easily fulfilled, there may be no need to make significant adjustments to the Concept Design. But in most cases additional analyses are necessary to determine an optimum design that will definitely be safe and usable.

Taking into account the philosophy of PIANC WG 121, detailed design involves the use of computer models whose type, purpose and methodology are outlined below. The Detailed Design of safety distances is considered using techniques which represent good present-day practice.

As in Concept Design, main design parameters are considered separately although, as already pointed out they are all interlinked. The following are a number of items which may require Detailed Design consideration:

- Critical factors including:
    (a) cargo
    (b) bottom conditions
    (c) traffic intensity
    (d) currents
    (e) waves
    (f) layout
    (g) complicated ship handling
    (h) special ships
    (i) detailed hydraulic modelling
- Accuracy (human factors)
- Optimisation
- Benefits
- Risk acceptance criteria

Tools and methods for Detailed Design include the following:

- Detailed parametric design and special formulae
- Simulation Models:
  - Ship navigation/maneuvering simulation models: Fast-Time and Real-Time Simulation models
  - Traffic Flow Model to Determine Safety Levels

Ship navigation/manoeuvring simulation models are used to determine the safety distances to wind farm and dimensions of manoeuvring areas, while traffic flow simulation models are used to determine safety levels and efficiency including quantitative risk assessment.

4.2.3 Risk Assessment

Risk assessment comprises the first step in the development and application of MEP (Maritime Emergency Planning). The aim of the risk assessment is to establish the risks which need to be managed in the area and to identify means to control them to acceptable levels.

The risk assessment process should identify the hazards, together with the events or circumstances which may give rise to their realisation, determine the risk posed by them and identify the measures that can be put in place to control the risk by preventing the realisation of the hazard and/or mitigating its effect if it does occur.

In the context of this document:

- 'Hazard' is defined as something with the potential to cause harm
- 'Risk' is defined as the combination or product of frequency of occurrence and consequence of a hazard

The risk assessment process consists of five parts:

- Data gathering
- Hazard identification
- Risk analysis
- Assessment of existing mitigation measures
- Identification of any additional risk control measures/options

Data Gathering

The data gathering process aims to establish an initial list of hazards. In essence, data gathering involves familiarisation with all aspects of the existing area where the OWF will be establish. This will include gaining a detailed understanding of:

- Topography of the OWF area and its approaches
- Environmental data (currents, tides, climate and weather, etc.)
- Traffic flows and cargoes handled
- Leisure crafts and users
- Fishing vessels
- General environment of the future OWF area, including VTS, pilotage, tug services, etc.
- Existing policies and procedures
- Priorities and safety culture of the Maritime Authority
- The organisational structure of the Maritime Authority

From this information, existing and potential hazards can be identified, together with an appreciation of how they are managed within the current safety management system. The process should include a detailed review of the existing incident database.

A number of tools can be used to accomplish hazard data gathering including:

- Questionnaires and interviews with the Maritime Authority, harbour masters and other port operations officers, pilots, other port employees, contractors and representative port users, including leisure users, fishing vessels and environmental groups
- Auditing marine and safety procedures
- Firsthand observation of various port operations (VTS, pilotage, tug operations, mooring, etc.)
- Identifying leisure harbours
- Identifying fishing harbours
- Collection of AIS data, maritime routes, etc.

Hazard Identification

The process of hazard identification attempts to list all the hazards which currently exist within the local sea area as a result of operations conducted therein. This includes and builds upon the hazards identified in the data gathering process.

One of the most effective tools for this is the group 'HAZID' (Hazard Identification) or SWIFT (Structured What-IF Techniques) meeting(s) where stakeholders (under the guidance of a suitable facilitator), identify new hazards and authenticate existing hazards and their risk control measures.

These stakeholders should include representatives of the Maritime Authority, port managers, marine professionals (including harbour masters, port control/VTS officers, pilots, PEC holders, tug masters) other port workers and users (both commercial and leisure). In all cases, personnel from management to the lowest operational level should be included to facilitate the full identification of the different levels of hazard.

Risk Analysis

Risk can be defined as the product of the probability of an event occurring and the consequences flowing from it. Thus, an event which occurs infrequently and has a low level of consequence constitutes a lower risk than one which occurs more frequently and has a higher consequence. The analysis for each hazard requires the establishment of probability of occurrence and the consequences reasonably expected to be associated with that level of probability.

While incident data can be helpful in identifying hazards, its value in assessing likely frequency of occurrence is marginal due in part to the scarcity of significant incidents and measures which have been put in place subsequent to those incidents. Near miss data may give a better impression but should still be treated with extreme caution. There will also be a number of potential major incidents identified which have never actually occurred within the particular area.

The consequences of an event are best developed by consideration of event scenarios by suitably experienced personnel. The consequences should be broken down into categories, assessing the effect of the event on personnel, on the environment, on users, and on the continued operation of the OWF (which will include the effect upon the reputation of the OWF operator). The potential for escalation of an unwanted event should be included in the consideration of consequence. The analysis can be established by qualitative or quantitative methodology, or a combination of both. Qualitative risk assessment is generally conducted on the basis of objective estimates of risk and consequences.

Quantitative Risk Assessment involves analysis based on historical data, mathematical modelling or other calculations of the probability and consequence for each hazard. Whichever method is used it will greatly assist the subsequent (ranking) process if a numerical value can be assigned to each risk. The baseline condition for the analysis should be clearly identified, and in particular which existing risk control measures are assumed to be in place. Ideally, the baseline condition would assume no existing risk control measures in place (ground zero). However, if effective use is to be made of current experience and historical data (where such measures would generally have been in place), this is difficult to achieve in practice. The analysis should generate a complete hazard list which is ranked by severity of the risk associated with each hazard. The ranking assigned should be proportional to the level of risk determined and referenced to the ALARP ('As Low As Reasonably Practicable') level. The definition of what constitutes a tolerable level of risk can usually be determined by inspection and

comparison of various hazards on the ranked hazard list, although it should be noted that it may be the subject of legislation within the country or region where the OWF will be located.

Assessment of Existing Measures

Existing control measures and defences identified in the Data Gathering and Hazard Identification stages should be reviewed. Additional control measures may be identified to address gaps, or where enhanced measures are indicated as being required by the analysis. There may be areas where risk control measures are disproportionately high, considering the risk involved, and may be reduced with subsequent benefit to resource allocation.

Risk Control

This stage identifies the specific control measures to be put in place to achieve the risk profile required by the Maritime Authority safety policy and/or other relevant legislation/standards. This will include consideration of all identified risk control options, together with the resource requirements, benefits and other consequences of their implementation.

Once the risk assessment has been completed, with risk control measures selected, the Marine Emergency Plan (MEP) can be established (or modified). The operation of these measures then becomes part of the MEP. As the MEP includes performance measurement and an audit and review process, the control measures adopted will be checked, audited and reviewed on a regular basis. The frequency of these reviews may be fixed, or may vary depending on the degree of risk identified.

The risk assessments themselves should also be subject to regular review of their applicability and effectiveness. Further information on compiling Risk Assessments for Port Operations can be obtained from References.

Software

Risk management software is available from a number of established sources. This can assist, not only with the collation, storage and updating of hazard data and risk control measures, but also with processing such data in a systematic and objective way. The software can typically process the data so as to give 'ranked' hazard lists, i.e. lists of hazards and/or risk control options which are prioritised in order of ascending or descending risk. As these systems are generally capable of continuous updating, it follows that they can show the current risk management status of the area on demand.

Such software can also generally accommodate MATRA (Multi Agency Threat and Risk Assessment) platforms to address terrorism, crime and other similar hazards. The information obtained from the system may be used by the operators to decide priorities for the allocation of resources to achieve a balanced risk profile within the targets set out in the OWF's Safety Management Policy.

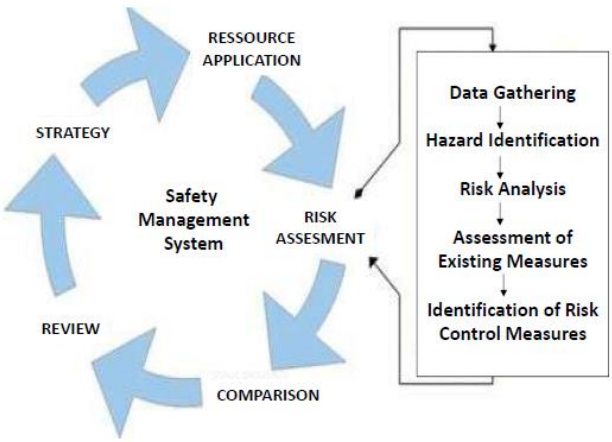


Figure 8: Safety Management System and Risk Assessment

5 ELECTROMAGNETIC RADIATIONS (EMR)

5.1 General Introduction to Electromagnetic Radiation

5.1.1 What is Electromagnetic Radiation?

Electromagnetic radiation (EMR) includes X-rays, ultraviolet, visible light, infrared and radio waves. Radio frequency (RF) EMR is commonly used for a wide variety of communications applications from the broadcast of television and radio, through to radars and mobile phones. It is important that wind farms do not impact the quality of this communications or, when necessary, that the effect is compensated by appropriate means.

5.1.2 What Do Wind Farms Have To Do With Electromagnetic Radiation?

Electromagnetic radiation (EMR) is naturally generated a body in motion in the air. Moreover, any power plant generate EMR with more or less power depending from the installation. This is the case with blades of OWF turning in the air as the wind is blowing and the same device generates electric power. From a wind resource perspective, height and exposure are attractive. It is not unusual for any of a range of telecommunications installations; radio and television masts, mobile phone base stations or emergency service radio masts, to be located close to terrestrial wind turbines and at a similar height to marine wind turbines. Care must be taken to ensure that wind turbines do not passively interfere with these facilities by directly obstructing, reflecting or refracting the RF EMR signals from these facilities. The problem at sea is similar to that on land but more sensitive because there are many radio communications and radio navigation systems dedicated to safety at sea. These systems are based on both terrestrial and satellite radio communications systems.

5.1.3 What Are Electromagnetic Radiation Interferences?

Unwanted radio emissions and background noise can impair effective telecommunications which rely on a sufficient signal to noise ratio. An appropriate transmitting antenna can dramatically improve this signal to noise ratio. A transmitting antenna can also increase the signal strength in a particular direction (i.e. toward a receiver). The directionality of a receiving antenna can also be enhanced, thus reducing the amount of unwanted noise.

5.1.4 How Can Electromagnetic Radiation Issues Be Managed?

Point to Point Communications: careful siting and directional antenna can eliminate any impact on point-to-point links.

Mobile Radio Services: interference can be overcome by moving the mobile unit a short distance away as per normal practice for avoiding any other structure. Any interference to mobile radio services is usually negligible and limited to mobile communications within the wind farm site itself. Nevertheless, ship mobile stations need to be operated in a homogeneous medium in order to comply with the requirement of radio watch-keeping of the global maritime distress and safety system (GMDSS) as it will be explained further.

Active interference is minimised or completely avoided by ensuring that all equipment complies with relevant electromagnetic compatibility standards, as all wind farm equipment does. In the unlikely event that a problem arises over time at a particular site, the wind farm operator will usually be able to rectify it.

In the focus of Interaction between offshore wind farms and maritime navigation, we will deal with the following equipment:

- radar (in particular vessel traffic service radar and shipborne radar)
- maritime radio communications in line with the GMDSS
- Automatic Identification System (AIS)
- shore-based Radio Direction Finder (RDF)

- Global Navigation Satellite Systems (GNSS)
- others navigation systems

5.2 Principles To Prevent Radar Interference

The wind farm developers are invited to seek the advice of radar operators before submitting their application for building permit. This phase should allow the developer to obtain elements to guide the project and avoid rejection on the occasion of its possible application for a building permit. This pre-consultation also allows the radar operators to provide as soon as possible to the competent authority their opinions during the investigation of the building permit.

Given the impact on air, sea and river safety, emergency services in general, and the prevention of natural disasters, radar operators opinion should be considered in a decision making process on the application for a building permit by a wind farm developer. We have considered below the principal radar operators: civil aviation, National Defence, weather office, and vessels traffic services (VTS). Because the use of radar is mandatory on many ships for the prevention of collision at sea and navigation, the National Competent Maritime Authority should also be consulted in order to take into account the proper safe distance from wind farms for ships to use radar without interference.

Radar operators should decide on the risk of disruption of their equipment especially in view of:

- security issues such as the need to monitor the national airspace
- radio, land and aviation restricted areas
- constraints related to air and sea traffic
- forecasting of weather disasters

Each radar operator should be consulted. There may be a competent authority in charge to co-ordinate the consultation, but the rules depend on national regulations. The guidelines below provide guidance to assist radar operators or any competent authority if no regulations on radar protection are implemented.

Around any radar installation the radar operator may consider three possible areas:

- **'Protected area**' where the risk of disruption to radar is too high, no wind turbine can be built.
- **'Regulated area'** where it is important to conduct a special study to assess the risk of disruption to radar in coordination with the different services concerned with the wind farm. Wind turbines could be built subject to restriction or further protection required by the radar operators or, depending of the case, the option could be the prohibition of any wind turbines.
- **'Authorised area'** where it is possible to build wind turbines.

The cases below provide values for the distance (d) for the radius of a 'protected area' and a 'regulated area' centred on the radar to be used by different operators (civil aviation, National Defence, weather and VTS) based on the experience of different countries.

In the absence of co-visibility of a wind turbine with a radar the risk of disruption of the radar is zero. If co-visibility of radar with a wind turbine exists, the method in the following chapters is proposed in order to organise space around a wind farm to determine whether a wind turbine is located in a 'protected area' or 'regulated area'.

5.2.1 Civil Aviation Radars and Systems

To protect flight paths and approaches, Civil Aviation authorities operate three types of equipment:

- **Primary radars** to detect aircraft. They provide monitoring without any cooperation from the target intervention.
- **Secondary radars** to communicate with the aircraft. They provide a cooperative surveillance through the active participation of target detection, the target being equipped with an answering machine, called transponder, which receives questions and answers from the radar.

- **Navigation systems** enable the aircrafts to position themselves. Some systems are working on global navigation satellite systems (GNSS) or different radio systems such as Visual Omni Range (VOR). VOR are ground-based system located at the airports and in the countryside.

a. Primary radars

Recommended distance between a wind turbine and a primary radar in co-visibility (d)			
Elevation angle originating home to the radar antenna (α)	d < 5 km	5 km ≤ d < 30 km	d ≥ 30 km
α ≤ 0.5°	Protected area	Authorised area	Authorised area
α > 0.5°		Regulated area	

b. Secondary radars

Recommended distance between a wind turbine and a secondary radar in co-visibility (d)		
d < 5 km	5 km ≤ d < 30 km	d ≥ 30 km
Protected area	Regulated area	Authorised area

c. Navigation systems

Civil aviation authority should be consulted to assess the reduction of EMR from wind turbine on the different navigation systems. A protected area, where no wind turbine can be built, will be in force depending from the navigation systems in place.

A study by the French Civil Aviation showed that wind turbines within a radius of less than 10 km from a VOR is likely to cause deviations from 1.5° to 2°. In fact, under the precautionary principle, a protected area in a 2 km radius around a VOR should be established. A regulated area, 10 km around VOR should be created to study case by case the risk of interference between a wind turbine and a VOR.

There are two types of VOR: conventional VOR and Doppler VOR. Given the greater immunity to interference of Doppler VOR to reflections on obstacles a change from a conventional VOR into a Doppler VOR could be considered in some cases. In this case, a contribution to the cost of the change by wind energy developers might be agreed with the civil aviation authority.

5.2.2 National Defence radars

Most National Defence radars are located on air force or naval bases. External deployments can also be made, including for the protection of sensitive sites or to ensure maximum detection for both service air traffic control and territorial surveillance. In addition, the National Defence may have radars dedicated to space surveillance and trajectory on shooting ranges for air/ground radars.

Following the attacks of 11 September 2001, in many countries no wind turbine can be installed in a temporary prohibited area mentioned in the aeronautical publications or the triangular surface(s) joining ground-based radar to a temporary prohibited area less than 30 km distant from the radar. This distance and definition of area may change depending of the national and local requirements.

5.2.3 Weather radars

Weather radars are used to locate precipitation (rain, snow, hail), measure their intensity in real time and perform wind measurements by Doppler (vertical profiles of wind fields and volume). Spread over the whole country in many States, they have a range of about 100 km for measuring precipitation and 150 to 200 km for the detection of hazardous precipitating events.

1) A project should be authorized if all the following conditions are met:

- no wind turbine is allowed within the protected area of the radar
- concealment of the radar beam by any group of wind turbines is less than 10 %
- wind turbines are not aligned in the direction of prevailing winds
- the size of the Doppler area of the wind farm does not exceed 10 km in its largest dimension

2) Sensitive sites cases:

A sensitive site is a geographic area defined by the competent Authority:

- which is responsive to the meteorological risk, including risks of strong wind exposure,
- which has an important socio-economic issues, such as industrial area or an area with high urban concentration,
- and whose time responsiveness requested to the weather office is compatible with warning capabilities for short-term forecast.

Thus, companies for which a special contingency plan is developed and aerodromes are considered sensitive sites. The Doppler area of a wind farm should be at least 10 km distant from a sensitive site.

<table>
<tr><td></td><td colspan="5">Recommended distance between a wind turbine and a weather radar in co-visibility (d)</td></tr>
<tr><td>Frequency band of the radar</td><td>d < 5 km</td><td>5 km ≤ d < 10 km</td><td>10 km ≤ d < 20 km</td><td>20 km ≤ d < 30 km</td><td>d ≥ 30 km</td></tr>
<tr><td>Band C</td><td>Protected area</td><td colspan="2">Regulated area</td><td colspan="2">Authorised area</td></tr>
<tr><td>Band S</td><td colspan="2">Protected area</td><td colspan="2">Regulated area</td><td>Authorised area</td></tr>
</table>

5.2.4 VTS Radars

"*Vessel Traffic Services (VTS) contribute to the safety of life at sea, safety and efficiency of navigation, the protection of the marine environment, the adjacent shore area, worksites, and offshore installations from possible adverse effects of maritime traffic*". [SOLAS V/12]

IMO Resolution A.857(20) states: "*A clear distinction may need to be made between a Port or Harbour VTS and a Coastal VTS. A Port VTS is mainly concerned with vessel traffic to and from a port or harbour or harbours, while a Coastal VTS is mainly concerned with vessel traffic passing through the area. A VTS could also be a combination of both types. The type and level of service or services rendered could differ between both types of VTS; in a Port or Harbour VTS a navigational assistance service and/or a traffic organisation service is usually provided for, while in a Coastal VTS usually only an information service is rendered*."

Performance requirements for VTS radars are generally different to the requirements for marine navigational radars. VTS radars normally need to operate simultaneously on short and long range and this leads to dynamic requirements that far exceed those required on board a ship.

Effect of the presence of a wind farm on VTS radar:

1) Since the angle of a VTS radar has to be near horizontal it is inevitable that confusion will exist between the position of ships and wind farms, but It should be noted, that wind generators are normally placed in a well define pattern, ships in the vicinity can be identified by breaking symmetry.

2) If Doppler analysis or Moving Target Indicator (MTI) is not used in the signal processing the rotation of the rotor doesn't cause interference.

3) The fineness of presentation depends on:

   a. the azimuth angle of the radar beam which depends on the antenna size of the radar
   b. the pulse length which defines the separation distance needed so that objects behind each other are shown separately

4) In close proximity to an OWF radars can be rendered inoperative by saturation if the power level of the received signal from reflection from the OWF is too large compared to its operating range.

5) Blind sectors behind wind turbines generated by the towers of the wind turbines and the masking blades whose attenuation is low. The average attenuation is about 0.3 dB on a reflected signal (see Figure 9).

6) The appearance of false targets, based on strong radar signatures of the wind turbines can generate false echoes. These are based on the side lobes of the radar antenna. These echoes appear with an angular offset relative to the wind turbine. Multi-path reflection of the radar signal to or from the desired target, based on passing vessels (see Figure *9*10), may also generate false targets.

In consequence these disturbances can significantly degrade the capabilities of detection, localisation and identification of radar around wind turbines.

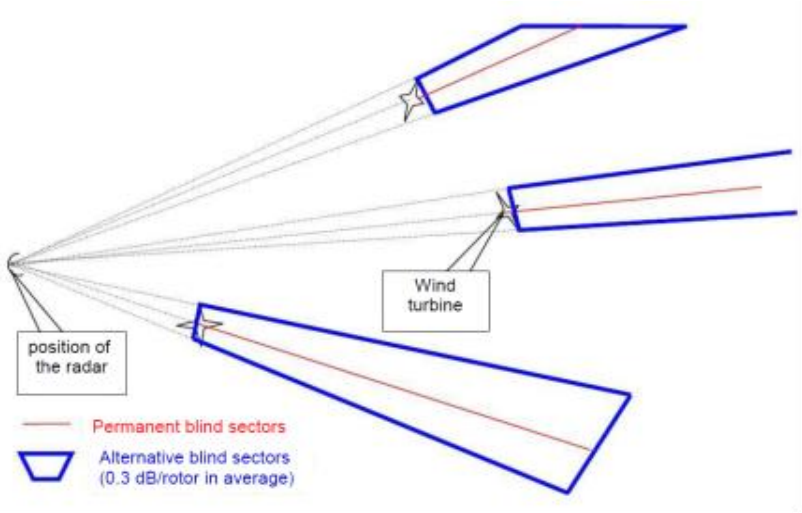


Figure 9: Blind sectors generated by wind turbines

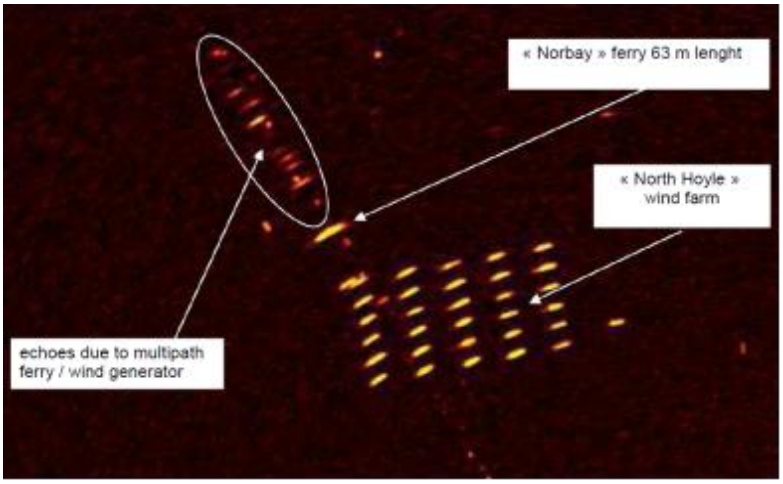


Figure 10: False target phenomena seen temporarily by a land based radar

	Recommended distance between a wind turbine and a VTS radar in co-visibility (d)		
Frequency band of the radar	d < 10 km	10 km ≤ d < 20 km	d ≥ 20 km
Band X	Protected area	Regulated area	Authorised area

In addition, the protected area should be restricted to ± 6 ° on either side of the operating sector of the VTS radar (see
Figure *11*).

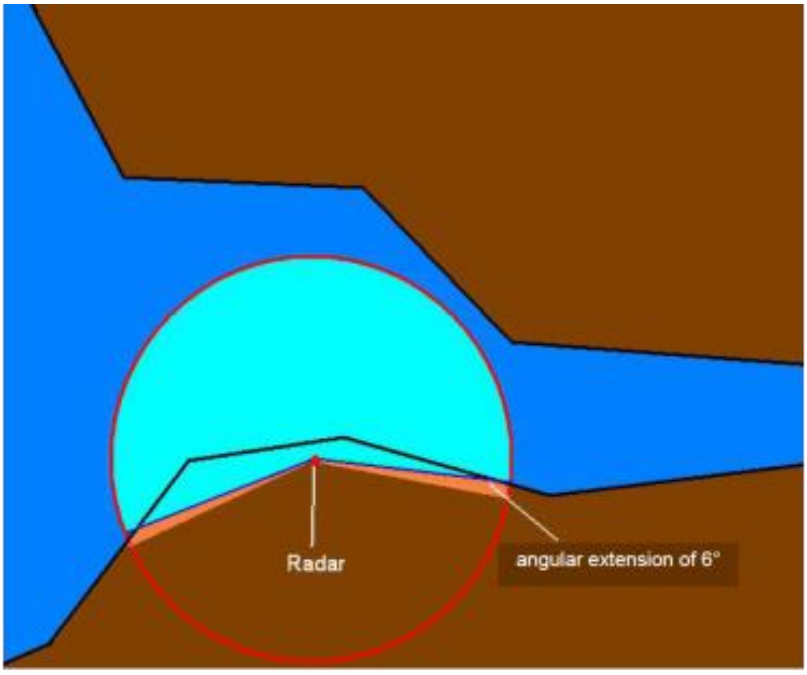


Figure 11: Recommendation for VTS radar protection on either side of the operating area

5.2.5 Ships Radars

Ships use two types of radar:

1) X band radar (9.2 to 9.5 GHz frequency) with a short wave length of 3 cm. This type of radar is mainly used for accurate navigation and to detect targets around the ship.

2) S band radar (3 GHz frequency) with a longer wave length of 10 cm. This type of radar is used for long distance detection and navigation system, but it is less sensitive to sea and rain clutter.

Depending of their size, merchant ships above GT 3000 carry both type of radar to be in compliance with Chapter V of the SOLAS convention. Band X radar is also used by VTS and band S radar is also use by weather services (see above). In consequence ship radar are disturbed in the same way as described above. When automatic radar plotting acquisition (ARPA) systems are used to track targets close to a wind farm target swaps may occur. Surveys have identified that at **distances below 1.5 NM** from a wind farm special care regarding the selected range, pulse length and gain is necessary to minimise the interference on ship born radar.

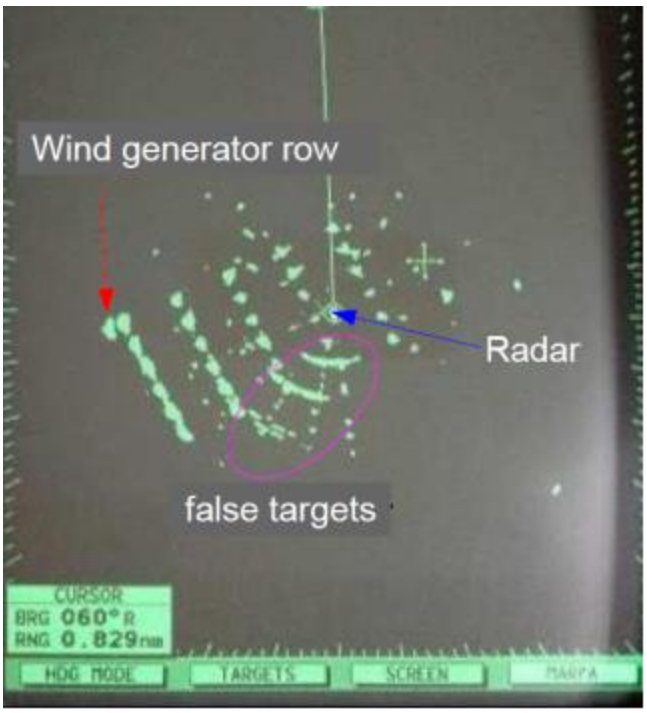


Figure 12: Example of false target generated on a ship radar screen (ship is in the wind farm close to a wind generator)

Interaction between wind turbines and ship radar can generate false targets by the side lobes of the antenna (as shown in Figure 12). Clutter is located at the same distance as the wind turbine.

5.3 Radio Communications

In addition to their potential impact on radar systems, offshore wind farm structure may also affect communications systems operating in the marine environment. This includes vessel-to-vessel, vessel-to-shore and vessel-to-space links. Examples of systems that potentially may be affected include satellite links such as GPS (global positioning system, 1.6 GHz) for navigation and Iridium (1.6 GHz) and Geostationary Operational Environmental Satellite (GOES on 400 MHz) for data relay by various ocean monitoring sensors, VHF (160 MHz) radio for marine communications, and AIS (automatic identification system on 160 MHz) for vessel identification and tracking.

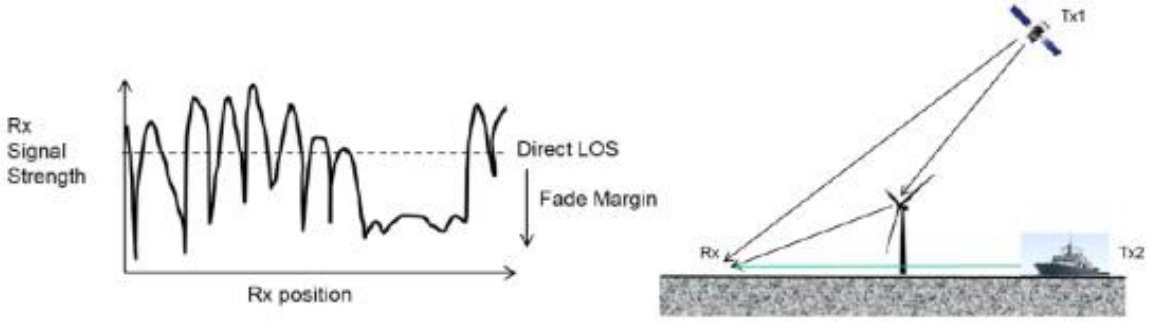


Figure 13: Illustration of communications channels encountered in the marine environment

A number of analytical and numerical approaches have been applied to model the wind farm blockage problem. A simple, approximate geometrical blockage estimate can be derived based on the Fresnel zone argument. This is the standard methodology used to estimate the shadowing effect due to wind turbine structures by the Federal Aviation Administration (USA) obstruction evaluation process.

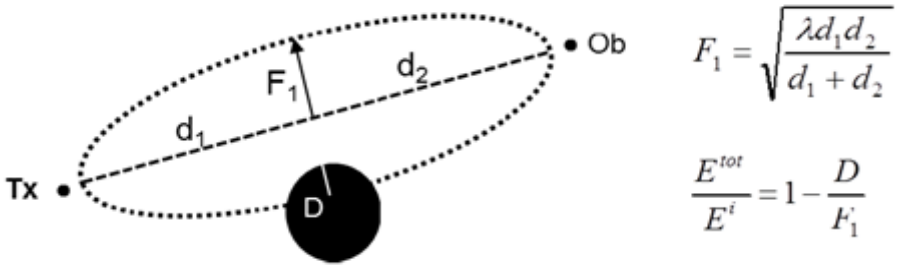


Figure 14: Fresnel zone blockage calculation for assessing wind turbine blockage

Based on various studies around the world, we can summarise the effect of wind farms on marine communications are as follows:

1) A distinct shadow region is observed behind the tower. Multi-path interference is observed outside the shadow region.

2) The shadow becomes more optical-like as frequency is increased, leading to longer, narrower and deeper shadows. However, the signal fade is still less than 6 dB relative to the direct line of sight (LOS) signal up into the GHz range.

3) The vessel-to-vessel link and the vessel-to-shore station links are worst-cases compared to vessel-to-satellite links.

4) The shadow becomes deeper when more than one turbine is lined up with respect to the transceiver (Tx) line of sight (LOS) and then the fading risk is higher.

5) Most communications systems have built-in link margins to compensate for signal fading. For example, typical GPS receivers have a fading margin of 15 dB or greater.

The Global Maritime Distress and Safety System (GMDSS) is an internationally agreed set of safety procedures, types of equipment, and communication protocols used to increase safety and make it easier to rescue people from ships, boats and aircraft in distress at sea. The GMDSS is internationally regulated in the ITU Radio Regulation and the related equipment on board the vessel by the IMO in chapter IV of the SOLAS convention.

Within the GMDSS several communication systems are used, some of them are new, but many of them have been in operation for many years. The system is intended to perform the following functions: distress alerting (including position determination of the unit in distress), search and rescue coordination, locating (homing), broadcasts of maritime safety information, general radio-communications, and bridge-to-bridge communications. Specific radio carriage requirements depend upon the ship's area of operation, rather than its tonnage. The system also requires redundant means of distress alerting, and emergency sources of power.

Vessels in national waters and those under 300 Gross Tonnage (GT) as well as recreational vessels are not subject to the convention. They do not need to comply with GMDSS radio carriage requirements, but increasingly the Digital Selective Calling (DSC) VHF radios are installed on voluntary base on these vessels.

Despite the use of DSC in the GMDSS, it is still mandatory to maintain a continuous watch on VHF channel 16 (156.8 MHz).

IMO Res.A.801(19) adopted on 23 November 1995, provides provisions for radio services for the GMDSS. It is the reference document to establish the different GMDSS sea areas. In particular, the formula to determine the coverage for a Coastal Radio Station (CRS) is defined. This helps Coastal States to declare their GMDSS infrastructure to IMO as requested in SOLAS IV/5.

The IMO secretary consolidated the collection of all GMDSS sea areas within the GMDSS master plan.This master plan helps to define the radio equipment to carry on board ships, which depends on the radio communication infrastructures onshore in the area of operation of the ship.

VHF Radio Communications and AIS

Because of possible EMR perturbations on the reception of distress alerts with a direct consequence on the safety of life at sea, and the potential new risks generated by the OWF additional VHF radio-communication resources may be required for:

- watch keeping distress call and alert
- broadcasting maritime safety information to prevent accidents
- co-ordination of search and rescue operation
- co-ordination for oil spill cleaning
- co-ordination of salvage operations

Automated Identification Systems (AIS) is a tracking system, which involves radio communication from ship to ship and also from ships to AIS shore based stations. The VHF transmissions of the system integrates identification of the vessel, positioning, speed and heading information. The purpose of AIS is first to identify ships. In that respect AIS assists in collision avoidance, but it should be kept in mind that AIS is not mandatory on all vessels. AIS are transceivers operating in the VHF Band. They are subject to the EMR interference of the OWF in the same way as the VHF radio communication systems.

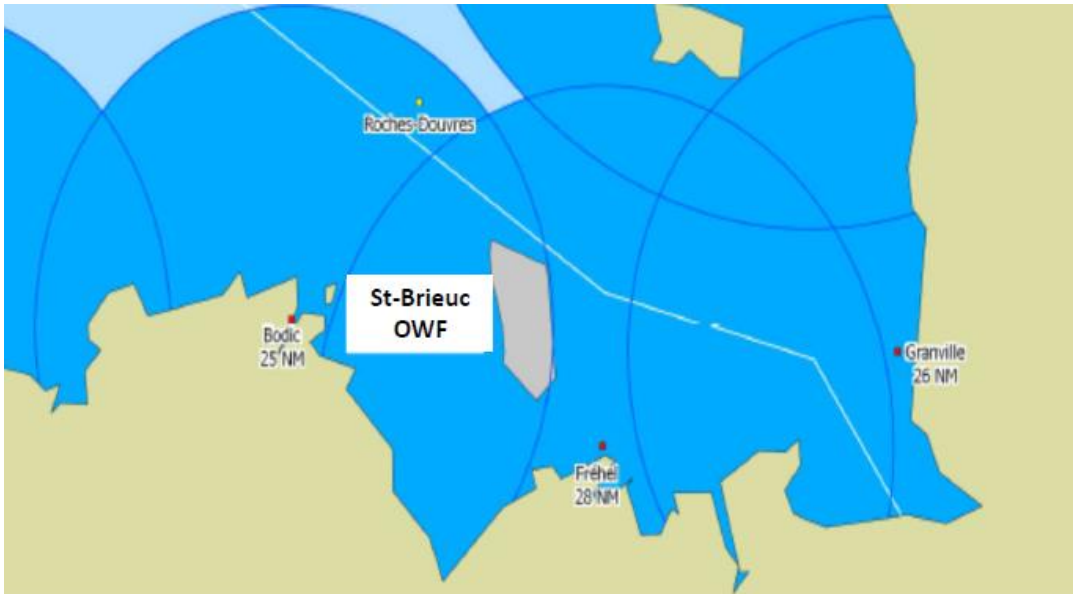


Figure 15: Saint-Brieuc (France) OWF project and the different VHF coverages
(GMDSS sea area A1 in blue) around VHF CRS

The establishment of wind farms is likely to impact the operational range of systems of monitoring and communication. This has an impact mainly for ships within VHF range when located behind OWF. There are several studies that confirm interference of VHF, which under certain conditions can impact not only the analogue voice communications but also DSC and AIS signals. The following precautionary principles would ensure maritime safety in and around the wind farms and facilitate radio communications in case of emergency operations:

- Study of the potential impact on VHF and AIS transmissions and coverage of the A1 area are to be considered during the planning process for a wind farm. The operator needs to approach in particular the services in charge for search and rescue (SAR) operations, such as the rescue coordination centre (RCC), but also VTS and harbour masters' office.

- On request, the operator may install in the offshore wind farm an extra VHF station with two sets of multi-channel equipment. Each unit will consist of a transmitter (Tx) and a receiver (Rx) on VHF frequencies.
- This VHF equipment would reinforce the VHF capacity of the RCC in the area during the construction phase of the OWF.
- During the months following the commissioning of the OWF, propagation measurements on VHF in and near the OWF should be carried out and the results are to be communicated to the services involved (RCC, VTS or harbour masters' office) for their study and conclusion of the effect of the OWF.
- During this transitional phase and until the results of the study are known, VHF equipment in the offshore wind farm may be made available to the RCC, VTS or harbour masters' office. The operator shall be responsible for the procedure of integration and installation of this equipment, including aerials.
- If studies reveal disturbances the RCC might require that the operator installs a GMDSS coastal radio station, as compensatory measures to preserve the integrity of the defined GMDSS sea area A1. VTS or harbour masters' office compensatory measures on VHF may be less stringent, in particular if these services are not related to the distress watch which is the primary task of RCC.
- AIS compensatory measures are to be checked case by case depending on the AIS base stations affected and the needs of the service affected. It would be possible that an additional AIS base station is placed on an appropriate position in the OWF.
- If no disturbance is detected, the operational requirement to keep up the equipment should be assessed. In the event that the station should be maintained for operational reasons, the RCC or any other service involved has to initiate a contractual procedure with the operator to define the maintenance of facilities and access to the sites.

In all cases, it is considered best practice to identify the possible implications for radio-communication systems and AIS operating in the area around a wind farm, and to carry out a study of the potential impact on radio-communication to the extent possible. Field measurements should be carried when OWF is completed in order to confirm the need for and location of any additional VHF coastal radio station or AIS base station in the OWF or simply to check the sea area A1 coverage.

5.4 Radio Direction Finder (RDF)

The disruption of phase due to OWF may cause some concern on applications where phase information is used, such as direction finding and precise GPS relative and absolute positioning techniques based on carrier phase measurements. These should be further examined.

In the case of the use of a shore based radio direction finder (RDF), whether for the purpose of a VTS or SAR, the D/F may be degraded due to the EMR area of the wind farm.

In this case it is suggested to study an alternative solution to any RDF shore based station.

5.5 Other Navigation Systems

Depending on the importance of the information provided by GNSS or local radio navigation systems, it is suggested that a study of the potential impact on GNSS and radio navigation transmissions and coverage be considered during the planning process for a wind farms. Last but not least, the electromagnetic field generated by wind generator should be considered on magnetic compasses.

5.5.1 GNSS

Multi-path disturbance effects of the satellite communication already exist on merchant ships. These effects are generated by cranes and mast of the ships. It is possible to minimise the disturbance on the GNSS receptor by dedicated settings.

Studies focussed on the DGPS which is a corrected signal of GPS transmitted by shore-based stations in a frequency range around 300 kHz:

1) The risk of disruption affects only the GPS signal from the reference station.
2) The reference station uses signals from satellites positioned more than 10° above the horizon.
3) In order to avoid interference it is necessary to respect a minimum distance:
   - Between the reference station and wind turbine and
   - Between the ship and the wind turbine.
4) As an example, for a wind turbine of 160 m height a distance greater than 1,200 m and an angle of 8 ° above the horizon overcomes the potential impact of multiple-paths between satellite, ship, wind turbines and DGPS reference station.

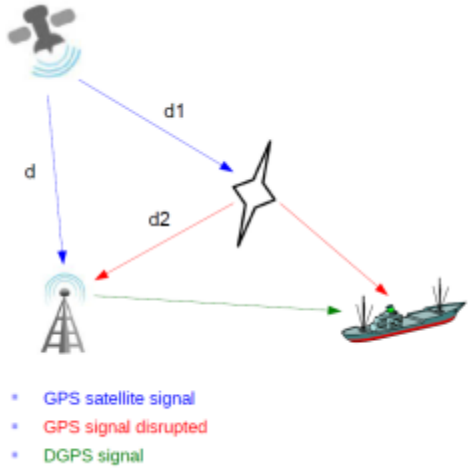


Figure 16: Disruption of DGPS

To maintain the accuracy of DGPS, it is necessary to ensure a safe distance between wind turbines and ships, and between wind turbines and the DGPS reference station. For 160 m high wind turbines this distance is 1.2 km.

5.5.2 Local Radio Navigation Systems

The hyperbolic radio navigation systems (DECCA, LORAN C) are discontinued, there may be others local systems (RTK or other systems) in some harbours to give an accurate position for piloting, survey ships or dredgers. There are new radio navigation systems under study such as R-mode. Whatever the terrestrial radio navigation systems, the operating principle is always the same and based on EMR. All these systems are subject to multi-path effects which reduce the accuracy of the position information in the same way as GNSS and DGPS.

5.5.3 Magnetic Compass

It is quite unlikely that the wind generators and the seabed cabling within the site and onshore produce electromagnetic fields affecting compasses and other navigation systems.

Nevertheless, it is always recommended to navigate with caution and check the proper operation of all navigation equipment.

6 EMERGENCY PROCEDURES

6.1 Introduction

As explained in chapter 2 emergency response is one of the crucial links in the global chain of contingency planning and associated risk management, which is described in Chapter 4. Maritime Emergency Planning (MEP) should be part of a holistic Safety Management System (as described in chapter 4) covering both risks to maritime navigation from OWF and vice versa. In order to avoid a complex identification of separate risks ordered by (direct-indirect) causes, risks are globally ordered by the nature of their consequences on:

1. People (health, safety & security) with SAR as the most important response
2. Planet (marine environment) with pollution (oil spill) contingency as the primary focus
3. Property & Assets (materials) with salvage as the main emergency response
4. Professions/Business (socio-economy, liability, reputation, etc.)

6.2 General Concepts

The main objective of a Contingency Plan is to establish a consultative structure in which various authorities with their specific competences come together under the leadership of a general response and crisis coordinator. Good understanding between all on-scene parties and adequate onshore-offshore emergency planning synergy is crucial for a successful emergency response. In every operational Contingency Plan, the tasks of the engaged rescue services are divided amongst five groups of disciplines [Debyser, 2015]:

- Discipline 1 = Rescue Operations
- Discipline 2 = Medical, sanitary and psychosocial assistance
- Discipline 3 = Law enforcement (Police)
- Discipline 4 = Logistic support
- Discipline 5 = Information-communication

Tiered preparedness and response is recognised as the basis on which to establish a robust incident preparedness and response framework and provides a structured approach to establishing a mechanism to build the required response effort. The established three-tiered structure allows those involved in contingency planning to describe which response capabilities can be identified to mitigate any potential emergency scenario; from small operations to a worst-case emergency at sea or on land. The structure provides a mechanism to identify how individual elements of capability will be cascaded. The aim is to provide suitable response resources at the right place at the right time. Response capabilities are defined as the resources required to deal with the incident and can be broadly considered in three categories [OGP, 2015]:

- Response personnel
- Equipment
- Additional support

Collectively these resources combine to establish response capability, and are categorised according to whether that capability is held locally, regionally or internationally. This geographical distinction is at the core of the tiered model, and enables capability to be built around the potential severity of the incident and the time frame in which resources are needed on scene [OGP, 2015].

- **Tier 1**: Resources necessary to handle a local emergency and/or provide an initial response (locally available resources)
- **Tier 2**: Shared resources necessary to supplement a Tier 1 response (regional or nationally available resources)
- **Tier 3**: Global resources are necessary to support the Tier 2 response due to the incident scale, complexity and/or consequence potential (internationally available resources)

The model also relies on successful cooperation between the different stakeholders that may be involved in the response.

6.2.1 People – Search And Rescue (SAR)

Maritime SAR is clearly defined in the international convention on maritime search and rescue 1979, also named Hamburg Convention or SAR 79. The IMO/ICAO joint working group on the harmonisation of aeronautical and maritime SAR (named IMO/ICAO JWG) has developed international guidelines for SAR. The references documents for National Administration in charge of SAR is contained in the international aeronautical and maritime search and rescue manual (IAMSAR manual).

United Kingdom has provided an interesting document at 22nd IMO/ICAO JWG (document ICAO/IMO JWG-SAR/22-WP.10) in relation to SAR procedures, processes and techniques for SAR helicopters and rescue boats responding to OWF and other renewable energy installations. This section is based on this input.

The number, size (of wind turbines and fields) and geographical coverage of offshore renewable energy installations impacts the sea-space and it is recognised that there will be an increasing SAR challenge caused by large numbers of physical obstacles at sea. The presence of OWF creates new, physical obstacles to both surface vessels and low flying aircrafts.

SAR helicopters normally have radar fitted for search, surveillance and navigation. The effects of wind turbines on an airborne radar picture have undergone limited assessment and it has been noted that wind-turbine radar returns may merge together into a single, large radar image at medium to long ranges (see Chapter 5). Discrimination between individual turbines may only become apparent at shorter ranges e.g. 1.5 to 5 NM. The discrimination is, of course, dependent on beam width and radar processing techniques available in the type of radar in use on the SAR helicopter. When operating amongst wind turbines, at night and/or in poor weather, nose-mounted, sector scan radar (e.g. 120 degree scan) may have limitations and 360 degree scan radars may be more effective as a flight safety and search aid. No significant data is yet available for the effects on radar picture quality when using radar inside a larger wind farm.

Navigating a SAR helicopter through a wind farm is difficult and requires careful mission management. The feedback from United Kingdom and some European SAR aircrew currently indicates that searches are possible within wind farms but that search quality may be lower than that expected in open water. Crew will need to refer to the available detailed OWF charts and ID numbers of turbines in their vicinity to visually navigate and cross-check location with electronic navigation systems and to plan a route to a rescue location or when searching. Aircraft are likely to need to fly slowly (e.g. 50 to 60 knots) and crew will be concentrating on obstacle avoidance and accurate navigation along the ‘SAR access lane’ centreline.

It is, therefore, likely that the number of crew able to conduct an effective search will be reduced: the two pilots would most probably focus on flight path management and safety, leaving only the rear crew to look for SAR objects. This may be a reduction in the normal search mode where one pilot may be sufficient to manage flying the aircraft and flight safety, leaving three crew members to look for SAR objects. It is also believed probable that, at times, all crew will be needed to conduct flight safety lookout tasks e.g. locating and identifying OWF structures, finding safe exit routes, etc. and that this will impact on the overall effectiveness of searches. There may also be further distractions caused by crew inadvertently watching for obstacles instead of looking for SAR objects.

An additional problem is that, depending on the wind farm layout and spacing of turbines, the use of SAR access lanes may lead to a reduction in coverage if the spacing between SAR access lanes is greater than the required sweep width. OWFs should, wherever possible, be laid out in a regular grid pattern (this is not always possible for engineering and construction reasons, e.g. seabed conditions and water depths, preventing turbines being laid in a regular pattern).

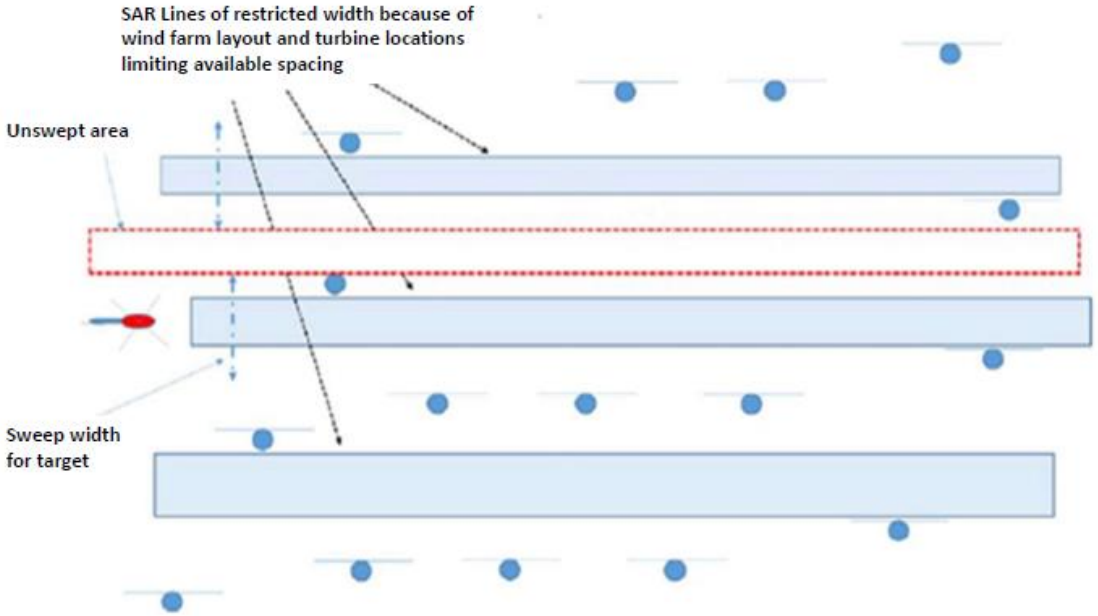


Figure 17: Effect on sweep width of SAR lane spacing. An unswept area (red rectangular) originates due to the wind farm layout limiting available spacing [ICAO/IMO JWG, 2015]

Because SAR lanes are 'fixed', in some weather conditions (strong winds for helicopters, and sea and swell direction for rescue boats) SAR units may find that they need to steer large offset headings to maintain their track over the ground. This is particularly important for SAR helicopters who may be trying to hold track within a wind farm SAR access lane. In extreme cases search effectiveness and flight safety may be compromised and the SAR helicopter may have to abort the mission. The same problem may be encountered by surface craft which may find that they cannot steer an effective search track without the vessel rolling and pitching excessively, and so search effectiveness will be significantly reduced.

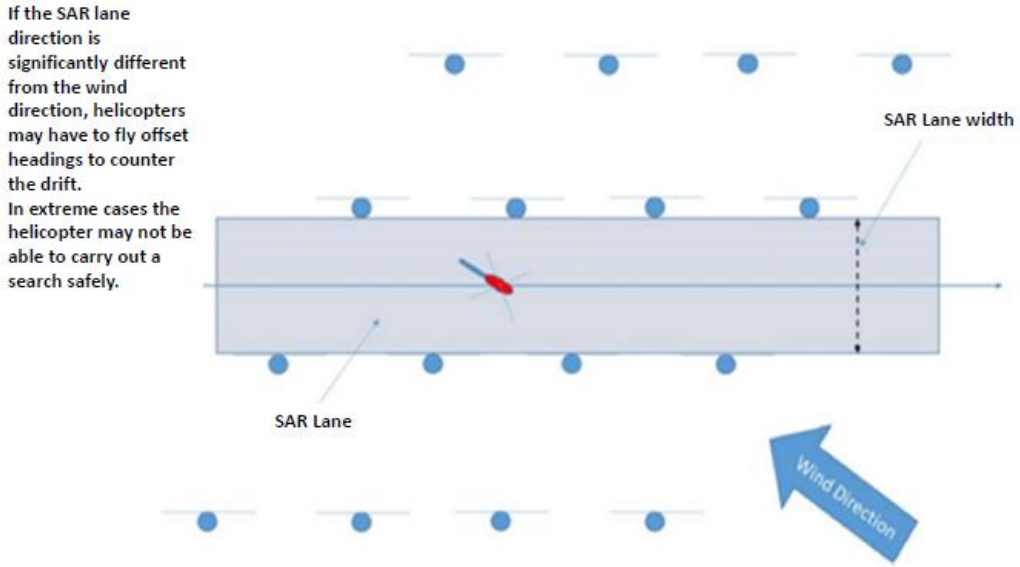


Figure 18: Effect of wind on SAR helicopter following SAR lane [ICAO/IMO JWG, 2015]

The existence of a large number of structures within an individual separate OWF field means that, during searches, lookouts may be distracted by occasional 'visual confusion' and interference caused by relative movement amongst the structures and rotating blades as the Search and Rescue Unit (SRU)

moves. Also, in certain light levels, sea and visibility conditions, the structures may be between a SAR object and the lookout at a critical moment – a 'detection opportunity'. This problem may be most likely to occur during rough sea and swell situations.

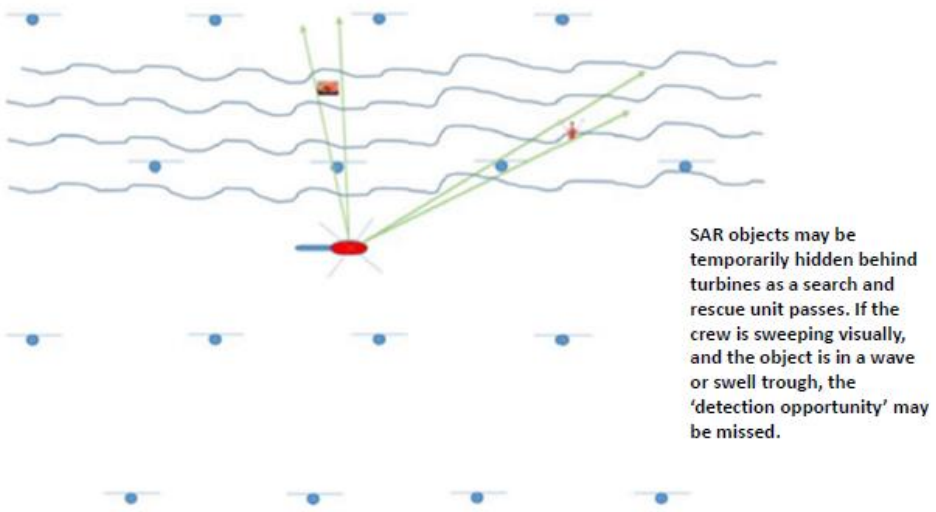


Figure 19: Effect of wind turbines blanking SAR objects – detection opportunities [ICAO/IMO JWG, 2015]

6.2.2 Planet Environment – Pollution (Planet)

The second consequence type defines the marine environment as the main driver for emergency response. When developing response actions for pollution of the environment at sea it is important to realise that incidents involving Hazardous and Noxious Substances (HNS) differ from oil spills, particularly with regard to the type and range of hazards, the need for appropriate protection to responders, the available response options and the fundamental requirement to safeguard the general public. HNS has a wide spectrum of physical properties which may impact upon the environment. Whilst some materials behave in a similar way to oil spills (not least because a number are derived from petroleum products) by forming surface or subsurface slicks, others can behave in a radically different manner, for example forming gases, evaporating into the atmosphere, dissolving into sea water, igniting, etc. It is therefore more helpful to think of an HNS incident as having the potential to 'release' a substance into the environment rather than 'spill' in the same way as oil. Depending on the substance involved, each release has its own characteristics, behaviour, impact, hazards and associated risks. One principle difference to an oil spill is that recovery of released HNS is often not appropriate using commonly available tools and techniques [EMSA, 2007].

A number of EU/EFTA coastal Member States have concluded cooperation agreements at a sub-regional or regional level, so-called 'Regional Agreements', in order to provide mutual assistance in responding to marine pollution or the threat thereof. The European Community is also a contracting party to the major Regional Agreements and EMSA has close cooperation and coordination with them on various common issues [EMSA, 2007].

6.2.3 Property – Salvage (Materials)

Salvage

The most important emergency measure to cover the third type of consequence (i.e. property & assets) is clearly salvage. Marine salvage is the process of recovering a ship, its cargo, or other property after a shipwreck. As the wreck of a (partly) destroyed wind turbine structure forms an equally important asset in this analysis, marine salvage should not only focus on the recovery/removal of ships and their property. Similar techniques and procedures will be implemented for both assets. Salvage encompasses towing, re-floating a sunken or grounded vessel, or patching or repairing a ship or an OWF. Today the protection of the environment from cargoes such as oil or other contaminants is often considered a high priority [Australia Parliament, 2004].

A salvage operation in relation to an OWF has not (yet) occurred at the time of writing this document. An operational example of removing material, wrecks or debris from a wind farm area can therefore not been given. Both, vessel and wind turbine structure wrecks can be handled similarly; each with their own detailed specifications as a direct consequence of their respective 'content'.

Removing wrecks is a major undertaking which can incur great cost. Analysis of the most expensive wreck removals from the past decade suggests that the following factors are central to the cost of wreck removal: location; the contractual arrangements; cargo recovery from container ships; effectiveness of contractors and the vessel's special casualty representative; the nature of bunker fuel removal operations; and the influence of government or other authorities. Of all these factors, government influence, reflecting public concern, appears to be the dominant factor in rising costs [Lloyd's, 2013].

Challenges of Salvage

Saving the cargo and equipment aboard a vessel may be of higher priority than saving the vessel itself. The cargo may pose an environmental hazard or may include expensive materials such as machinery or precious metals. In this form of salvage, the main focus is on the rapid removal of goods and may include deliberate dissection, disassembly or destruction of the hull. Wreck removal, on the other hand, focuses on the removal of hazardous or unsightly wrecks that have little or no salvage value. Because the objectives here are not to save the vessel, the wrecks are usually re-floated or removed by the cheapest and most practical method possible. [Black Sea Diving Centre LTD, 2015].

The location of a wreck or turbine debris is central to the cost of removing it. Wrecks in remote locations far from supply bases and sources of necessary equipment are likely to be more expensive. The conditions at the wreck site are also important; a rocky site surrounded by deeper water will present more of a challenge than a gently shelving sandy beach. The weather conditions at the location are also important. For example, whether the wreck or debris site is a lee shore exposed to prevailing winds and waves, or whether it is in a sheltered location. Similarly, whether the tide, or waves will scour the sand or mud from under the wreck/debris, causing instability, could be an important factor. A wreck/debris occurring in the approaches to a major port or close to active berths could represent additional risk in the form of major business interruption [Lloyd's, 2013].

Increasing size and growing content volumes (both in volume and value) drive up wreck/debris removal costs. Both vessels and wind turbine structures have generally increased in size. Larger ships and wind turbine components are generally harder to handle as casualties, and will take longer to remove as wrecks, partly because of the larger volume of content that will have to be taken off. In the case of container ships, removing cargo can be a long and difficult process, driving up costs. Due to the complex infrastructure (electrical components, data transmission, oil components, etc.) of a wind turbine also the removal/recovery of the content might be a difficult task. Representatives from owners, the design industry, the salvage industry and insurers should consider exploring ideas together aimed at the challenges of salvaging mega-ships and structures [Lloyd's, 2013].

6.2.4 Professions – Social Economic Impact – Business

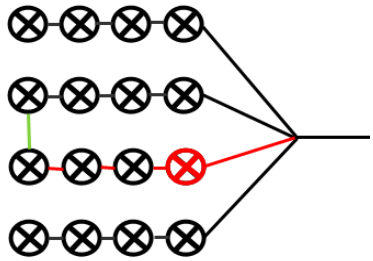
Type 4 forms a trans-boundary phase between emergency response and recovery. In case an emergency occurs in an OWF, two businesses can be impacted: the vessel/OWF and its owner but also the (socio-)economy supported by the vessel and/or windfarm operations.

The effects and cost implications due to equipment loss are discussed in the section about salvage but there is also a large implication for the wind farm's guaranteed energy production, transfer and delivery. Apart from the obvious costs related to the damage of property, the (re)liability of the wind farm operator and/or owner (vessel or OWF) might become questionable. In the event a wind turbine (and the wind turbines connected to the same in field connection cable) is idle, the continuity of energy delivery to the shore might become uncertain.

An accidental disturbance/interruption of the energy transfer of the produced electricity from the OWF through the export cable towards the onshore distribution network induces the same level of business emergency. Contractual agreements with energy consumers could become impossible to comply with as the amount of produced energy will be reduced – both in volume as time span.

The (re)liability and reputation of the energy producer could be irreversibly damaged in such case. This example is given from a wind farm owner point of view, but also vessel owners could suffer reputational damage in case an emergency occurs with - one of - their vessel(s).

Since such reputation damage is not covered by insurances, owners and operators have to cover this emergency related risk in different ways. An OWF is usually monitored by an onshore control unit which continuously checks the amount of energy that is delivered by the wind farm via an online system (SCADA – Supervisory control and data acquisition). A reduction (caused by whatever reason) in the supply chain, is immediately noted and corrective actions can start to be implemented immediately. A possible solution is described in the example below. These risks of potential loss of liability and/or reputation are more and more being considered in the cost estimations.

Example: 	In case one of the OWF boundary is damaged to the point here it becomes idle (red circle) and the other 3 wind turbines connected to the same connection cable cannot transmit energy to the shore. The loss of 1 wind turbine therefore causes the reduction of energy produced by (in this case) 4 wind turbines. To overcome this problem, a connection can be made between the isolated but working wind turbine chain and a fully operational chain (green line). However, such a redundant solution should have been planned in the design phase of the wind farm as the connection cable would need to be able to carry the addition power of the extra wind turbines.

Vessel and OWF owners take a whole range of measures and means aimed towards ‘recovery’, or at least reducing the extent of damage when an emergency occurs and/or increasing the inherent capabilities for recovery. These operational measures and means are mainly covered in a global maintenance contract for the OWF and its respective elements (wind turbines, electrical cabling, transformation stations, export cable, etc.) together with associated insurance coverage.

Dealing with this kind of recovery has been ignored mostly by organizations and projects because it is assumed that the risk management, prevention and preparation of an emergency and even the contingency planning will minimise the recovery efforts. Nonetheless, emergency events will occur and recovery will be required even though the phase has large unidentified complexities. There should be for example a difference between short-term and long-term recovery.

Short-term recovery is immediate and overlaps with response. It includes actions such as providing essential health and safety services, restoring interrupted utility and other essential services by salvage (removal of vessel, damaged structures, drifting items, or pollution), re-establishing transportation routes, reimplementation of the no go zone and providing food, shelter and medical means for those displaced by the incident. Although called “short term,” some of these activities may last for weeks.

Long-term recovery, which is outside the scope of the Risk Management Framework, may involve some of the same actions but may continue for a number of months or years, depending on the severity and extent of the damage sustained. For example, long-term recovery may include the complete reconstruction of parts of the OWF or the reestablishment the operator’s reputation.

The recovery phase includes associated responsibilities and factors that influence business recovery. The importance of business recovery is widely acknowledged – importance for the owners of the business, the employees of the business, the suppliers, the customers, the economy, governmental agencies depending on tax revenues, and the community at large. The immediate consequences of an extreme event are often relatively easy to quantify and comprehend. However, the ‘systemic community consequences’ depend on a number of secondary events and the ‘reverberations’ in the community and the ‘outside world’ [Baird, 2010].

7 SUMMARY OF RECOMMENDATIONS

7.1 Important Notice

Due to their particular character offshore wind turbines and their positioning in an offshore cluster configuration, present new challenges to safe and efficient maritime navigation in their neighbourhood. Interactions between OWF and shipping activities induce an operational need to integrate OWF design and planning with navigational mitigation-management and emergency procedures in order to assure this safe and effective navigational safety and emergency response preparedness. The recommendations which are presented should be used primarily by OWF developers seeking consent to undertake works, but also by Maritime Authorities to ensure safety of navigation and emergency response management. Finally, navigators also can use these guidelines for a safe and efficient practice of navigation in the vicinity of an OWF.

It is important to recognise that the recommendations in this report are not prescriptive tools but need intelligent application and advice provided on a case-by-case basis. It is noted that specific details of individual sites (local factors or boundary conditions) or national-regional (legal) requirements may vary from the general guidance which is presented.

7.2 General Recommendations

7.2.1 Identification of Interactions

The identification of the interactions between OWF and navigation can best be achieved by Preparing (or amending existing) a Marine Spatial Plan (MSP) and by preparing a Marine Emergency Plan (MEP) (see Chapter 2)

7.2.2 Legal Background

When the OWF is located in the high sea or close to an international ship's routeing scheme, a submission to IMO, NCSR sub-committee, should be made if ship's routeing measures around the OWF are foreseen in order to safeguard the safety of navigation (see Chapter 3).

7.2.3 Navigation Constraints, Collision Avoidance & Marine Navigational Marking

The basic rule which should firstly be adopted by navigators around or within OWF zones is: 'Navigate with caution and avoid these OWF areas as much as possible'.

During all phases of the OWF project (exploration including planning and design, construction, exploitation and maintenance and decommissioning) a dedicated marine navigation safety management plan is to be established, which could include:

- analysis of safety distances between shipping traffic and OWF which requires a good description of the ships involved (see Chapter 4.1.1)
- perform a risk analysis of the routes and the frequencies of the ships (see Chapter 4.1.2)
- analysis of the geometric [geographic and hydrographic] configuration of the sea area in respect of the shipping traffic (see Chapter 4.1.3)
- Identify local met-ocean conditions that could present difficulties to vessels (see Chapter 4.1.5)
- pilot or towing vessel may be a mitigation or preventive measures (see Chapter 4.1.6)
- provisions and regulations as discussed in Chapter 4.2.1 for a **minimum distance between** a shipping route and a wind farm can be determined as follows:

- Starboard side of any route: 0.3 NM + 6 ship lengths + 500 m (i.e. for a ship of 400 m length a minimum distance of 3,456 m, which is almost 2 NM)
- Portside of any route: 6 ship lengths + 500 metres
- In most cases additional detailed design analyses are necessary to determine an optimum design that will definitely be safe and usable (see Chapter 4.2.2)

- For the offshore infrastructure of the OWF, marine navigational marking is required according to IALA recommendations O-139 on the Marking of Man-Made Offshore Structures (see Chapter 4.1.4)
- The risk assessment process should identify the hazards, together with the events or circumstances which may give rise to their realisation determine the risk posed by them and identify preventative measures that can be put in place to control the risk by preventing the realisation of the hazard and/or mitigating its effect if it does occur (see Chapter 4.2.3).

7.2.4 Electromagnetic Radiations (EMR)

RADAR

The main principle in the prevention of shore-based radar interferences is that each radar operator shall be consulted. Radar operators include, civil aviation, weather office, national defence, VTS and ports. There may be a competent Authority in charge to co-ordinate the consultation, but the rules shall depend on national regulations (see Chapter 5.2).

Whatever the distance of vessels from OWFs, they may generate multiple echoes on the radars of the VTS. The VTS Authority might also need to secure the full visibility of sensitive sectors and avoid any obstacle for this purpose.

For shipborne radar each navigator should properly adjust their radar equipment to prevent interferences and to obtain accurate results from operation of automatic Target Tracking facility such as ARPA. In case of an improper setting of the radar, false targets and loss of small targets may occur whatever the distance of the ship from the OWF.

Risk	On board mitigation	External mitigation	Distance where risk may be significant**
False targets	**Adjust Selected range, Gain**	**Adapt design (e.g. radar absorbing coating)***	**< 0.25 NM** (500 m)
Small targets lost	**Increase gain**	**Reflector for calibration**	**< 1.5 NM** (2,778 m)

***** radar absorbing coating or material is a very expensive mitigation solution.
****** the distances indicated are the minimum distances where the risk is intolerable (< 0.25 NM), or tolerable if as low as reasonably practicable (< 1.5 NM).

General guidance for precautionary use of S or X band radar

It should be noted that especially inside and around a port, since ships can recognise the range and direction of a shipping route by using navigation marks, appropriate measures can be examined in each country to mitigate the influence of an offshore wind farm on radar.

RADIO COMMUNICATIONS

In all cases, it is considered best practice to establish the implications for radio communication systems and AIS operating in the area around a wind farm, and to carry out a study on the potential impact on radio communications to the extent possible. Field measurements should be carried out when OWF is completed in order to confirm the location of any extra VHF coastal radio station or AIS shore based station or simply to check the sea area A1 coverage (see Chapter 5.3).

The same conclusion should be adopted for RDF and others radio navigation systems (GNSS, local radio navigation systems, magnetic compass, etc). To maintain the accuracy of DGPS, it is necessary to ensure a safe distance between wind turbines and ships, and between wind turbines and the DGPS reference station. For 160-m high wind turbines this distance is 1.2 km.

7.2.5 Emergency Procedures

It is recommended to establish a contingency plan within and around the OWF (see Chapter 6)

Potential impacts or difficulties caused to (individual) mariners or emergency response services (by competent authorities) in the OWF area or its direct environs, should be assessed in a Maritime Emergency Plan (MEP), leading to a proper list of mitigation measures or operational risk management tools. In close collaboration with all stakeholders, a protocol between parties is set up to ensure a safe and efficient emergency response preparedness and operation.

Setting up a MEP for the specific interaction between offshore wind farm operations and maritime navigation is basically developed from a mutual interaction: risks induced by impact from off-shore wind farm (OWF) towards maritime navigation (MN) and vice versa. In order to avoid a complex identification of separate risks ordered by (direct-indirect) causes, risks are globally ordered by their nature of consequences. Doing so, the associated emergency management (and consequently emergency planning and response) is also categorised following the 4 basic types of consequences:

1. People (health, safety and security) with SAR as most important emergency action
2. Planet (marine environment) with pollution (oil spill) control as primary focus
3. Property and Assets (materials) with salvage as main emergency measure
4. Professions/Business (socio-economy, liability, reputation, etc.), where business can be impacted on two levels: the vessel/OWF and its owner but also the socio-economy supported by the vessel and/or windfarm operations and activities in the vicinity.

The effects and cost implications due to equipment loss are discussed in the section about salvage (see Chapter 6.2.3) but there is also a large implication for the wind farm's guaranteed energy production, transfer and delivery. Ship and OWF owners take a whole range of measures and means aimed towards 'recovery', or at least reducing the extent of damage when an emergency occurs and/or increasing the inherent capabilities for recovery. These operational measures and means are mainly covered in a global maintenance contract for the OWF and its respective elements (wind turbines, electrical cabling, transformation stations, export cable, etc.) together with associated insurance coverage.

7.3 Extra Notice

It is important to recognise that the table below is not a prescriptive tool, but need intelligent application and advice provided on a case-by-case basis.

There may be opportunities for the interactive safety distance to be flexible where, again, for example, vessels may be able to distance themselves from OWF to provide more comfort without significant penalty, or where OWF could be distanced from shipping nodal points. It is recognised that larger ships, high speed crafts, hazardous cargo and passengers carrying vessels may have larger domains and then require more space for manoeuvring.

Traffic surveys would also establish any route traffic bias where mariners may naturally turn to starboard to facilitate passing encounters in accordance with the COLREG 72. Additionally, marine traffic surveys would identify vessel type or category which may consequently require larger domains to ensure that the following factors can be taken into consideration in determining corridor widths:

a. Compliance with the best practices of seamanship and principles to be observed in keeping a navigational watch including the composition of the watch
b. The manoeuvrability of vessels with special reference to stopping distance and turning ability in the prevailing conditions
c. Provisions that may be required with mechanical failure of vessels involved and level of support services
d. The state of visibility, wind, sea and tidal stream, and the proximity of navigational hazards
e. The traffic density including concentrations of fishing vessels or any other vessels

f. The draught in relation to the available depth of water and the existence of submarine cables and obstructions
g. The effect on radar detection of the sea state, weather and other OWF sources of interference (see precautionary use of radar in Chapter 7.2.4 above)

In the approaches to ports this is particularly relevant. This additional information would influence where safety distance need to be established.

Where larger developments have to provide corridors between sites to allow safe passage of shipping a detailed assessment will be required to establish the minimum width of the corridor. The assessment of the required sea room (corridor width) will be undertaken on a case-by-case basis and should take into account not only the requirements of the traffic survey but also the general location and sea area involved. It will not always be possible to make a course that is planned and experience shows that in heavy sea conditions it is much harder to stop or turn the vessel around. Deviations from track by as much as 20°, or more, are common and must be considered. This deviation is used as the baseline for calculating corridor widths contained in the OWF.

Both MSP and MEP tools which should be prepared for the OWF project will further refine the suggested safety distances in the table below which are based on unrestricted navigation (i.e. the largest vessels).

Distance in miles of the first wind generator row from the shipping route	Factors for consideration	risk	Tolerability for SOLAS ships
< 0.25 NM (500 m)	Inter-turbine spacing only recommended for small craft	**VERY HIGH**	**Intolerable** Unless for very small craft (small leisure craft)
0.5 NM (926 m)	Distance between a high traffic navigation route, used by ships covered by the SOLAS Convention and a wind farm	**VERY HIGH**	
1 NM (1,852 m)	Distance between a high traffic navigation route, used by ships covered by the SOLAS Convention and a wind farm	**HIGH**	**Tolerable** If ALARP (As Low As Reasonably Practicable)
2 NM (3,704 m)	Compliance with COLREGs becomes less challenging	**MEDIUM**	
5 NM (9,260 m)	Distance between shipping route and a wind farm in restricted waters	**LOW**	**Acceptable**
10 NM (18,520 m)	Ideal distance between a TSS and a wind farm	**VERY LOW**	

Table of general guidance for planning safety distance between a shipping route and the first obstacle of an OWF

Note:

- No OWF must be installed in a zone situated in the extension of a traffic lane.
- Shipping routes are routes regularly used by ships, whose definition is governed by geographical and hydrographic parameters; these routes cover long distances, particularly between two TSS. These routes concern the approaches of the channels of a port as well as travel between two ports.
- The width of the waterways through an offshore wind farm or between two OWFs will be interpolated from the table above. The general principle of separation of the waterway should follow the following scheme:

Red area: **Intolerable** unless for very small craft (small leisure craft)
Orange area: **Tolerable** If ALARP (As Low As Reasonably Practicable)
Green area: **Acceptable**

It should be noted that especially inside and around a port, since it is normally physically difficult for a ship to execute a round turn because of a completely specified shipping route, the safety distance between a shipping route and an offshore wind farm can be defined based on the existing standards in each country.

In order to illustrate the complexity of the precept to determine a safety distance between a shipping route and an OWF, examples showing current practice in different countries related to the safety distance between shipping traffic and OWF are indicated in annexes of the report.

APPENDIX A: REFERENCES

- Convention Law of the Sea (UNCLOS), United Nations, available from: [redacted].
- Navigation Rules (Colregs), USCG, available from: [redacted]
- Ship's Routeing, IMO publication, the updated 2015 edition is now available; sales code IF927E (print and e-reader file formats).
- IMO Resolution A.572(14) general provisions on ships' routeing, 20 November 1985.
- IMO Resolution A.801(19), provisions on radio services for the global maritime distress and safety system, 23 November 1995.
- IMO Resolution MSC.137(76) Standards for ship manoeuvrability, 4 December 2002.
- IMO Resolution MSC/Circ.1053 explanatory notes for the standards for ship manoeuvrability.
- IMO MSC-MEPC.2/Circ.12/Rev.1 Revised guidelines for formal safety assessment (FSA) for use in the IMO rule-making process, 18 June 2015.
- IMO MSC-MEPC.2/Circ.13 Guidelines for the application of the human element analysing process (HEAP) to the IMO rule-making process, 8 July 2013.
- ICAO/IMO JWG-SAR/22-WP 10, 10 August 2015, Search and Rescue Procedures, Processes and Techniques for SAR Helicopters and Rescue Boat Operations Responding to Offshore Wind Farms and other Renewable Energy Installations, presented by the United Kingdom.
- Marine Spatial Planning, a Step-by-Step Approach toward Ecosystem-based Management.
- Intergovernmental Oceanographic Commission, Manual and Guides No. 53, IOCAM Dossier No. 6, available from: [redacted]
- Directive 2014/89/EU, Establishing a framework for maritime spatial planning, 23 July 2014, available from: [redacted].
- IALA Recommendation O-139 "Marking of Man-Made Offshore Structures"; IALA Recommendation R1010 "The involvement of maritime authorities in marine spatial planning (MSP)"; and IALA guideline G1121 "Navigational safety within marine spatial planning", available from: [redacted]
- Marine Spatial Planning, November 2013, The Nautical Institute, available from: [redacted]
- Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI), 2013, available from: www.gov.uk/government/uploads/system/uploads/attachment_data/file/372597/NRA_Methodology_2013.pdf.
- Marine Guidance Note 371 (M+F) "Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues." Maritime and Coastguard Agency, August 2008, replaced by MGN 543 (M+F).
- Marine Guidance Note 372 (M+F) "Offshore Renewable Energy Installations (OREIs): Guidance to Mariners Operating in the Vicinity of UK OREIs" Maritime and Coastguard Agency, August 2008.

- Marine Guidance Note 543 (M+F) “Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response.” Maritime and Coastguard Agency, January 2016, available from: https://www.gov.uk/government/organisations/maritime-and-coastguard-agency.

- “Investigation of Technical and Operational Effects on Marine Radar close to Kentish Flats Offshore Wind Farm”, BWEA (British Wind Energy Association), April 2007, available from: www.dft.gov.uk/mca/kentish_flats_radar.pdf.

- Results of the electromagnetic investigations and assessments of marine radar, communications and positioning systems undertaken at the North Hoyle wind farm by QinetiQ and the Maritime and Coastguard Agency, 15 November 2004, Requests for further information should be sought from: Navigation Safety Branch, Bay 2/30, MCA.

- Final Report DE-EE0005380 Assesment of Offshore Wind Farm Effects on Sea Surface, Subsurface and Airborne Electronic Systems, prepared for US department of Energy, the University of Texas at Austin, 30 September 2013.

- Radio Regulations, International Telecommunication Union (ITU) available from: [redacted].

- Annexes to the Convention on International Civil Aviation Organisation (ICAO): Annex 14 Volume I — Aerodrome Design and Operations, contains Standards and Recommended Practices that prescribe the physical characteristics, obstacle limitation surfaces and visual aids to be provided at aerodromes, as well as certain facilities and technical services normally provided at an aerodrome. Volume II — Heliports, contains Standards and Recommended Practices covering aspects of heliport planning, design and operations. Available from: [redacted]

- Proposals for the amendment to annex 14, volume I and volume II, 4 June 2015, ICAO, A35 – A40. Available from the Internet

- Policy and Guidelines on Wind Turbines, CAP74, Civil Aviation Authority, June 2013, available from: [redacted]

APPENDIX B: GLOSSARY

- AIS: Automatic Identification System
- ARPA: Automatic Radar Plotting Assistance
- COLREGs: Collision Regulations
- CRS: Coastal Radio Station
- DGPS: Differential GPS
- DSC: Digit Selecting Calling
- EEZ: Exclusive Economic Zone
- EFTA: European Free Trade Association
- EMR: Electromagnetic Radiation
- EU: European Union
- FEMA: Federal Emergency Management Agency (USA)
- GMDSS: Global Maritime Distress and Safety System
- GNSS: Global Navigation Satellite System
- GPS: Global Positioning System
- GPSR: General Provision for Ship Routeing
- GT: Gross Tonnage
- ICAO: International Civil Aviation Organization
- IALA: International Association for Lighthouses and Aids to navigation
- IMO: International Maritime Organization
- ITU: International Telecommunications Union
- JWG: Joint Working Group
- LOS: Line Of Sight
- MEP: Maritime Emergency Planning
- MSP: Marine Spatial Planning
- MTI: Moving Target Indicator
- NM: Nautical Miles
- OWF: Offshore Wind Farm
- RCC: Rescue Co-ordinating Centre
- RDF: Radio Direction Finder
- RF: Radio Frequency
- RR: Radio Regulations
- Rx: Receiver
- SAR: Search And rescue
- SOLAS: Safety Of Life At Sea
- Tx: Transmitter
- UN: United Nations
- UNCLOS: United Nations Convention on the Law Of the Seas
- UNESCO: United Nations Educational, Scientific and Cultural Organization
- VHF: Very High Frequency
- VOR: Visual Omni Range
- VTS: Vessel Traffic Services

APPENDIX C TERMS OF REFERENCE OF WG 161

Interaction between Offshore Wind Farms and Maritime Navigation

TERMS OF REFERENCE

Historical Background – Definition of the Problem

Increased activity within Europe's marine waters has led inevitably to growing competition for maritime space. Competing claims from a range of activities, including fisheries, leisure navigation locations allocated for military exercises, old ammunition dumps, navigation and anchoring areas, oil and gas exploitation, sand extraction and wind and wave energy generation are accompanied by increased pressure on vital marine ecosystems and habitats. Without the means to co-ordinate a common approach to the allocation of maritime space among different sectors, the problems of overlap and conflict between sectors and individual stakeholders is evident. There are also cross-border issues as developments in the maritime area of one country may well have impacts for another. The relatively new notion of Maritime Spatial Planning has emerged as a means of resolving conflicts over maritime space.

In order to increase the amount of environmentally friendly produced electrical energy, some coastal states decided that a significant part of the total yearly consumption has to be produced at sea favourably as close as possible to the shore in order to achieve as low as possible transportation losses. For these areas, which are situated between or near the shipping lanes, a conflict between shipping and the areas appears.

When a sea area of considerable size for the production of energy is to be located in a route junction or converging area of ships' routeing or in any other way in the vicinity of ship's routeing systems or shipping lanes, it is necessary to maintain the risk to shipping at a minimum but certainly not higher than the present level of risk. One of the relevant issues is that in some countries navigation within the borders of a windfarm is allowed; in that case crossing traffic can be expected to emerge from the windfarm.

Objective and Product of the Study

In order to ensure that a sea area for the exploitation of mineral resources or for the production of energy from water, currents or wind, will not interfere with sea lanes essential to international navigation or other navigation activities and will not cause problem to electronic navigation aids, the Working Group aims at the development of a set of recommendations and guidelines for consideration to assess the sufficient manoeuvring space and the minimal distance between navigation and the offshore installations, making sure that the risk to shipping is acceptable.

The sufficient manoeuvring space and minimal distance will depend on various situations and criteria as:

- Traffic density
- Ships routeing systems/precautionary areas
- Radar and VTS
- Size of ships including manoeuvring characteristics
- Recreational activities
- Fishing activities
- Available width of the [established] traffic lane
- Crossing traffic incoming from starboard in front of a wind farm
- Crossing traffic emerging from the wind farm
- Crossing traffic incoming from starboard behind of a wind farm
- The possibility of fishing vessels or other small craft being present in the area between wind farms and traffic lanes

- Weather conditions (wind and waves)
- Tidal current conditions
- The positioning of anchor areas
- Areas for (dis)embarkation of pilots
- Effects of windfarms on the ship's radar presentation

The Working Group will pay attention to international rules like the Collision Regulations and the General provisions on ships routeing etc.

Previous PIANC Reports

WG 30 – Approach Channels: A Guide for Design, 1997 (95)
WG 49 – Horizontal and Vertical Dimensions of Fairways

Method of Approach

- review of actual practice of distances between shipping and offshore wind farms so far by consultation of stakeholders
- collect the available background information and review the approach taken
- give considerations for determining the safe distance for different situations, according to the various uses of the sea, the size of the vessels, the layout of the shipping routes, anchorages, pilot stations etc.
- review of recent developments in design tools (such as risk assessments and simulation techniques) in order to assess the appropriate manoeuvring space and minimal distance between shipping and wind farms in order to achieve safe navigation
- develop risk-based considerations, recommendations and guidelines for assessing the sufficient manoeuvring space and the minimal distance between shipping and areas for wind farms, in order to ensure a minimal risk level for navigation

Suggested Final Product of the Working Group

The final report of the Working Group 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 for offshore windfarms, in order to ensure a minimal risk level for navigation.

Desirable Disciplines of the Members of the Working Group

It is proposed this working group should include practising engineers engaged in maritime disciplines or responsible for design or use of maritime infrastructure; navigation captains.

Relevance for Countries in Transition

The recommendations of the Working Group will be appropriate for the maritime spatial planning in Countries in Transition.

APPENDIX D: CURRENT PRACTICE IN THE NETHERLANDS

The 2016-2021 North Sea Policy Document

Introduction

This Annex summarises the relevant sections of the 2016-2021 North Sea Policy Document for the Dutch Exclusive Economic Zone related to wind farms and shipping.

On the North Sea, a large number of (user) functions must be assessed so that the best use can be made of the limited space. The current '2016-2021 North Sea Policy Document' offers integral frameworks for the use of space on the North Sea.

The Ministry of Infrastructure and Environment instigated the process that produced this new policy document. Central government agencies, local governments, international parties and users of the North Sea have all helped to update the policy.

The '2016-2021 North Sea Policy Document' describes the current situation on the North Sea, maps out the developments for the years to come and records the policy choices for the upcoming planning period.

The North Sea Policy Document describes three societal demands that require a new policy:

- Marine Strategy Framework Directive (MSFD) Program of measures
- Offshore wind energy
- Sand extraction strategy

Other subjects covered in the North Sea Policy Document include oil and gas extraction, shipping, defence exercise areas, CO_2 storage, tourism and recreation and underwater cultural heritage. It also pays specific attention to the interaction between land and sea and international co-operation.

Please find below the link to the 2016-2021 North Sea Policy Document: 2016-2021 North Sea Policy Document.

Design Criterion: Distance between Shipping Routes and Wind Farms

For the purposes of reserving space, the 'reference ship' is important. Depending on the route, the reference ship is 300 or 400 metres long. The routes to Amsterdam, for example, have a reference ship 300 metres long.

The largest manoeuvre a ship must be able to make, and hence for which there must be sufficient space, is the so-called round turn. 6 ship lengths are required for this. An extra 0.3 NM evasive manoeuvre is necessary on the starboard side prior to a ship executing the round turn, because an initial effort will be made to avoid performing a round turn. The overall space required on the starboard side is therefore 0.3 NM + 6 ship lengths. Moreover, a safety zone of 500 metres around single objects (wind turbines) is in force. Within this zone no passage is possible at present. The required safety distances for shipping are therefore:

- In the case of ships 400 metres in length: 1.87 NM on the starboard side and 1.57 NM on the port side
- In the case of ships 300 metres in length: 1.54 NM on the starboard side and 1.24 NM on the port side

For the clearways, the connecting routes between the formal routes, these distances have been included in the width of the clearway path. For anchorages and precautionary areas, the same safe distances can be maintained as for a traffic separation scheme.

Please note: The 'Design Criterion: Distance between Shipping Routes and Wind Farms' has been worked out together with the shipping sector. It is intended to determine the space between the shipping route and wind farms at sea that shipping needs to be able to navigate swiftly and safely. It has been

applied to the wind energy areas ‘Coast of Holland’ and ‘North of the Wadden Islands’. The design criterion has not been applied to the wind energy areas ‘Borssele’ and ‘IJmuiden Ver’, designated in 2009. In this regard a provisional distance of 2 NM applies for the shipping route.

Passage and Multiple Use

At present, passage through and multiple use of wind farms at sea are not permitted. Various users of the North Sea, such as recreational sailing and (professional) fishing, want these areas to be accessible. The closure of the wind farms for these and other users will, in the future, cause increasing pressure, due to wind farm development within the framework of the Energy Agreement, the increasing activities at sea and the reduction of the fishing zones. Passage through and multiple use of wind farms can contribute to efficient use of space, as well as presenting opportunities to bolster the sustainable use and biodiversity of the North Sea.

The policy is that, from 2017, passage and multiple use will be allowed in all operational wind farms under the following conditions:

- Passage will be facilitated for smaller vessels with a maximum length, under enforceable conditions that ensure an acceptable level of SAR possibilities.
- Multiple use will be made possible for recreational purposes and activities that do not disturb the seabed, as well as for aquaculture and other forms of sustainable generation of energy. Furthermore, interests will be weighed up in the context of installing a safety zone around the wind farm or - where the various uses of permanent constructions are concerned – in the context of granting a permit pursuant to the Water Act.
- For the purposes of innovative activities that do not require a permit, not all forms of passage through and multiple use of wind farms can be allowed. Approval needs to be obtained for each individual initiative on the basis of an assessment of: the risks related to possible nuisance and damage to the wind farm, the legally protected ecological values and enforceability.

Not all forms of passage and multiple use are deemed suitable, due to the safety risks, the chance of damage to the wind farm or obstruction of its management and maintenance and ecological risks. On the other hand restrictions in multiple use can also create possibilities for ecological development. For these reasons and to be able to maintain responsible passage and multiple use, this policy will be elaborated in policy rules.

In the operational farms to be opened in 2017, the activities taking place there and their frequency will be monitored. Effective implementation will be carried out by revising the Act of General Application regarding Installing a Safety Zone for each individual wind farm.

Prior to opening the wind farms, the Central Government will provide the infrastructure and facilities necessary for setting the conditions and, in cooperation with the sectors involved, initiate an information campaign.

On the basis of monitoring and evaluation of the farms opened from 2017 onwards (for two high seasons following opening), any amendment to the policy rules and the acts for installing a safety zone will take place in mid-2020. The stakeholders will be expressly involved in the monitoring and evaluation.

Because of high costs for enforcement of the conditions for passage and multiple use in the remote windfarm Gemini, this farm will remain closed. In the foreseen evaluation of 2020 this decision could be reconsidered.

Design Process: Distance between Mining Sites and Wind Farms

The characteristics of a mining platform, the location and format of the wind farm, and the possibility of multiple use of space will vary for each site. Consequently, accessibility to helicopters will have to be assessed for each platform individually. To this end consultation will be held with the mining company concerned, with due regard for relevant aspects from the perspective of flight safety and the interests of the future wind farm operator. A procedure leading up to the establishment of a draft plot decree for a wind farm is applicable.

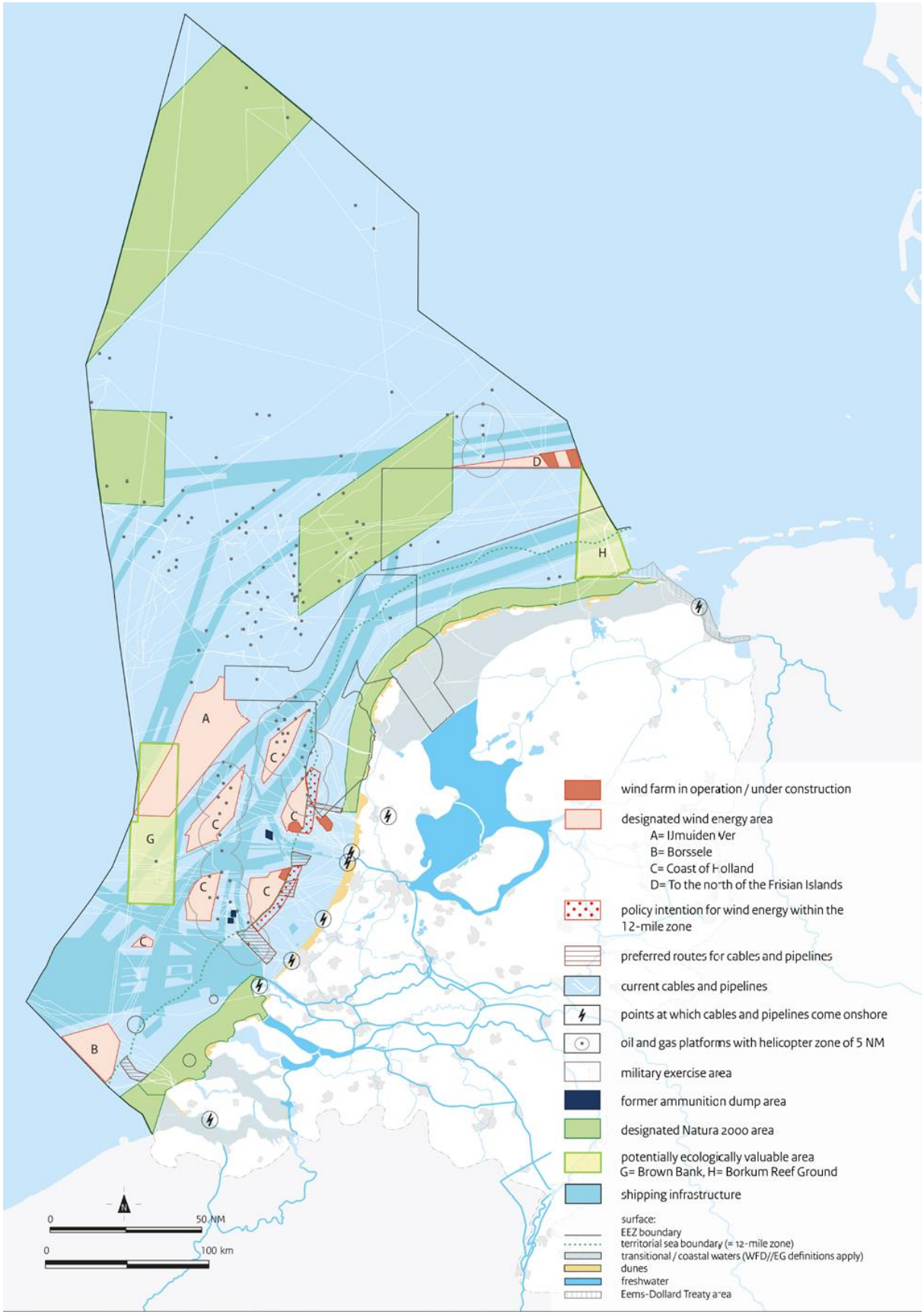


Figure 1: Dutch EEZ of the North Sea with various functions

APPENDIX E: CURRENT PRACTICE IN JAPAN

Technical Guidelines for Offshore Wind Power Generation Facilities in Ports

Introduction

In Japan, a port area is considered promising as a suitable construction site for offshore wind farms. Because a port has a water area management body and also has infrastructure necessary for the construction and maintenance of wind turbines nearby. In 2015, the Ports and Harbors Bureau of the Ministry of Land, Infrastructure, Transport and Tourism, formulated 'Technical Guidelines for Offshore Wind Power Generation Facilities in Ports' as technical advice based on the Local Autonomy Law of Japan. The guidelines propose the separation distance from an offshore wind farm area to port facilities such as shipping routes and breakwaters.

Separation from Water Area Facilities

Offshore wind farm operators shall secure the separation distance to water area facilities such as navigation routes in order to satisfy both of the followings.

- The separation distance with which the water area facilities cannot be affected by the wake behind a wind turbine.
- The separation distance with which the water area facilities cannot be directly affected by the collapse of an offshore wind power generation facility.

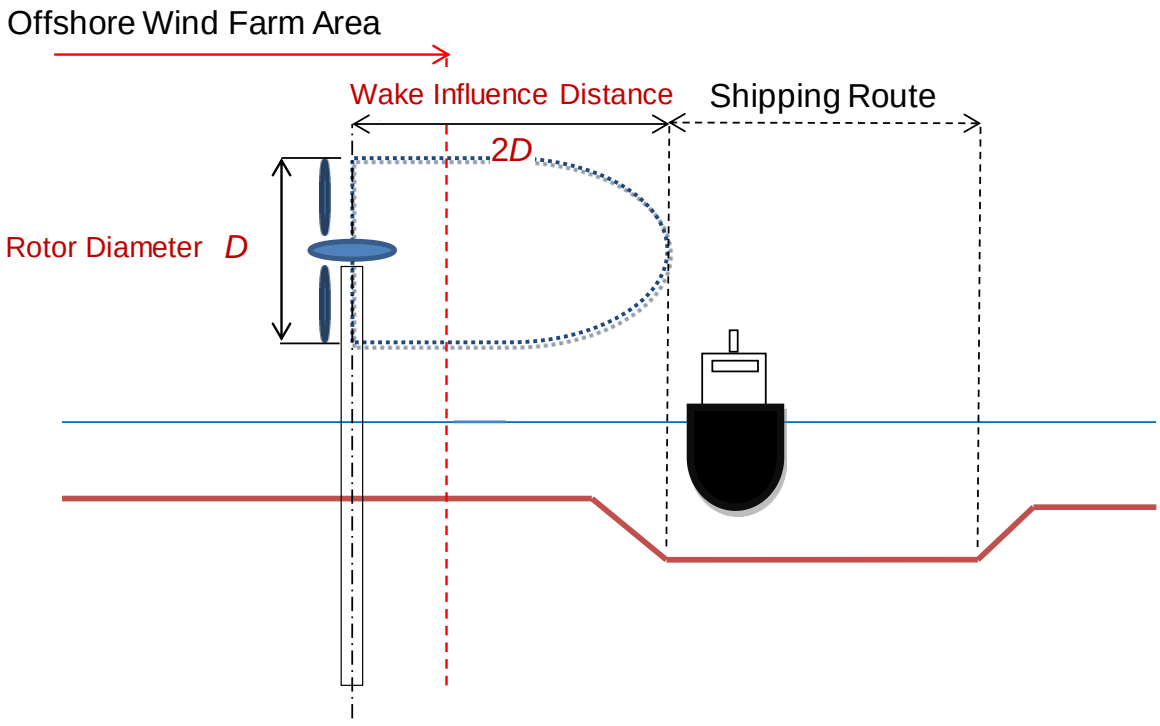


Figure1: An example of the separation distance considering the wake behind a wind turbine

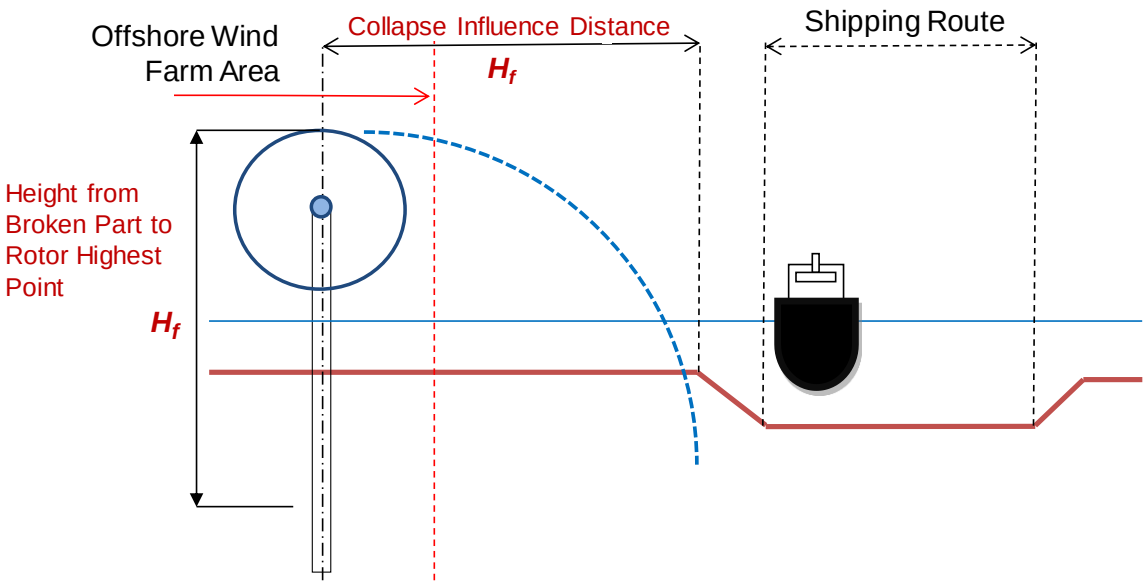


Figure 2: An example of the separation distance considering the collapse of an offshore wind power generation facility

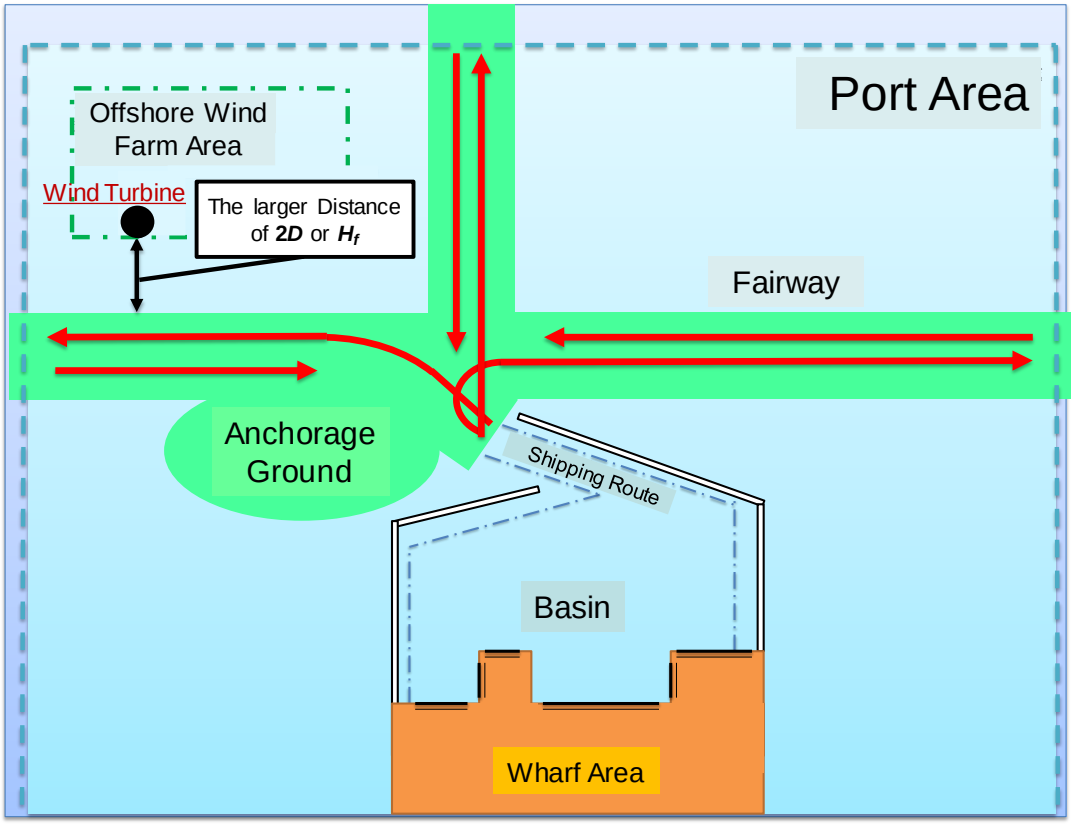
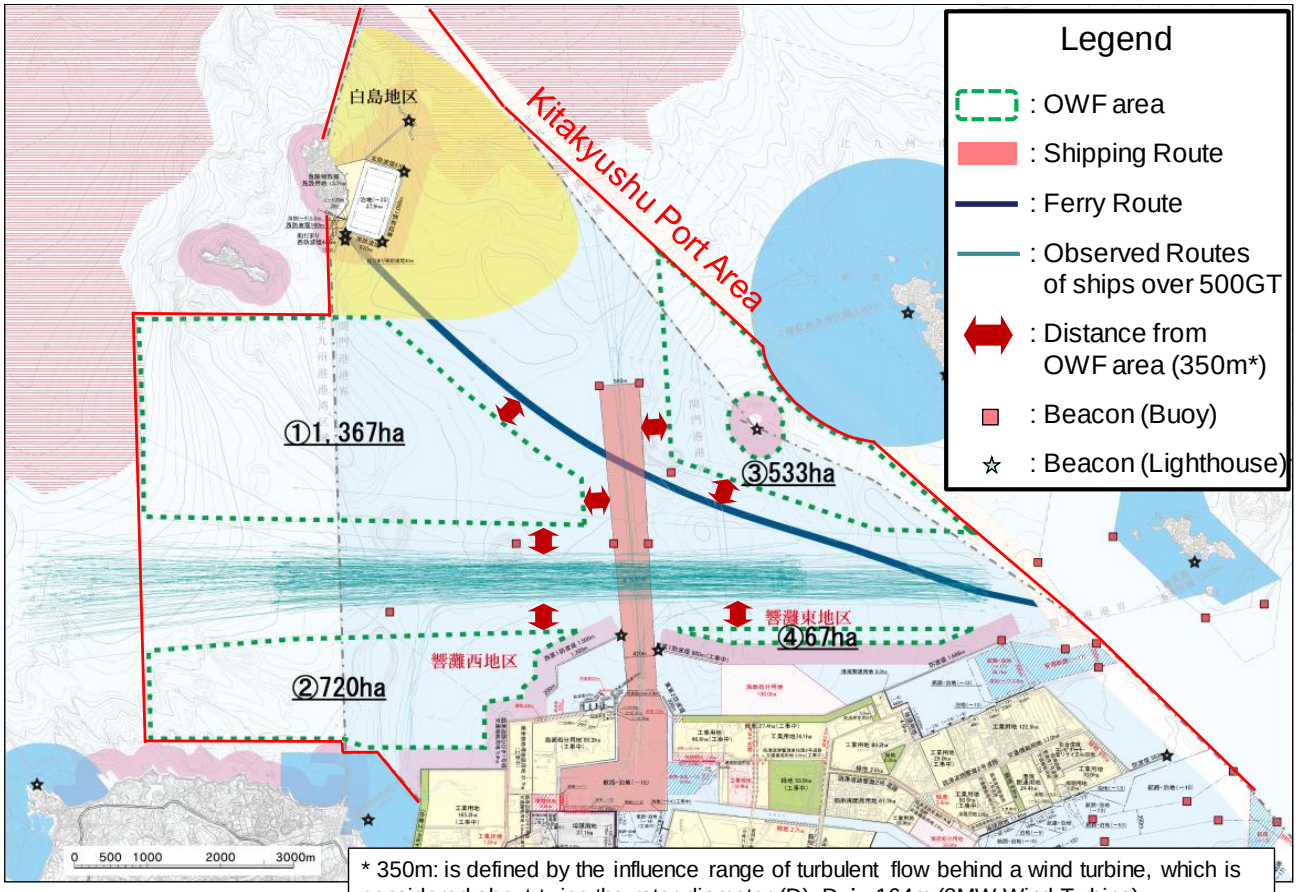


Figure 3: An example of the separation distance to a fairway (which can be considered one of the water area facilities)

Example of Project: The Offshore Wind Farms Plan in Port of Kitakyushu



* 350m: is defined by the influence range of turbulent flow behind a wind turbine, which is considered about twice the rotor diameter (D). D ≒ 164m (8MW Wind Turbine)

APPENDIX F: CURRENT PRACTICE IN FRANCE

Technical Note on Maritime Safety Measures for Offshore Wind Farm Planning

The Maritime Affairs Directorate in France, with the help of the nautical expertise of Cerema, has established a Technical Note on Maritime Safety Measures to be taken into account during the phases of defining and planning the areas suitable for the installation of offshore wind farms (OWFs).

This note, dated on 11 July 2016, defines the recommendations related to maritime safety contributing to the definition of areas suitable for the installation of offshore wind turbines and for the study of offshore wind farm (OWF) projects.

Background and Purpose of the Note

Background

The introduction at sea of a new activity must take into account the constraints of maritime transport when this zone or sector includes a shipping route, whether it is free or inscribed in compulsory traffic lanes. Indeed, it is necessary to know the subjects specific to the ship and its environment, namely in particular:

- The need to have sufficient manoeuvring space to avoid collision and to ensure compliance with the rules of navigation imposed by the International Regulations for Preventing Collisions at Sea (COLREGs). The definition of this space should take into account the density and nature of maritime traffic, the reduction of visibility, the presence of fishing vessels and pleasure craft.
- Vessel characteristics including stopping distances, radius of gyration, dynamic squatting, etc.
- The necessity, in case of bad weather, of being able to shelter from the coast in an anchorage
- Radio interference, generated by the OWFs that impact radio navigation systems, such as radar, and radio communications, in particular VHF
- Road deviations due to exceptional circumstances or cases of force majeure (damage to helms, medical evacuation, engine failure)
- Restricted manoeuvring capabilities due to, inter alia, a deep draft, transfer of a pilot, transhipment operation or towing
- The geographical specificity, current and hydrography of the area
- The nature of the cargo carried
- The necessity for rescue and assistance vessels to gain access to the area in question in case of distress or sea event
- The vessel's alertness and alert level (presence of a pilot or ready mooring arrangements)

Purpose

This note defines the maritime safety measures to implement during the phases of defining the areas suitable for the installation of OWFs as well as during the study of the projects developed by the operators. It allows the Maritime Authority to lay down provisions to ensure the safety of maritime traffic in the vicinity of an offshore, floating or laid wind farm facilities.

The note concerns ships of 300 gross tonnage or more, excluding traffic dedicated to the installation, operation and dismantling of the OWF. However, recommendations for the use of radar and VHF radio are also relevant to all other vessels.

The measures defined in this note relate to:

- The safe distance between the facilities and the vessel traffic areas
- Aids to navigation through maritime marking, vessel traffic services (VTS) and some measures to facilitate search and rescue (SAR)

Maritime Navigation: Minimum Safety Distance between an OWF and Maritime Traffic

For the purposes of this note, the right-of-way of an OWF includes, in addition to the limits of the authorisation to occupy the public maritime domain:

- The peripheral zone intended for the protection of the site defined by the Maritime Authority in territorial and inland waters
- 500 metres in accordance with Article 60 (5) of the United Nations Convention on the Law of the Sea, in the exclusive economic zone

The Minimum Distance to Stop a Vessel

Resolution MSC.137 (76) and Circular MSC/Circ 1053 set minimum standards for vessel manoeuvrability. These standards should be considered in the following two situations:

- The ship is in 'free-running' situation: the ship is underway with its machines delivering a power corresponding to about 80 % of their maximum power
- The ship is in 'manoeuvring' situation: which corresponds to a take of a pilot or entry into a port navigation channel, the stopping distances are much smaller. Indeed, the vessel reduces its speed and its manoeuvring and anchoring auxiliaries are ready to accelerate the evolution or stopping of the ship.

In the event that the OWF does not about a port entry channel and is located further offshore in the free navigation zone or in the environment of a traffic separation scheme (TSS), the ship should be considered in 'free-running' situation.

The Emergency Stopping of a Ship ('Crash-Stop')

According to international regulations, the distance recommended for the 'emergency stopping of a ship' test shall not exceed 15 times the length of the vessel; for deep draft vessels, this distance may be greater, but may not exceed 20 times their length. This test is for a vessel launched at 90 % of its maximum speed to give the order to 'reverse all', to reverse the direction of thrust of the propeller in order to stop the vessel. This total stopping distance for a large vessel is about 3 miles.

The Turning of the Ship

In addition to the 'crash-stop', a ship may make a half-turn by making a turn to avoid an obstacle. The advance is the distance travelled between the time the bar command is given and the time when the ship is heading + 90 °. This distance is at least 0.3 miles while the turning circle diameter is 5 times the length of the ship.

However, these values are variable because several ship-specific parameters are involved: ship's beam, initial velocity, draft, depth of water under the keel to take account of small radius of turning circle, weather conditions, strength and current direction. The human element should also be considered for the decision time to manoeuvre. As a result, it is reasonable to add an additional ship length.

While it is often preferable to shirk by making a turning circle, which is more effective than a 'crash-stop' for a ship on the open sea, this is not always possible in heavy traffic areas (presence of many vessels) or in danger areas (shallow water).

As an indication, the manoeuvring space of a vessel of 300 metres long in open sea and 'free-running' situation will be a turning circle with a diameter of 1 mile.

Sufficient Space to Assess Collision Risk

Given the visual impediment of an OWF, sufficient space should be maintained to allow the vessel to determine the risk of collision, in accordance with COLREGs Rule 7. The vessel shall be able to assess

the possibility of crossing traffic originating from starboard in front of the OWF, crossing traffic from the OWF or crossing starboard behind the OWF irrespective of the size and type of vessels.

This assessment takes into account the distance available in front of the ship and on the sides of the vessel, which distances may vary depending on the manoeuvring space required for a vessel.

Vessels should also be given a sufficient field of view to assess the risk of collision of ships coming from the same side of the OWF (in front, inside or behind the OWF).

The distance made during the time required to assess the risk of collision is estimated at 0.5 miles.

The Distance Required to Minimise Disturbance on Ship's Radars

The presence of OWF causes disruptions to the reception of radar signals from ships sailing in or near these areas. A mirror effect of radar waves on wind turbines generates false echoes that can be confused with echoes from other ships. The accumulation of these false echoes with real echoes complicates the kinematic analysis of the routes of ships transiting near the wind farm. These false echoes constitute a disturbance or even a risk in collision course situations, especially at night and in case of poor visibility. In addition, small vessels with low radar signature are no longer systematically detected when they are sailing close to OWFs.

The recommended distance to minimise disturbance on radars in ships is 1.5 miles.

The Distance Required to Minimise Disturbances on Radio Navigation Systems

Depending on the importance of the information provided by a global navigation satellite system (GNSS) or a local radio navigation system available, it is suggested a study on the potential impact on GNSS and the local radio navigation system and its coverage is carried out during the risk analysis period of an OWF project.

Studies has been carried out in France on the disturbance generated by an OWF on the differential GPS signal (DGPS). These studies show that to maintain the accuracy of the DGPS with OWF made of 160 m high wind turbines, it is necessary to ensure a distance of 1,200 m between wind turbines and ships and between wind turbines and the DGPS reference station. The disturbance of the GPS signal affects the AIS as a GPS-related vessel identification system. The higher would be the wind turbines of the OWF, the greater would be the distance to minimize disturbance on DGPS.

Minimum Safety Distance Recommendation

The installation of an OWF must take maritime navigation into account. The definition of a safe distance between these installations and the passage of vessels is particularly important if the OWF is located close to a shipping route, in particular a TSS or a port approach channel.

The criteria for determining this minimum safety distance, which contribute to the definition of the areas suitable for the installation of OWF, are summarised in the table in annex 1.

However, the Maritime Authority may ask the operator for a formal risk assessment when the acceptable distances recommended in annex 1 cannot be met.

Even if the safety distance is observed, a formal risk assessment may also be requested when the OWF is located near a high-speed craft route, passenger ship route or a regular line of vessels carrying dangerous goods, with particularly difficult navigational conditions. This formal risk assessment is based on IMO Formal Safety Assessment (FSA). The latest IMO reference is MSC-MEPC.2/Circ.12/Rev.1 Revised guidelines for formal safety assessment (FSA) for use in the IMO rule-making process, 18 June 2015. An example of a risk analysis table for FSA is presented in Annex 2.

Aids to Navigation in the Vicinity of Offshore Wind Farms

Maritime Marking

The offshore wind farms have a maritime marking in accordance with IALA recommendation O-139.

Vessel Traffic Services (VTS)

Coastal VTS monitor maritime navigation of traffic separation schemes (TSS) and any ship routeing measures at sea. Port VTS monitor maritime navigation in and around approaches to seaport access channels. In addition, the Maritime Authority, in consultation with the Shore Authority, have defined maritime and river regulated areas for access to certain ports. Finally, naval signal stations monitor maritime approaches.

Operated independently of the monitoring of OWF, the VTS perform their missions with the use of radar, direction finder and AIS shore stations. The continuity of operation of radar, direction finder and AIS monitoring must be preserved in the VTS areas.

There is a need to provide a safety area on each side of a TSS, in order to facilitate ships safety manoeuvres in case of damage, collision or avoidance (see 2 above). In addition, a minimum distance between the wind turbines of the OWF and TSS allows to limit the areas of radar shadow and AIS frequency disturbances. To this end, a circular protection area of 5-mile radius around the VTS radar antennas must be provided. Within this protection area, the risk of disturbance of the radar is too high to allow the installation of any wind turbine.

In case of installation at a lower distance, the operator integrates this situation into the formal risk assessment (See 2.5 above) and proposes, where appropriate, measures to reduce the identified risks (e.g. additional radar capacity, pilot, tug, etc.).

The installation of an OWF in the vicinity of the equipment necessary to monitor a VTS area is likely to generate disturbances that should be assessed and compensated. All compensatory equipment must transmit the data and information in real time to the impacted VTS.

The objective is to maintain equivalent capacities not only in terms of coverage and performance but also in terms of the time between the detection of a hazardous situation and the risk of a collision with a wind turbine or between two ships in the immediate vicinity of an OWF. Consequently, the arrangements for integrating compensatory equipment are examined and analysed appropriately with the competent departments, in particular those of the relevant VTS.

VHF Radio Communications

In order to ensure the radio watch of distress calls (radiotelephony VHF 16) and alerts (digital selecting call) for distress and safety at sea and in order to coordinate the response to incidents, accidents and marine or navigation events, coastal radio stations are deployed along the coast. Their number and performance are established to ensure a consistent and permanent coverage of the areas declared on the IMO global maritime distress and safety system (GMDSS) master plan. These stations are remote controlled from the MRCC, which coordinates maritime rescue operations.

The current documentation on the presence of several dozens of wind turbines does not demonstrate any impact on VHF emissions. There are, however, several studies confirming a VHF disturbances, which, under certain conditions, may affect not only the voice but also the digital selective call and the AIS signal. It is therefore necessary to adopt a precautionary principle: within the OWF a supplementary VHF station composed of two multi-channel equipment. In the months following commissioning of the OWF, the operator shall carry out VHF propagation measurements in and near its OWF. It will communicate the results to the maritime authority, which may request any official service or a public institution for their competence or technicality to validate or invalidate the analyses presented by the petitioner. The technical characteristics of a supplementary VHF station deployed in an OWF are specified in Annex 3.

During this transitional phase and until the results of the assessment, VHF equipment can be made available to the operator by the Maritime Affairs Directorate. The operator will be responsible for the integration and installation of the latter, in particular the aerials, and the network connection to the shore. If the studies reveal VHF disturbances, the Maritime Affairs Directorate will require the operator to install and connect a VHF coastal radio station in order to comply with the GMDSS sea area A1 requirements, and operated by the competent MRCC.

If no disturbance is noted, the operational interest in maintaining the equipment will be assessed. In the event that the station should be maintained for operational reasons, the Maritime Affairs Directorate will initiate a contractual procedure with the operator to define the modalities of accommodation of the equipment and accessibility to the sites.

ANNEX 1: REQUIREMENTS FOR MINIMUM SAFETY DISTANCE BETWEEN MARITIME NAVIGATION AND OFFSHORE WIND FARMS

Distance in miles (NM) of the first wind generator row from the shipping route	Factors for consideration	risk	Tolerability
< 0.25 NM (500 m)	Inter-turbine spacing only recommended for small crafts	**VERY HIGH**	**Intolerable** unless for very small craft (small leisure craft)
0.25 NM (500 m)	X band radar interference	**VERY HIGH**	
0.45 NM (800 m)	Vessel may generate multiple echoes on VTS radars	**VERY HIGH**	
0.8 NM (1481 m)	Distance from a shipping route taken by SOLAS vessels and a wind farm	**HIGH**	**Tolerable** if As Low As Reasonably Practicable (ALARP)
1.5 NM (2778 m)	S band radar interference ARPA affected	**MEDIUM**	
2 NM (3,704 m)	Distance between a shipping route and a wind farm	**LOW**	**Acceptable** depending on traffic density
5 NM (9,260 m)	Distance between TSS and a wind farm in restricted waters	**LOW**	**Acceptable**
10 NM (18,520 m°	Ideal distance between a TSS and a wind farm	**VERY LOW**	

Note:

- No wind farm must be installed in a zone situated in the extension of a traffic lane.
- Shipping routes are routes regularly used by ships, whose definition is governed by geographical and hydrographic parameters; these routes cover long distances, particularly between two TSS. These routes concern the approaches of the channels of a port as well as travel between two ports.
- The As Low As Reasonably Practicable (ALARP) concept is part of a risk management approach which consists in reducing as much as possible the frequency and severity of hazards that may affect the wind field or ships, by compensatory measures associated with the project (traffic control, enhanced maneuvering capabilities, means of assistance, specific equipment).

ANNEX 2: EXAMPLE OF A RISK ANALYSIS TABLE FOR FORMAL SAFETY ASSESSMENT (FSA)

Summary of the main hazards relating to merchant ships near an OWF			Effects	Gravity SI	Frequency FI	Risk RI=SI+FI
Hazards	**Causes**					
Collision	Human element		founding, grounding, fire, pollution, human life lost			
	Related to the ship	Radar info lost, ME failure, steering gear failure, black-out, breaking mooring				
	External to the ship	Other ships, weather				
Grounding while underway	Human element		fire, pollution, human life lost			
	Related to the ship	Automatic positioning error, radar info lost				
	External to the ship	GNSS info lost, fixed danger, reported (wreck), weather, tide				
Grounding while drifting	Human element		fire, pollution, human life lost			
	Related to the ship	Main engine failure, steering gear failure, black-out, breaking mooring, fouled anchor				
	External to the ship	Weather, tide				
Allision with a structure at sea (wind generator) while underway	Human element		fire, pollution, human life lost			
	Related to the ship	Automatic positioning error, radar info lost				
	External to the ship	GNSS info lost, fixed danger reported, weather, state of the sea, tide				
Allision with a structure at sea (wind generator) while drifting	Human element		fire, pollution, human life lost			
	Related to the ship	Main engine failure, steering gear failure, black-out, breaking mooring				
	External to the ship	Fixed danger reported, weather, state of the sea, tide				

ANNEX 3: TECHNICAL SPECIFICATIONS OF AN EXTRA VHF STATION DEPLOYED IN AN OWF TO COMPENSATE DISTURBANCE OF MRCC VHF WATCH KEEPING

1. Objectives and Constraints

The desired continuous radio coverage is 20 NM from the OWF. This coverage corresponds to a receiver of -107 dBm on an antenna at 4 metres above water and a transmitter with a power of 25 W placed at 40 metres above water. The extra VHF station will consist of two marine VHF transmitters/receivers (Tx/Rx) which operate in multi-channel mode, that is to say, the MRCC will control remotely the Rx/Tx to change the working channel.

Two hypotheses are being considered, including:

1) A single Tx/Rx is in operation. The second Tx/Rx is the first backup activated in case of failure of the primary Tx/Rx
2) Two Tx/Rx are in operation with a clean aerial compliance vertical decoupling of at least 9 metres

The first assumption allows hardware redundancy of Tx/Rx but is not free of a damage on the aerial (connection/pulling) unlike the second. The second hypothesis is therefore sought if the implantation conditions allow the installation of two pairs of aerials.

1.1 Expected Availability

The station will operate round the clock, 7 days on 7. In case of damage incurred on an Tx/Rx, the intervention will occur within 10 business days. In case of damage on the 2 Tx/Rx or on a common aerial, the intervention must be made within 2 business days.

1.2 Maintenance Constraints

Access to the site will be the subject of an agreement between the operator and the MRCC. Equipment maintenance based on preventive visits (1 year) and corrective visits if necessary.

This maintenance will be carried out at the expense of the operator if the impacts on the MRCC communication devices are proven. Otherwise, these maintenance operations will be at the expense of the Administration.

2. Characteristics of the Station

2.1 Frequencies Used by the Tx/Rx VHF

The frequencies are spread over two frequency bands, namely 156.025 MHz to 157.425 MHz and 160.625 to 162.025 MHz. These bands consist of 25 kHz wide channels and are defined in Appendix 18 of the Radio Regulations of the ITU. They must be protected and will not be subject to interference.

2.2 Technical Area Equipment

The technical area where the equipment will be installed must be sealed against salt air and fitted with a humidity control, ideally the room must be air conditioned.

A 2-metres high bay, 19 inches wide and 80 cm deep (42U type) will contain the following:

- two Tx/Rx Built VHF and PTT relay
- an IP/analog switches and its associated power supplies
- a converter 220/24V
- a battery pack
- battery charger

- fans if the equipment room is not air conditioned

2.3 Aerials

The aerials are placed close to the outer face of the wind turbine, without obstruction by the blades. A blade passing in front of a transmitting antenna would cause a high return of energy that could quickly destroy the amplification stage of the Tx/Rx.

In addition, the mass of air pressure effects disturbed the blades passage may introduce forces on the antenna connectors and damage the seal.

Depending on the assumption chosen, the aerials will be composed of one or two pairs of aerials installed on the platform or the wind turbine tower at a minimum height of 20 metres above the highest high tide water level.

The maximum cable length between the Tx/Rx and the aerial should be 50 metres. If two pairs of aerials are installed, they must comply with a vertical decoupling of 9 metres to protect the Tx/Rx from each other.

A pair of aerials consists of two aerials located at the same height but positioned either side of the wind turbine tower in order to ensure a 360° coverage of the area. These aerials are connected to the couplers through straps 1/2".

The coaxial cable between the couplers and Tx/Rx will be of type 3/8" and 1/2" according to the cable outlet to respect cable bending radius.

The aerials have only a minimum to lightning protection since they are protected by the lightning rod of the cone of the wind turbine.

The aerials will be whips of the MAT type on the platform or will be frame of the DAPA type if placed along the wind turbine tower.

2.4 Link between MRCC and Extra VHF Station

A SDSL link will be provided by the MRCC on the shore side and delivered to an operator's premises. The transmission of signals between the link and the offshore radio station at sea will use a protected link (isolated or VPN) provided by the operator.

2.5 Power Consumption and Energy Autonomy

Overall power consumption of the station is estimated at 1,500 Watts.

The energy provided will be of type 230V/60Hz or DC 24V or 48V if necessary.

The batteries of the station will allow autonomy of 12 hours.

APPENDIX G: CURRENT PRACTICE IN SWEDEN

Regarding MSP/OWF

Introduction

Today there are no formal MSP implemented in Sweden.

The Swedish Agency for Marine and Water Management (SwAM) has been assigned the work to present a new MSP for the Swedish government, which should be in force no later than 2021.

In Sweden there are currently national interests designated for different sectors such as shipping, energy, fishing, defence etc. In the coming MSP this national interest are to be weighed against each other. The forthcoming MSP in Sweden will be developed from an ecosystem approach.

Current practice with regard to OWF.

In 2009 the Swedish Maritime Administration (SMA) and the Swedish Transport Agency (STA) together constructed a guideline for establishing offshore windfarms in Swedish waters. This guideline is mainly focusing on risk assessment. Each individual windfarm can have different safety levels (safety distances).

Therefore, no formal minimum distances are given within the guideline since this is an assessment which is done for each individual case.

The guideline is written in Swedish and can be found at the link below:

https://www.transportstyrelsen.se/globalassets/global/sjofart/dokument/vagledning_vid_proj_o_riskanalys_av_vindkraftverksetabl_svenska_kusten.pdf

The Swedish Maritime Administration submits above mentioned observations in regard to the work performed by PIANC WG 161.

Above mentioned has been handled by the Head of the Infrastructure unit Marielle Svan in participation with the senior nautical adviser at the Infrastructure unit Johan Eriksson.

APPENDIX H: CURRENT PRACTICE IN GERMANY

Marine Spatial Planning in EEZ

Introduction

In order to co-ordinate the growing conflict of maritime uses, in particular between developing and space intensive offshore wind farms and marine environmental protection goals as well as traditional maritime uses such as shipping and fisheries, an integrative and sustainable approach is needed for the development of the German Exclusive Economic Zone (EEZ).

With the Ordinances on Spatial Planning in the German Exclusive Economic Zone in the North Sea of 12 September 2009 and in the Baltic Sea of 10 December 2009, there are Spatial Plans available for the North Sea and the Baltic Sea.

The Spatial Plan sets up as a statutory ordinance due to §18a Federal Spatial Planning Act, which was introduced by the act of 24 June 2004 into the Federal Spatial Planning Act, for the first time targets and principles of spatial planning in the EEZ regarding economic and scientific uses, ensuring the safety and efficiency of navigation, as well as protection of the marine environment.The Spatial Plan also contributes to the implementation of the Federal Government's national marine strategy for sustainable use and protection of the seas (national strategy for the seas) of 1 October 2008, which is aimed at achieving sustainable development and better co-ordination of marine uses and marine environmental protection interests and which sees Spatial Planning as an important tool to solve an increasing number of conflicts in coastal and offshore waters.

A Strategic Environmental Assessment according to SEA Directive 2001/42/EC on the impact of certain plans and programs on the environment has been carried out in connection with the establishment of this Spatial Plan, in compliance with §7 para. 5 ROG 1998 (cf. §9 ROG). The objective of the SEA Directive, as stated in Art. 1, is "to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programs with a view to promoting sustainable development, by ensuring that, in accordance with this Directive, an environmental assessment is carried out of certain plans and programs which are likely to have significant effects on the environment." The provisions of the Spatial Plan (see Chapter 3) have been made taking into account the results of the Strategic Environmental Assessment (see chapter 5).

Chapter 2 formulates the guidelines for spatial development.
Chapter 3 sets targets and principles, especially areas, for functions and uses.
Chapter 4 deals with other interests that need to be taken into account as well.
Chapter 5 describes the use of the results of the environmental assessment report.
Chapter 6 contains the co-ordinates concerning the regulations and maps with transnational pipelines and cables in the specific area.

The areas for wind power production have been designated in implementation of the Federal Government's strategy for wind energy use at sea, 2002, which is part of its overall sustainability strategy and is aimed at creating framework conditions allowing the offshore wind energy potential to be exploited. Also the Federal Government's Energy and Climate Programme (IEKP) of December 2007 formulates the goal of increasing the proportion of renewable energies in electricity production.

Specifics for the German EEZ in the North Sea

Figure 1: German EEZ in the North Sea

For the German EEZ in the North Sea the Spatial Plan contains provisions aimed at co-ordinating the individual uses and functions of shipping, the exploitation of resources, laying of pipelines and submarine cables, scientific marine research, wind power production, fisheries and mariculture, as well as protection of the marine environment. in the North Sea region.

The spatial planning designations of the German coastal states Lower Saxony and Schleswig-Holstein concerning the territorial sea have been taken into account. The spatial planning programme of Lower Saxony, in its revised version promulgated in May 2008, includes provisions concerning wind power production and nature conservation, offshore electricity transmission, and shipping. Relevant provisions in the spatial report coast and sea 2005 of Schleswig-Holstein, issued in February 2006, have been considered as well. The state of Schleswig-Holstein's 2009 development plan including provisions for its coastal waters is being revised currently.

The final position of point E_0 (53°43'30,8" N; 6°20'49,7" E) of the lateral boundary of the German Exclusive Economic Zone to the Kingdom of the Netherlands as well as the point's landward boundary will be determined by the Federal Government at a later time, following further consultations; cf. Proclamation by the Federal Republic of Germany concerning the establishment of an Exclusive Economic Zone of the Federal Republic of Germany in the North Sea and in the Baltic Sea of 25 November 1994 (BGBl. II, p. 3769, 3770).

Specifics for the German EEZ in the Baltic Sea

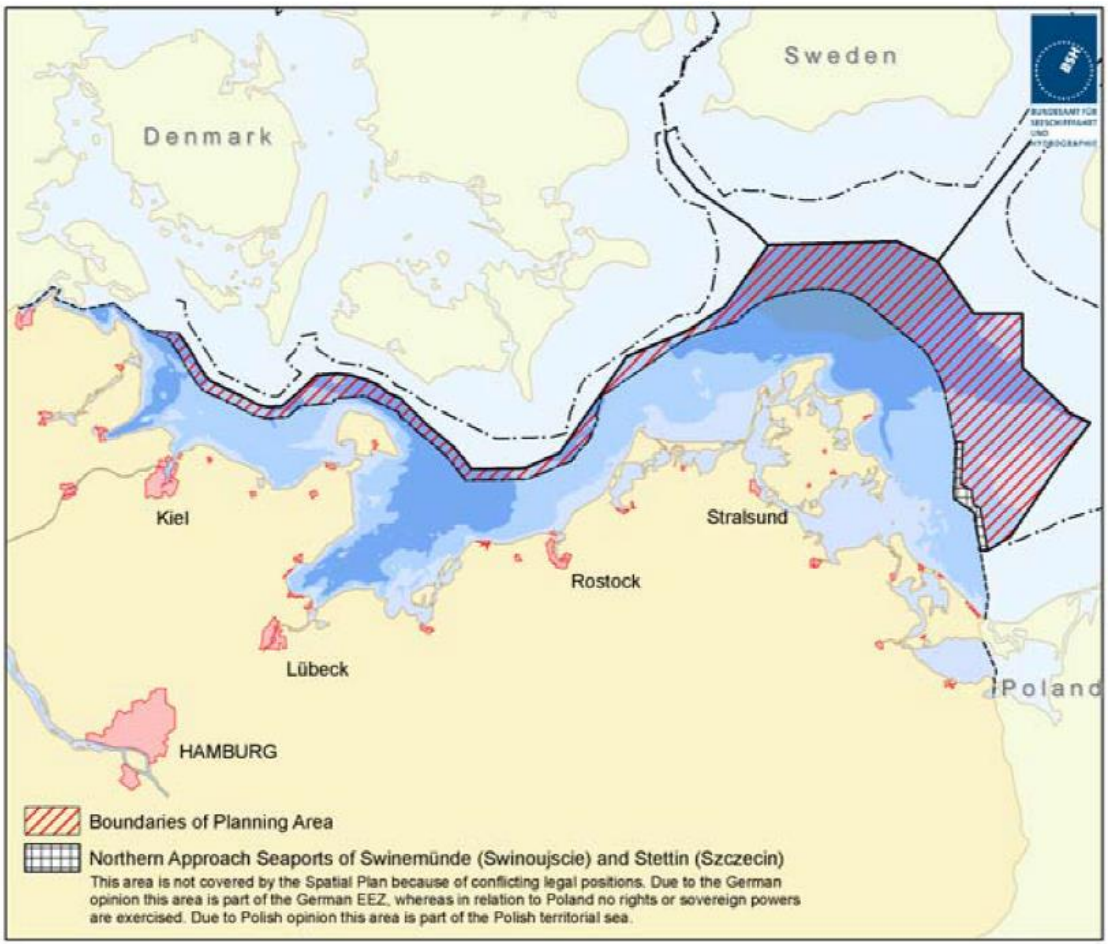


Figure 2: German EEZ in the Baltic Sea

For the German EEZ in the Baltic Sea the Spatial Plan contains provisions aimed at coordinating the individual uses and functions of shipping, the exploitation of resources, laying of pipelines and submarine cables, scientific marine research, wind power production, fisheries and mariculture, as well as protection of the marine environment.

The spatial planning designations of the German coastal states Mecklenburg-Western Pomerania and Schleswig-Holstein concerning the territorial sea have been taken into account. Relevant provisions in the spatial report coast and sea of Schleswig-Holstein, issued in February 2006, have been considered as well. The state of Schleswig-Holstein's 2009 development plan including provisions for its coastal waters is being revised currently. The spatial development programme of Mecklenburg-Western Pomerania of May 2005, which includes provisions concerning wind turbines, nature conservation, pipeline routeing and use of resources, has been considered as well.

The Spatial Plan Baltic Sea does not cover the charted area showing the northern approaches to the harbours of Świnoujście (Swinemünde) and Szczecin (Stettin) and anchorage no. 3 because of contradictory legal opinions. Due to German opinion this area is part of the German EEZ, whereas in relation to Poland no rights or sovereign powers are exercised. Due to polish opinion this area is part of the Polish territorial sea.

Spatial Plan for the German EEZ in the North Sea

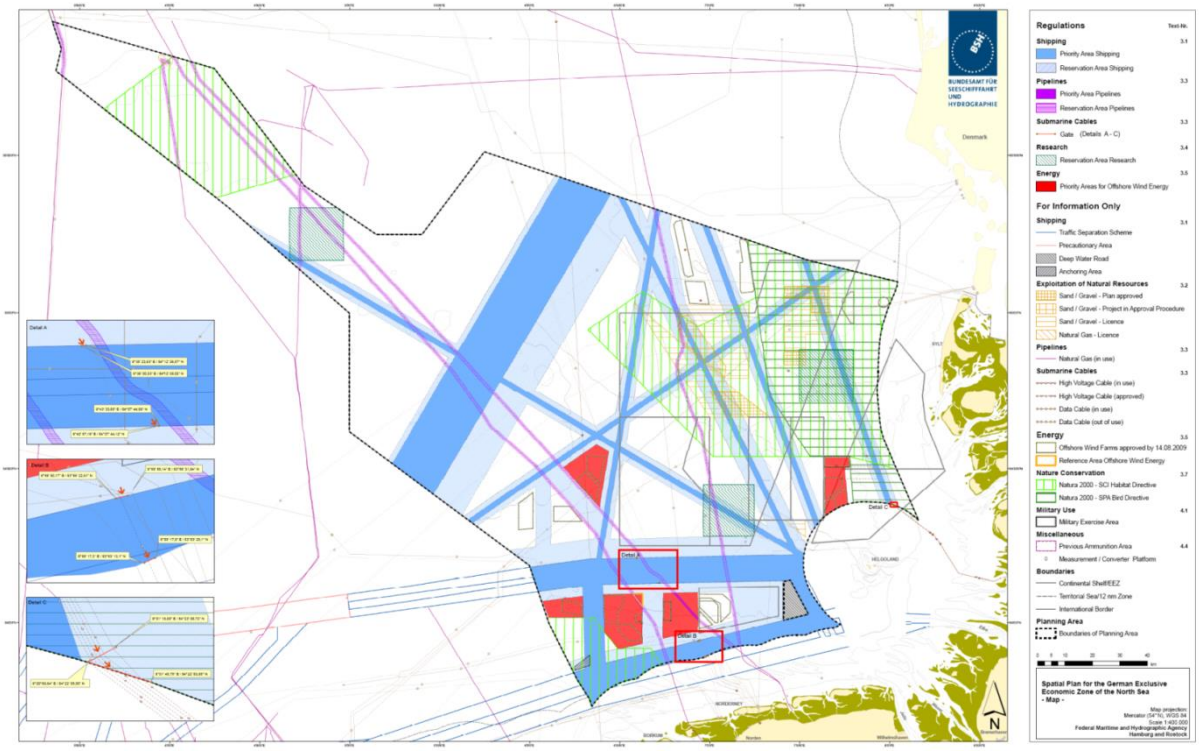


Figure 3: Spatial Plan for the German EEZ of the North Sea
http://www.bsh.de/en/Marine_uses/Spatial_Planning_in_the_German_EEZ/documents2/MSP_DE_NorthSea.pdf

The Spatial Plan for the German EEZ of the North See contains priority areas as well as reservation areas for shipping. According to the target 3.1.1 (1) shipping is granted priority over the other spatially significant uses in the priority areas for shipping. To the extent spatially significant planning, measures and projects are not compatible with the function of the shipping priority area in these areas they are not permitted.

The principle 3.1.1 (2) states that special consideration is given to shipping in the reservation areas for shipping. This needs to be taken into account in a comparative evaluation with other spatially significant planning tasks, measures and projects.

The Spatial Plan for the German EEZ of the North See also contains priority areas for energy production, wind energy in particular, as well as targets and principles (see chapter 3.5 of the Spatial Plan). According to the principle 3.5.1 (7) the safety and efficiency of navigation shall not be impaired by the construction and operation of installations for energy production.

Spatial Plan for the German EEZ in the Baltic Sea

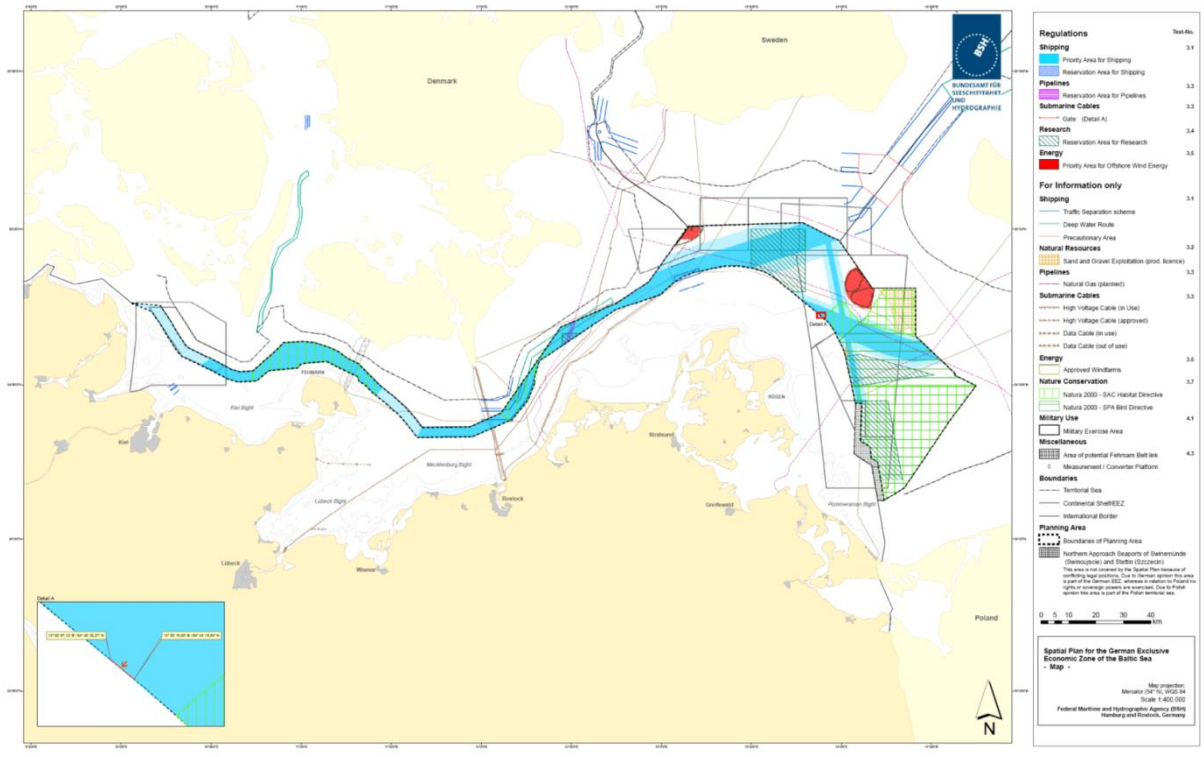


Figure 4: Spatial Plan for the German EEZ of the Baltic Sea
http://www.bsh.de/en/Marine_uses/Spatial_Planning_in_the_German_EEZ/documents2/MSP_DE_BalticSea_Dec2009.pdf

The Spatial Plan for the German EEZ of the Baltic See contains priority areas as well as reservation areas for shipping. According to the target 3.1.1 (1) shipping is granted priority over the other spatially significant uses in the priority areas for shipping. To the extent spatially significant planning, measures and projects are not compatible with the function of the shipping priority area in these areas they are not permitted.

The principle 3.1.1 (2) states that special consideration is given to shipping in the reservation areas for shipping. This needs to be taken into account in a comparative evaluation with other spatially significant planning tasks, measures and projects.

The Spatial Plan for the German EEZ of the Baltic See also contains priority areas for energy production, wind energy in particular, as well as targets and principles (see chapter 3.5 of the Spatial Plan). According to the principle 3.5.1 (6) the construction and operation of power production facilities in the priority areas for wind energy shall not impair the safety and efficiency of navigation.

Further information (some only in German language) can be obtained from:
http://www.bsh.de/en/Marine_uses/Spatial_Planning_in_the_German_EEZ/index.jsp
https://www.bmwi.de/Redaktion/DE/Downloads/E/windseeg-gesetz-en.pdf?__blob=publicationFile&v=9

Please note that the revision of the Spatial Plans for the German EEZ is planned from 2018 with entry into force in 2021. The revision will take into account among other things the current objectives Federal Government and the current spatial planning of the German coastal states.

Safety Zones

According to Section 11 Offshore Installations Ordinance and Section 53 Offshore Wind Energy Act the Federal Maritime and Hydrographic Agency can set up safety zones around the facilities in the exclusive economic zone where this is necessary to ensure the safety of shipping or the facilities. Where the setting up of the safety zones is needed to ensure the safety of shipping, this shall require the agreement of the Federal Waterways and Shipping Agency. Safety zones shall be areas of water which extend to a distance of up to 500 meters, measured from every point of the external edge, around the facilities. The width of a safety zone may exceed 500 meters if generally recognized international standards permit this or the relevant international organization recommends this.

Basic Design Requirements for OFW of the Federal Waterways and Shipping Agency:

- Around Offshore facilities as safety area with a radius of 500m is to be defined. For objects placed in cluster a closed safety line 500m outside of the periphery is to be defined.
- The Distance between singular offshore structures within a cluster should not be larger than 1,000 m.
- The width of the passage between two or more clusters depends on the traffic structure and density but should not be less than 2 NM with additional safety margin of 2x 500 m.
- Between Vessel separations schemes and offshore facilities a distance of 2 NM and a safety margin of 500 m is required
- The minimum distance between offshore facilities and fareways or other ways used by shipping should be 2 NN plus a safety margin of 500 m, in special cases where necessary other margins may be defined by the administration.

Further information (some only in German language) can be obtained from:

[redacted]

PIANC Secrétariat Général
Boulevard du Roi Albert II 20, B 3
B-1000 Bruxelles
Belgique

[redacted]
VAT BE 408-287-945

ISBN 978-2- 87223-250-5
EAN 9782872232505

No. 15824

MULTILATERAL

Convention on the international regulations for preventing collisions at sea, 1972 (with International Regulations, 1972, procès-verbal of rectification of the English and French originals of the Convention dated 1 December 1973, official Russian and Spanish translations established in accordance with article IX of the Convention, Final Act of the International Conference on Revision of the International Regulations for Preventing Collisions at Sea, 1972, and Resolutions Nos. I and II adopted by the Conference). Concluded at London on 20 October 1972

Authentic texts of the Convention, International Regulations, procès-verbal of rectification and the resolutions: English and French.

Authentic texts of the Final Act: English, French, Russian and Spanish.

Registered by the Inter-Governmental Maritime Consultative Organization on 8 August 1977.

CONVENTION[1] ON THE INTERNATIONAL REGULATIONS FOR PREVENTING COLLISIONS AT SEA, 1972

The Parties to the present Convention,

Desiring to maintain a high level of safety at sea,

Mindful of the need to revise and bring up to date the International Regulations for Preventing Collisions at Sea annexed to the Final Act of the International Conference on Safety of Life at Sea, 1960[2],

Having considered those Regulations in the light of developments since they were approved,

[1] Came into force on 15 July 1977 in respect of the States indicated hereafter, on whose behalf it had been signed definitively or an instrument of ratification, acceptance, approval or accession had been deposited with the Inter-Governmental Maritime Consultative Organization, i.e., 12 months after the date (14 July 1976) on which the conditions provided for to that effect (viz., *inter alia*, that at least 15 States, the aggregate of whose merchant fleets constitutes 65 per cent by tonnage of the world fleet of vessels of 100 gross tons and over, became Contracting Parties thereto) had been fulfilled, in accordance with article IV (1):

State	*Date of definitive signature (s) or of deposit of the instrument of ratification, acceptance (A), approval (AA) or accession (a)*	
Algeria	4 October	1976 *a*
Argentina	11 May	1977 *a*
Austria	8 June	1977 *a*
Bahamas	22 July	1976 *a*
Belgium*	22 December	1975
Brazil* (Signature affixed on 23 May 1973.)	26 November	1974
Bulgaria*	29 April	1975
Canada*†	7 March	1975 *a*
Cape Verde	28 April	1977 *a*
Czechoslovakia†	7 April	1977 *a*
Denmark*	24 January	1974
Finland	16 February	1977
France*	10 May	1974 *AA*
German Democratic Republic*†	15 May	1975 *a*
Germany, Federal Republic of* (With a declaration of application to Berlin (West).)	14 July	1976
Ghana*	7 December	1973
Greece* Signature affixed on 17 May 1973.)	17 December	1974
Hungary†	15 December	1976 *a*
Iceland*	21 April	1975
India*	30 May	1973 *s*
Israel	24 June	1977 *a*
Japan	21 June	1977 *a*
Liberia*	28 December	1973 *a*
Mexico*	8 April	1976 *a*
Monaco	18 January	1977 *a*
Morocco	27 April	1977 *a*
Netherlands*	4 February	1976 *a*
New Zealand (Signature affixed on 1 June 1973.)	26 November	1976
Nigeria*	17 January	1974 *a*
Norway*	13 August	1974
Papua New Guinea*	18 May	1976 *a*
Poland	14 December	1976
Romania*†	27 March	1975 *a*
Singapore	29 April	1977 *a*
South Africa	20 December	1976 *a*
Spain*	31 May	1974 *a*
Sweden*	28 April	1975
Switzerland*	30 December	1975
Syrian Arab Republic*†	16 February	1976 *a*
Tonga	12 April	1977 *a*
Union of Soviet Socialist Republics*†	9 November	1973 *a*
United Kingdom* (With a declaration of application to Hong Kong dated 30 October 1974, and a declaration of application to the Bailiwick of Guernsey, the Bailiwick of Jersey and the Isle of Man dated 15 July 1977.)	28 June	1974 *a*
United States of America (With a declaration of application dated 1 April 1977 to Puerto Rico, Guam, the Panama Canal Zone, the United States Virgin Islands, American Samoa, the Trust Territory of the Pacific Islands, Midway Islands, Wake Islands, Johnston Island, Palmyra Island, Kingman Reef, Howland Island, Baker Island, Jarvis Island and Navassa Islands.)	23 November	1976 *A*
Yugoslavia*	23 March	1976 *a*
Zaire	10 February	1977 *a*

* State whose definitive signature, ratification, acceptance, approval or accession contributed towards the entry into force of the Convention.

† See p. 90 of this volume for the texts of declarations and reservations made upon accession.

[2] United Nations, *Treaty Series*, vol. 536, p. 27.

Have agreed as follows:

Article I. GENERAL OBLIGATIONS

The Parties to the present Convention undertake to give effect to the Rules and other Annexes constituting the International Regulations for Preventing Collisions at Sea, 1972 (hereinafter referred to as "the Regulations") attached hereto.

Article II. SIGNATURE, RATIFICATION, ACCEPTANCE, APPROVAL AND ACCESSION

1. The present Convention shall remain open for signature until 1 June 1973 and shall thereafter remain open for accession.

2. States Members of the United Nations, or of any of the Specialized Agencies, or the International Atomic Agency, or Parties to the Statute of the International Court of Justice may become Parties to this Convention by:

(*a*) signature without reservation as to ratification, acceptance or approval;

(*b*) signature subject to ratification, acceptance or approval followed by ratification, acceptance or approval; or

(*c*) accession.

3. Ratification, acceptance, approval or accession shall be effected by the deposit of an instrument to that effect with the Inter-Governmental Maritime Consultative Organization (hereinafter referred to as "the Organization") which shall inform the Governments of States that have signed or acceded to the present Convention of the deposit of each instrument and of the date of its deposit.

Article III. TERRITORIAL APPLICATION

1. The United Nations in cases where they are the administering authority for a territory or any Contracting Party responsible for the international relations of a territory may at any time, by notification in writing to the Secretary-General of the Organization (hereinafter referred to as "the Secretary-General"), extend the application of this Convention to such a territory.

2. The present Convention shall, upon the date of receipt of the notification or from such other date as may be specified in the notification, extend to the territory named therein.

3. Any notification made in accordance with paragraph 1 of this Article may be withdrawn in respect of any territory mentioned in that notification and the extension of this Convention to that territory shall cease to apply after one year or such longer period as may be specified at the time of the withdrawal.

4. The Secretary-General shall inform all Contracting Parties of the notification of any extension or withdrawal of any extension communicated under this Article.

Article IV. ENTRY INTO FORCE

1. (*a*) The present Convention shall enter into force twelve months after the date on which at least 15 States, the aggregate of whose merchant fleets constitutes not less than 65 per cent by number or by tonnage of the world fleet of vessels of 100 gross tons and over have become Parties to it, whichever is achieved first.

(*b*) Notwithstanding the provisions in sub-paragraph (*a*) of this paragraph, the present Convention shall not enter into force before 1 January 1976.

2. Entry into force for States which ratify, accept, approve or accede to this Convention in accordance with Article II after the conditions prescribed in sub-paragraph 1(*a*) have been met and before the Convention enters into force, shall be on the date of entry into force of the Convention.

3. Entry into force for States which ratify, accept, approve or accede after the date on which this Convention enters into force, shall be on the date of deposit of an instrument in accordance with Article II.

4. After the date of entry into force of an amendment to this Convention in accordance with paragraph 4 of Article VI, any ratification, acceptance, approval or accession shall apply to the Convention as amended.

5. On the date of entry into force of this Convention, the Regulations replace and abrogate the International Regulations for Preventing Collisions at Sea, 1960[1].

6. The Secretary-General shall inform the Governments of States that have signed or acceded to this Convention of the date of its entry into force.

Article V. REVISION CONFERENCE

1. A conference for the purpose of revising this Convention or the Regulations or both may be convened by the Organization.

2. The Organization shall convene a conference of Contracting Parties for the purpose of revising this Convention or the Regulations or both at the request of not less than one-third of the Contracting Parties.

Article VI. AMENDMENTS TO THE REGULATIONS

1. Any amendment to the Regulations proposed by a Contracting Party shall be considered in the Organization at the request of that Party.

2. If adopted by a two-thirds majority of those present and voting in the Maritime Safety Committee of the Organization, such amendment shall be communicated to all Contracting Parties and Members of the Organization at least six months prior to its consideration by the Assembly of the Organization. Any Contracting Party which is not a Member of the Organization shall be entitled to participate when the amendment is considered by the Assembly.

[1] The following governments have agreed to accept and to apply the Regulations:*

Algeria	Finland	Libyan Arab Jamahiriya	Romania
Argentina	France	Madagascar	Singapore
Australia	Gambia	Maldives	South Africa
Austria	Germany, Federal Republic of	Monaco	Spain
Bahamas	Ghana	Morocco	Surinam (succession)
Barbados	Greece	Netherlands	Sweden
Belgium	Iceland	New Zealand	Switzerland
Brazil	India	Nigeria	Tonga
Bulgaria	Indonesia	Norway	Trinidad and Tobago
Burma	Ireland	Oman	Tunisia
Canada	Israel	Pakistan	Turkey
China	Italy	Papua New Guinea	USSR
Cuba	Ivory Coast	Paraguay	United Kingdom
Cyprus	Jamaica	Peru	United Republic of Cameroon
Czechoslovakia	Japan	Philippines	United States
Denmark	Kuwait	Poland	Uruguay
Ecuador	Lebanon	Portugal	Viet Nam
Egypt	Liberia	Republic of Korea	Yugoslavia
Fiji			

* Information provided by the Inter-Governmental Maritime Consultative Organization.

3. If adopted by a two-thirds majority of those present and voting in the Assembly, the amendment shall be communicated by the Secretary-General to all Contracting Parties for their acceptance.

4. Such an amendment shall enter into force on a date to be determined by the Assembly at the time of its adoption unless, by a prior date determined by the Assembly at the same time, more than one third of the Contracting Parties notify the Organization of their objection to the amendment. Determination by the Assembly of the dates referred to in this paragraph shall be by a two-thirds majority of those present and voting.

5. On entry into force any amendment shall, for all Contracting Parties which have not objected to the amendment, replace and supersede any previous provision to which the amendment refers.

6. The Secretary-General shall inform all Contracting Parties and Members of the Organization of any request and communication under this Article and the date on which any amendment enters into force.

Article VII. DENUNCIATION

1. The present Convention may be denounced by a Contracting Party at any time after the expiry of five years from the date on which the Convention entered into force for that Party.

2. Denunciation shall be effected by the deposit of an instrument with the Organization. The Secretary-General shall inform all other Contracting Parties of the receipt of the instrument of denunciation and of the date of its deposit.

3. A denunciation shall take effect one year, or such longer period as may be specified in the instrument, after its deposit.

Article VIII. DEPOSIT AND REGISTRATION

1. The present Convention and the Regulations shall be deposited with the Organization, and the Secretary-General shall transmit certified true copies thereof to all Governments of States that have signed this Convention or acceded to it.

2. When the present Convention enters into force, the text shall be transmitted by the Secretary-General to the Secretariat of the United Nations for registration and publication in accordance with Article 102 of the Charter of the United Nations.

Article IX. LANGUAGES

The present Convention is established, together with the Regulations, in a single copy in the English and French languages, both texts being equally authentic. Official translations in the Russian and Spanish languages shall be prepared and deposited with the signed original.

IN WITNESS WHEREOF the undersigned, being duly authorized by their respective Governments for that purpose, have signed the present Convention.

DONE at London this twentieth day of October one thousand nine hundred and seventy-two.

INTERNATIONAL REGULATIONS FOR PREVENTING COLLISIONS AT SEA, 1972

PART A. GENERAL

Rule 1. APPLICATION

(*a*) These Rules shall apply to all vessels upon the high seas and in all waters connected therewith navigable by seagoing vessels.

(*b*) Nothing in these Rules shall interfere with the operation of special rules made by an appropriate authority for roadsteads, harbours, rivers, lakes or inland waterways connected with the high seas and navigable by seagoing vessels. Such special rules shall conform as closely as possible to these Rules.

(*c*) Nothing in these Rules shall interfere with the operation of any special rules made by the Government of any State with respect to additional station or signal lights or whistle signals for ships of war and vessels proceeding under convoy, or with respect to additional station or signal lights for fishing vessels engaged in fishing as a fleet. These additional station or signal lights or whistle signals shall, so far as possible, be such that they cannot be mistaken for any light or signal authorized elsewhere under these Rules.

(*d*) Traffic separation schemes may be adopted by the Organization for the purpose of these Rules.

(*e*) Whenever the Government concerned shall have determined that a vessel of special construction or purpose cannot comply fully with the provisions of any of these Rules with respect to the number, position, range or arc of visibility of lights or shapes, as well as to the disposition and characteristics of sound-signalling appliances, without interfering with the special function of the vessel, such vessel shall comply with such other provisions in regard to the number, position, range or arc of visibility of lights or shapes, as well as to the disposition and characteristics of sound-signalling appliances, as her Government shall have determined to be the closest possible compliance with these Rules in respect to that vessel.

Rule 2. RESPONSIBILITY

(*a*) Nothing in these Rules shall exonerate any vessel, or the owner, master or crew thereof, from the consequences of any neglect to comply with these Rules or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

(*b*) In construing and complying with these Rules due regard shall be had to all dangers of navigation and collision and to any special circumstances, including the limitations of the vessels involved, which may make a departure from these Rules necessary to avoid immediate danger.

Rule 3. GENERAL DEFINITIONS

For the purpose of these Rules, except where the context otherwise requires:

(*a*) The word "vessel" includes every description of water craft, including non-displacement craft and seaplanes, used or capable of being used as a means of transportation on water.

(*b*) The term "power-driven vessel" means any vessel propelled by machinery.

(*c*) The term "sailing vessel" means any vessel under sail provided that propelling machinery, if fitted, is not being used.

(*d*) The term "vessel engaged in fishing" means any vessel fishing with nets, lines, trawls or other fishing apparatus which restrict manoeuvrability, but does not include a

vessel fishing with trolling lines or other fishing apparatus which do not restrict manoeuvrability.

(*e*) The word "seaplane" includes any aircraft designed to manoeuvre on the water.

(*f*) The term "vessel not under command" means a vessel which through some exceptional circumstance is unable to manoeuvre as required by these Rules and is therefore unable to keep out of the way of another vessel.

(*g*) The term "vessel restricted in her ability to manoeuvre" means a vessel which from the nature of her work is restricted in her ability to manoeuvre as required by these Rules and is therefore unable to keep out of the way of another vessel.

The following vessels shall be regarded as vessels restricted in their ability to manoeuvre:

(i) a vessel engaged in laying, servicing or picking up a navigation mark, submarine cable or pipeline;

(ii) a vessel engaged in dredging, surveying or underwater operations;

(iii) a vessel engaged in replenishment or transferring persons, provisions or cargo while underway;

(iv) a vessel engaged in the launching or recovery of aircraft;

(v) a vessel engaged in minesweeping operations;

(vi) a vessel engaged in a towing operation such as [severely restricts the towing vessel and her tow in their ability to deviate from their][1] course.

(*h*) The term "vessel constrained by her draught" means a power-driven vessel which because of her draught in relation to the available depth of water is severely restricted in her ability to deviate from the course she is following.

(*i*) The word "underway" means that a vessel is not at anchor, or made fast to the shore, or aground.

(*j*) The words "length" and "breadth" of a vessel mean her length overall and greatest breadth.

(*k*) Vessels shall be deemed to be in sight of one another only when one can be observed visually from the other.

(*l*) The term "restricted visibility" means any condition in which visibility is restricted by fog, mist, falling snow, heavy rainstorms, sandstorms or any other similar causes.

PART B. STEERING AND SAILING RULES

SECTION I. CONDUCT OF VESSELS IN ANY CONDITION OF VISIBILITY

Rule 4. APPLICATION

Rules in this Section apply in any condition of visibility.

Rule 5. LOOK-OUT

Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

[1] By a procès-verbal of rectification dated 1 December 1973, the words "render her unable to deviate from her" appearing in the original English text have been replaced by the text in brackets — Par un procès-verbal de rectification daté du 1er décembre 1973, les mots «render her unable to deviate from her» apparaissant dans le texte original anglais ont été remplacés par le texte entre crochets.

Rule 6. SAFE SPEED

Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions.

In determining a safe speed the following factors shall be among those taken into account:

(*a*) by all vessels:

(i) the state of visibility;

(ii) the traffic density including concentrations of fishing vessels or any other vessels;

(iii) the manoeuvrability of the vessel with special reference to stopping distance and turning ability in the prevailing conditions;

(iv) at night the presence of background light such as from shore lights or from back scatter of her own lights;

(v) the state of wind, sea and current, and the proximity of navigational hazards;

(vi) the draught in relation to the available depth of water;

(*b*) additionally, by vessels with operational radar:

(i) the characteristics, efficiency and limitations of the radar equipment;

(ii) any constraints imposed by the radar range scale in use;

(iii) the effect on radar detection of the sea state, weather and other sources of interference;

(iv) the possibility that small vessels, ice and other floating objects may not be detected by radar at an adequate range;

(v) the number, location and movement of vessels detected by radar;

(vi) the more exact assessment of the visibility that may be possible when radar is used to determine the range of vessels or other objects in the vicinity.

Rule 7. RISK OF COLLISION

(*a*) Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt such risk shall be deemed to exist.

(*b*) Proper use shall be made of radar equipment if fitted and operational, including long-range scanning to obtain early warning of risk of collision and radar plotting or equivalent systematic observation of detected objects.

(*c*) Assumptions shall not be made on the basis of scanty information, especially scanty radar information.

(*d*) In determining if risk of collision exists the following considerations shall be among those taken into account:

(i) such risk shall be deemed to exist if the compass bearing of an approaching vessel does not appreciably change;

(ii) such risk may sometimes exist even when an appreciable bearing change is evident, particularly when approaching a very large vessel or a tow or when approaching a vessel at close range.

Rule 8. ACTION TO AVOID COLLISION

(*a*) Any action taken to avoid collision shall, if the circumstances of the case admit, be positive, made in ample time and with due regard to the observance of good seamanship.

(*b*) Any alteration of course and/or speed to avoid collision shall, if the circumstances of the case admit, be large enough to be readily apparent to another vessel observing visually or by radar; a succession of small alterations of course and/or speed should be avoided.

(*c*) If there is sufficient sea room, alteration of course alone may be the most effective action to avoid a close-quarters situation provided that it is made in good time, is substantial and does not result in another close-quarters situation.

(*d*) Action taken to avoid collision with another vessel shall be such as to result in passing at a safe distance. The effectiveness of the action shall be carefully checked until the other vessel is finally past and clear.

(*e*) If necessary to avoid collision or allow more time to assess the situation, a vessel shall slacken her speed or take all way off by stopping or reversing her means of propulsion.

Rule 9. NARROW CHANNELS

(*a*) A vessel proceeding along the course of a narrow channel or fairway shall keep as near to the outer limit of the channel or fairway which lies on her starboard side as is safe and practicable.

(*b*) A vessel of less than 20 metres in length or a sailing vessel shall not impede the passage of a vessel which can safely navigate only within a narrow channel or fairway.

(*c*) A vessel engaged in fishing shall not impede the passage of any other vessel navigating within a narrow channel or fairway.

(*d*) A vessel shall not cross a narrow channel or fairway if such crossing impedes the passage of a vessel which can safely navigate only within such channel or fairway. The latter vessel may use the sound signal prescribed in Rule 34(*d*) if in doubt as to the intention of the crossing vessel.

(*e*) (i) In a narrow channel or fairway when overtaking can take place only if the vessel to be overtaken has to take action to permit safe passing, the vessel intending to overtake shall indicate her intention by sounding the appropriate signal prescribed in Rule 34(*c*)(i). The vessel to be overtaken shall, if in agreement, sound the appropriate signal prescribed in Rule 34(*c*)(ii) and take steps to permit safe passing. If in doubt she may sound the signals prescribed in Rule 34(*d*).

(ii) This Rule does not relieve the overtaking vessel of her obligation under Rule 13.

(*f*) A vessel nearing a bend or an area of a narrow channel or fairway where other vessels may be obscured by an intervening obstruction shall navigate with particular alertness and caution and shall sound the appropriate signal prescribed in Rule 34(*e*).

(*g*) Any vessel shall, if the circumstances of the case admit, avoid anchoring in a narrow channel.

Rule 10. TRAFFIC SEPARATION SCHEMES

(*a*) This Rule applies to traffic separation schemes adopted by the Organization.

(*b*) A vessel using a traffic separation scheme shall:

(i) proceed in the appropriate traffic lane in the general direction of traffic flow for that lane;

(ii) as far as practicable keep clear of a traffic separation line or separation zone;

(iii) normally join or leave a traffic lane at the termination of the lane, but when joining or leaving from the side shall do so at as small an angle to the general direction of traffic flow as practicable.

(*c*) A vessel shall so far as practicable avoid crossing traffic lanes, but if obliged to do so shall cross as nearly as practicable at right angles to the general direction of traffic flow.

(*d*) Inshore traffic zones shall not normally be used by through traffic which can safely use the appropriate traffic lane within the adjacent traffic separation scheme.

(*e*) A vessel, other than a crossing vessel, shall not normally enter a separation zone or cross a separation line except:

(i) in cases of emergency to avoid immediate danger;

(ii) to engage in fishing within a separation zone.

(*f*) A vessel navigating in areas near the terminations of traffic separation schemes shall do so with particular caution.

(*g*) A vessel shall so far as practicable avoid anchoring in a traffic separation scheme or in areas near its terminations.

(*h*) A vessel not using a traffic separation scheme shall avoid it by as wide a margin as is practicable.

(*i*) A vessel engaged in fishing shall not impede the passage of any vessel following a traffic lane.

(*j*) A vessel of less than 20 metres in length or a sailing vessel shall not impede the safe passage of a power-driven vessel following a traffic lane.

SECTION II. CONDUCT OF VESSELS IN SIGHT OF ONE ANOTHER

Rule 11. APPLICATION

Rules in this Section apply to vessels in sight of one another.

Rule 12. SAILING VESSELS

(*a*) When two sailing vessels are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other as follows:

(i) when each has the wind on a different side, the vessel which has the wind on the port side shall keep out of the way of the other;

(ii) when both have the wind on the same side, the vessel which is to windward shall keep out of the way of the vessel which is to leeward;

(iii) if a vessel with the wind on the port side sees a vessel to windward and cannot determine with certainty whether the other vessel has the wind on the port or on the starboard side, she shall keep out of the way of the other.

(*b*) For the purposes of this Rule the windward side shall be deemed to be the side opposite to that on which the mainsail is carried or, in the case of a square-rigged vessel, the side opposite to that on which the largest fore-and-aft sail is carried.

Rule 13. OVERTAKING

(*a*) Notwithstanding anything contained in the Rules of this Section, any vessel overtaking any other shall keep out of the way of the vessel being overtaken.

(*b*) A vessel shall be deemed to be overtaking when coming up with another vessel from a direction more than 22.5 degrees abaft her beam, that is, in such a position with reference to the vessel she is overtaking, that at night she would be able to see only the sternlight of that vessel but neither of her sidelights.

(*c*) When a vessel is in any doubt as to whether she is overtaking another, she shall assume that this is the case and act accordingly.

(*d*) Any subsequent alteration of the bearing between the two vessels shall not make the overtaking vessel a crossing vessel within a meaning of these Rules or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

Rule 14. HEAD-ON SITUATION

(*a*) When two power-driven vessels are meeting on reciprocal or nearly reciprocal courses so as to involve risk of collision, each shall alter her course to starboard so that each shall pass on the port side of the other.

(*b*) Such a situation shall be deemed to exist when a vessel sees the other ahead or nearly ahead and by night she could see the masthead lights of the other in a line or nearly in a line and/or both sidelights and by day she observes the corresponding aspect of the other vessel.

(*c*) When a vessel is in any doubt as to whether such a situation exists, she shall assume that it does exist and act accordingly.

Rule 15. CROSSING SITUATION

When two power-driven vessels are crossing so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way and shall, if the circumstances of the case admit, avoid crossing ahead of the other vessel.

Rule 16. ACTION BY GIVE-WAY VESSEL

Every vessel which is directed [ ][1] to keep out of the way of another vessel shall, so far as possible, take early and substantial action to keep well clear.

Rule 17. ACTION BY STAND-ON VESSEL

(*a*) (i) Where [ ][1] one of the two vessels is to keep out of the way, the other shall keep her course and speed.

(ii) The latter vessel may, however, take action to avoid collision by her manoeuvre alone, as soon as it becomes apparent to her that the vessel required to keep out of the way is not taking appropriate action in compliance with these Rules.

(*b*) When, from any cause, the vessel required to keep her course and speed finds herself so close that collision cannot be avoided by the action of the give-way vessel alone, she shall take such action as will best aid to avoid collision.

[1] By a procès-verbal of rectification dated 1 December 1973, the words "by these Rules" have been deleted from the original English text — Par un procès-verbal de rectification daté du 1er décembre 1973, les mots «by these Rules» ont été supprimés du texte original anglais.

(*c*) A power-driven vessel which takes action in a crossing situation in accordance with sub-paragraph (*a*)(ii) of this Rule to avoid collision with another power-driven vessel shall, if the circumstances of the case admit, not alter course to port for a vessel on her own port side.

(*d*) This Rule does not relieve the give-way vessel of her obligation to keep out of the way.

Rule 18. RESPONSIBILITIES BETWEEN VESSELS

Except where Rules 9, 10 and 13 otherwise require:

(*a*) A power-driven vessel underway shall keep out of the way of:

(i) a vessel not under command;

(ii) a vessel restricted in her ability to manoeuvre;

(iii) a vessel engaged in fishing;

(iv) a sailing vessel.

(*b*) A sailing vessel underway shall keep out of the way of:

(i) a vessel not under command;

(ii) a vessel restricted in her ability to manoeuvre;

(iii) a vessel engaged in fishing.

(*c*) A vessel engaged in fishing when underway shall, so far as possible, keep out of the way of:

(i) a vessel not under command;

(ii) a vessel restricted in her ability to manoeuvre.

(*d*) (i) Any vessel other than a vessel not under command or a vessel restricted in her ability to manoeuvre shall, if the circumstances of the case admit, avoid impeding the safe passage of a vessel constrained by her draught, exhibiting the signals in Rule 28.

(ii) A vessel constrained by her draught shall navigate with particular caution having full regard to her special condition.

(*e*) A seaplane on the water shall, in general, keep well clear of all vessels and avoid impeding their navigation. In circumstances, however, where risk of collision exists, she shall comply with the Rules of this Part.

SECTION III. CONDUCT OF VESSELS IN RESTRICTED VISIBILITY

Rule 19. CONDUCT OF VESSELS IN RESTRICTED VISIBILITY

(*a*) This Rule applies to vessels not in sight of one another when navigating in or near an area of restricted visibility.

(*b*) Every vessel shall proceed at a safe speed adapted to the prevailing circumstances and conditions of restricted visibility. A power-driven vessel shall have her engines ready for immediate manoeuvre.

(*c*) Every vessel shall have due regard to the prevailing circumstances and conditions of restricted visibility when complying with the Rules of Section I of this Part.

(*d*) A vessel which detects by radar alone the presence of another vessel shall determine if a close-quarters situation is developing and/or risk of collision exists. If so, she shall take avoiding action in ample time, provided that when such action consists of an alteration of course, so far as possible the following shall be avoided:

(i) an alteration of course to port for a vessel forward of the beam, other than for a vessel being overtaken;

(ii) an alteration of course towards a vessel abeam or abaft the beam.

(*e*) Except where it has been determined that a risk of collision does not exist, every vessel which hears apparently forward of her beam the fog signal of another vessel, or which cannot avoid a close-quarters situation with another vessel forward of her beam, shall reduce her speed to the minimum at which she can be kept on her course. She shall if necessary take all her way off and in any event navigate with extreme caution until danger of collision is over.

PART C. LIGHTS AND SHAPES

Rule 20. APPLICATION

(*a*) Rules in this Part shall be complied with in all weathers.

(*b*) The Rules concerning lights shall be complied with from sunset to sunrise, and during such times no other lights shall be exhibited, except such lights as cannot be mistaken for the lights specified in these Rules or do not impair their visibility or distinctive character, or interfere with the keeping of a proper look-out.

(*c*) The lights prescribed by these Rules shall, if carried, also be exhibited from sunrise to sunset in restricted visibility and may be exhibited in all other circumstances when it is deemed necessary.

(*d*) The Rules concerning shapes shall be complied with by day.

(*e*) The lights and shapes specified in these Rules shall comply with the provisions of Annex I to these Regulations.

Rule 21. DEFINITIONS

(*a*) "Masthead light" means a white light placed over the fore and aft centreline of the vessel showing an unbroken light over an arc of the horizon of 225 degrees and so fixed as to show the light from right ahead to 22.5 degrees abaft the beam on either side of the vessel.

(*b*) "Sidelights" means a green light on the starboard side and a red light on the port side each showing an unbroken light over an arc of the horizon of 112.5 degrees and so fixed as to show the light from right ahead to 22.5 degrees abaft the beam on its respective side. In a vessel of less than 20 metres in length the sidelights may be combined in one lantern carried on the fore and aft centreline of the vessel.

(*c*) "Sternlight" means a white light placed as nearly as practicable at the stern showing an unbroken light over an arc of the horizon of 135 degrees and so fixed as to show the light 67.5 degrees from right aft on each side of the vessel.

(*d*) "Towing light" means a yellow light having the same characteristics as the "sternlight" defined in paragraph (*c*) of this Rule.

(*e*) "All-round light" means a light showing an unbroken light over an arc of the horizon of 360 degrees.

(*f*) "Flashing light" means a light flashing at regular intervals at a frequency of 120 flashes or more per minute.

Rule 22. VISIBILITY OF LIGHTS

The lights prescribed in these Rules shall have an intensity as specified in Section 8 of Annex I to these Regulations so as to be visible at the following minimum ranges:

(*a*) in vessels of 50 metres or more in length:
— a masthead light, 6 miles;
— a sidelight, 3 miles;
— a sternlight, 3 miles;
— a towing light, 3 miles;
— a white, red, green or yellow all-round light, 3 miles;

(*b*) in vessels of 12 metres or more in length but less than 50 metres in length:
— a masthead light, 5 miles; except than where the length of the vessel is less than 20 metres, 3 miles;
— a sidelight, 2 miles;
— a sternlight, 2 miles;
— a towing light, 2 miles;
— a white, red, green or yellow all-round light, 2 miles;

(*c*) in vessels of less than 12 metres in length:
— a masthead light, 2 miles;
— a sidelight, 1 mile;
— a sternlight, 2 miles;
— a towing light, 2 miles;
— a white, red, green or yellow all-round light, 2 miles.

Rule 23. POWER-DRIVEN VESSELS UNDERWAY

(*a*) A power-driven vessel underway shall exhibit:

(i) a masthead light forward;

(ii) a second masthead light abaft of and higher than the forward one; except that a vessel of less than 50 metres in length shall not be obliged to exhibit such light but may do so;

(iii) sidelights;

(iv) a sternlight.

(*b*) An air-cushion vessel when operating in the non-displacement mode shall, in addition to the lights prescribed in paragraph (*a*) of this Rule, exhibit an all-round flashing yellow light.

(*c*) A power-driven vessel of less than 7 metres in length and whose maximum speed does not exceed 7 knots may, in lieu of the lights prescribed in paragraph (*a*) of this Rule, exhibit an all-round white light. Such vessel shall, if practicable, also exhibit sidelights.

Rule 24. TOWING AND PUSHING

(*a*) A power-driven vessel when towing shall exhibit:

(i) instead of the light prescribed in Rule 23(*a*)(i), two masthead lights forward in a vertical line. When the length of the tow, measuring from the stern of the towing vessel to the after end of the tow exceeds 200 metres, three such lights in a vertical line;

(ii) sidelights;

(iii) a sternlight;

(iv) a towing light in a vertical line above the sternlight;

(v) when the length of the tow exceeds 200 metres, a diamond shape where it can best be seen.

(*b*) When a pushing vessel and a vessel being pushed ahead are rigidly connected in a composite unit they shall be regarded as a power-driven vessel and exhibit the lights prescribed in Rule 23.

(*c*) A power-driven vessel when pushing ahead or towing alongside, except in the case of a composite unit, shall exhibit:

(i) instead of the light prescribed in Rule 23(*a*)(i), two masthead lights forward in a vertical line;

(ii) sidelights;

(iii) a sternlight.

(*d*) A power-driven vessel to which paragraphs (*a*) and (*c*) of this Rule apply shall also comply with Rule 23(*a*)(ii).

(*e*) A vessel or object being towed shall exhibit:

(i) sidelights;

(ii) a sternlight;

(iii) when the length of the tow exceeds 200 metres, a diamond shape where it can best be seen.

(*f*) Provided that any number of vessels being towed [alongside][1] or pushed in a group shall be lighted as one vessel,

(i) a vessel being pushed ahead, not being part of a composite unit, shall exhibit at the forward end, sidelights;

(ii) a vessel being towed alongside shall exhibit a sternlight and at the forward end, sidelights.

(*g*) Where from any sufficient cause it is impracticable for a vessel or object being towed to exhibit the lights prescribed in paragraph (*e*) of this Rule, all possible measures shall be taken to light the vessel or object towed or at least to indicate the presence of the unlighted vessel or object.

Rule 25. SAILING VESSELS UNDERWAY AND VESSELS UNDER OARS

(*a*) A sailing vessel underway shall exhibit:

(i) sidelights;

(ii) a sternlight.

(*b*) In a sailing vessel of less than 12 metres in length the lights prescribed in paragraph (*a*) of this Rule may be combined in one lantern carried at or near the top of the mast where it can best be seen.

(*c*) A sailing vessel underway may, in addition to the lights prescribed in paragraph (*a*) of this Rule, exhibit at or near the top of the mast, where they can best be seen, two all-round lights in a vertical line, the upper being red and the lower green, but these lights shall not be exhibited in conjunction with the combined lantern permitted by paragraph (*b*) of this Rule.

[1] Rectifications to the English text, appearing between brackets, were effected by a procès-verbal of rectification dated 1 December 1973 — Les rectifications concernant le texte anglais, apparaissant entre crochets, ont été effectuées par un procès-verbal de rectification en date du 1 décembre 1973.

(*d*) (i) A sailing vessel of less than 7 metres in length shall, if practicable, exhibit the lights prescribed in paragraph (*a*) or (*b*) of this Rule, but if she does not, she shall have ready at hand an electric torch or lighted lantern showing a white light which shall be exhibited in sufficient time to prevent collision.

(ii) A vessel under oars may exhibit the lights prescribed in this Rule for sailing vessels, but if she does not, she shall have ready at hand an electric torch or lighted lantern showing a white light which shall be exhibited in sufficient time to prevent collision.

(*e*) A vessel proceeding under sail when also being propelled by machinery shall exhibit forward where it can best be seen a conical shape, apex downwards.

Rule 26. FISHING VESSELS

(*a*) A vessel engaged in fishing, whether underway or at anchor, shall exhibit only the lights and shapes prescribed in this Rule.

(*b*) A vessel when engaged in trawling, by which is meant the dragging through the water of a dredge net or other apparatus used as a fishing appliance, shall exhibit:

(i) two all-round lights in a vertical line, the upper being green and the lower white, or a shape consisting of two cones with their apexes together in a vertical line one above the other; a vessel of less than 20 metres in length may instead of this shape exhibit a basket;

(ii) a masthead light abaft of and higher than the all-round green light; a vessel of less than 50 metres in length shall not be obliged to exhibit such a light but may do so;

(iii) when making way through the water, in addition to the lights prescribed in this paragraph, sidelights and a sternlight.

(*c*) A vessel engaged in fishing, other than trawling, shall exhibit:

(i) two all-round lights in a vertical line, the upper being red and the lower white, or a shape consisting of two cones with apexes together in a vertical line one above the other; a vessel of less than 20 metres in length may instead of this shape exhibit a basket;

(ii) when there is outlying gear extending more than 150 metres horizontally from the vessel, an all-round white light or a cone apex upwards in the direction of the gear;

(iii) when making way through the water, in addition to the lights prescribed in this paragraph, sidelights and a sternlight.

(*d*) A vessel engaged in fishing in close proximity to other vessels [engaged in fishing][1] may exhibit the additional signals described in Annex II to these Regulations.

(*e*) A vessel when not engaged in fishing shall not exhibit the lights or shapes prescribed in this Rule, but only those prescribed for a vessel of her length.

Rule 27. VESSELS NOT UNDER COMMAND OR RESTRICTED IN THEIR ABILITY TO MANOEUVRE

(*a*) A vessel not under command shall exhibit:

(i) two all-round red lights in a vertical line where they can best be seen;

(ii) two balls or similar shapes in a vertical line where they can best be seen;

(iii) when making way through the water, in addition to the lights prescribed in this paragraph, sidelights and a sternlight.

(*b*) A vessel restricted in her ability to manoeuvre, except a vessel engaged in minesweeping operations, shall exhibit:

[1] Rectifications to the English text, appearing between brackets, were effected by a procès-verbal of rectification dated 1 December 1973 — Les rectifications concernant le texte anglais, apparaissant entre crochets, ont été effectuées par un procès-verbal de rectification en date du 1 décembre 1973.

(i) three all-round lights in a vertical line where they can best be seen. The highest and lowest of these lights shall be red and the middle light shall be white;

(ii) three shapes in a vertical line where they can best be seen. The highest and lowest of these shapes shall be balls and the middle one a diamond;

(iii) when making way through the water, masthead lights, sidelights and a sternlight, in addition to the lights prescribed in sub-paragraph (i);

(iv) when at anchor, in addition to the lights or shapes prescribed in sub-paragraphs (i) and (ii), the light, lights or shape prescribed in Rule 30.

(*c*) A vessel engaged in a towing operation such as renders her unable to deviate from her course shall, in addition to the lights or shapes prescribed in sub-paragraph (*b*)(i) and (ii) of this Rule, exhibit the lights or shape prescribed in Rule 24(*a*).

(*d*) A vessel engaged in dredging or underwater operations, when restricted in her ability to manoeuvre, shall exhibit the lights and shapes prescribed in paragraph (*b*) of this Rule and shall in addition, when an obstruction exists, exhibit:

(i) two all-round red lights or two balls in a vertical line to indicate the side on which the obstruction exists;

(ii) two all-round green lights or two diamonds in a vertical line to indicate the side on which another vessel may pass;

(iii) when making way through the water, in addition to the lights prescribed in this paragraph, masthead lights, sidelights and a sternlight;

(iv) a vessel to which this paragraph applies when at anchor shall exhibit the lights or shapes prescribed in sub-paragraphs (i) and (ii) instead of the lights or shape prescribed in Rule 30.

(*e*) Whenever the size of a vessel engaged in diving operations makes it impracticable to exhibit the shapes prescribed in paragraph (*d*) of this Rule, a rigid replica of the International Code flag "A" not less than 1 metre in height shall be exhibited. Measures shall be taken to ensure all-round visibility.

(*f*) A vessel engaged in minesweeping operations shall, in addition to the lights prescribed for a power-driven vessel in Rule 23, exhibit three all-round green lights or three balls. One of these lights or shapes shall be exhibited at or near the foremast head and one at each end of the fore yard. These lights or shapes indicate that it is dangerous for another vessel to approach closer than 1,000 metres astern or 500 metres on either side of the minesweeper.

(*g*) Vessels of less than 7 metres in length shall not be required to exhibit the lights prescribed in this Rule.

(*h*) The signals prescribed in this Rule are not signals of vessels in distress and requiring assistance. Such signals are contained in Annex IV to these Regulations.

Rule 28. VESSELS CONSTRAINED BY THEIR DRAUGHT

A vessel constrained by her draught may, in addition to the lights prescribed for power-driven vessels in Rule 23, exhibit where they can best be seen three all-round red lights in a vertical line, or a cylinder.

Rule 29. PILOT VESSELS

(*a*) A vessel engaged on pilotage duty shall exhibit:

(i) at or near the masthead, two all-round lights in a vertical line, the upper being white and the lower red;

(ii) when underway, in addition, sidelights and a sternlight;

(iii) when at anchor, in addition to the lights prescribed in sub-paragraph (i), the anchor light, lights or shape.

(*b*) A pilot vessel when not engaged on pilotage duty shall exhibit the lights or shapes prescribed for a similar vessel of her length.

Rule 30. ANCHORED VESSELS AND VESSELS AGROUND

(*a*) A vessel at anchor shall exhibit where it can best be seen:

(i) in the fore part, an all-round white light or one ball;

(ii) at or near the stern and at a lower level than the light prescribed in sub-paragraph (i), an all-round white light.

(*b*) A vessel of less than 50 metres in length may exhibit an all-round white light where it can best be seen instead of the lights prescribed in paragraph (*a*) of this Rule.

(*c*) A vessel at anchor may, and a vessel of 100 metres and more in length shall, also use the available working or equivalent lights to illuminate her decks.

(*d*) A vessel aground shall exhibit the lights prescribed in paragraph (*a*) or (*b*) of this Rule and in addition, where they can best be seen:

(i) two all-round red lights in a vertical line;

(ii) three balls in a vertical line.

(*e*) A vessel of less than 7 metres in length, when at anchor or aground, not in or near a narrow channel, fairway or anchorage, or where other vessels normally navigate, shall not be required to exhibit the lights or shapes prescribed in paragraphs (*a*), (*b*) or (*d*) of this Rule.

Rule 31. SEAPLANES

Where it is impracticable for a seaplane to exhibit lights and shapes of the characteristics or in the positions prescribed in the Rules of this Part she shall exhibit lights and shapes as closely similar in characteristics and position as is possible.

PART D. SOUND AND LIGHT SIGNALS

Rule 32. DEFINITIONS

(*a*) The word "whistle" means any sound-signalling appliance capable of producing the prescribed blasts and which complies with the specifications in Annex III to these Regulations.

(*b*) The term "short blast" means a blast of about one second's duration.

(*c*) The term "prolonged blast" means a blast of from four to six seconds' duration.

Rule 33. EQUIPMENT FOR SOUND SIGNALS

(*a*) A vessel of 12 metres or more in length shall be provided with a whistle and a bell and a vessel of 100 metres or more in length shall, in addition, be provided with a gong, the tone and sound of which cannot be confused with that of the bell. The whistle, bell and gong shall comply with the specifications in Annex III to these Regulations. The bell or gong or both may be replaced by other equipment having the same respective sound characteristics, provided that manual sounding of the required signals shall always be possible.

(*b*) A vessel of less than 12 metres in length shall not be obliged to carry the sound-signalling appliances prescribed in paragraph (*a*) of this Rule but if she does not, she shall be provided with some other means of making an efficient sound signal.

Rule 34. MANOEUVRING AND WARNING SIGNALS

(*a*) When vessels are in sight of one another, a power-driven vessel underway, when manoeuvring as authorized or required by these Rules, shall indicate that manoeuvre by the following signals on her whistle:

— one short blast to mean "I am altering my course to starboard";

— two short blasts to mean "I am altering my course to port";

— three short blasts to mean "I am operating astern propulsion".

(*b*) Any vessel may supplement the whistle signals prescribed in paragraph (*a*) of this Rule by light signals, repeated as appropriate, whilst the manoeuvre is being carried out:

(i) these light signals shall have the following significance:

— one flash to mean "I am altering my course to starboard";

— two flashes to mean "I am altering my course to port";

— three flashes to mean "I am operating astern propulsion";

(ii) the duration of each flash shall be about one second, the interval between flashes shall be about one second, and the interval between successive signals shall be not less than ten seconds;

(iii) the light used for this signal shall, if fitted, be an all-round white light, visible at a minimum range of 5 miles, and shall comply with the provisions of Annex I.

(*c*) When in sight of one another in a narrow channel or fairway:

(i) a vessel intending to overtake another shall in compliance with Rule 9(*e*)(i) indicate her intention by the following signals on her whistle:

— two prolonged blasts followed by one short blast to mean "I intend to overtake you on your starboard side";

— two prolonged blasts followed by two short blasts to mean "I intend to overtake you on your port side";

(ii) the vessel about to be overtaken when acting in accordance with Rule 9(*e*)(i) shall indicate her agreement by the following signal on her whistle:

— one prolonged, one short, one prolonged and one short blast, in that order.

(*d*) When vessels in sight of one another are approaching each other and from any cause either vessel fails to understand the intentions or actions of the other, or is in doubt whether sufficient action is being taken by the other to avoid collision, the vessel in doubt shall immediately indicate such doubt by giving at least five short and rapid blasts on the whistle. Such signal may be supplemented by a light signal of at least five short and rapid flashes.

(*e*) A vessel nearing a bend or an area of a channel or fairway where other vessels may be obscured by an intervening obstruction shall sound one prolonged blast. Such signal shall be answered with a prolonged blast by any approaching vessel that may be within hearing around the bend or behind the intervening obstruction.

(*f*) If whistles are fitted on a vessel at a distance apart of more than 100 metres, one whistle only shall be used for giving manoeuvring and warning signals.

Rule 35. SOUND SIGNALS IN RESTRICTED VISIBILITY

In or near an area of restricted visibility, whether by day or night, the signals prescribed in this Rule shall be used as follows:

(*a*) A power-driven vessel making way through the water shall sound at intervals of not more than 2 minutes one prolonged blast.

(*b*) A power-driven vessel underway but stopped and making no way through the water shall sound at intervals of not more than 2 minutes two prolonged blasts in succession with an interval of about 2 seconds between them.

(*c*) A vessel not under command, a vessel restricted in her ability to manoeuvre, a vessel constrained by her draught, a sailing vessel, a vessel engaged in fishing and a vessel engaged in towing or pushing another vessel shall, instead of the signals prescribed in paragraphs (*a*) or (*b*) of this Rule, sound at intervals of not more than 2 minutes three blasts in succession, namely one prolonged followed by two short blasts.

(*d*) A vessel towed or if more than one vessel is towed the last vessel of the tow, if manned, shall at intervals of not more than 2 minutes sound four blasts in succession, namely one prolonged followed by three short blasts. When practicable, this signal shall be made immediately after the signal made by the towing vessel.

(*e*) When a pushing vessel and a vessel being pushed ahead are rigidly connected in a composite unit, they shall be regarded as a power-driven vessel and shall give the signals prescribed in paragraphs (*a*) or (*b*) of this Rule.

(*f*) A vessel at anchor shall at intervals of not more than one minute ring the bell rapidly for about 5 seconds. In a vessel of 100 metres or more in length the bell shall be sounded in the forepart of the vessel and immediately after the ringing of the bell the gong shall be sounded rapidly for about 5 seconds in the after part of the vessel. A vessel at anchor may in addition sound three blasts in succession, namely one short, one prolonged and one short blast, to give warning of her position and of the possibility of collision to an approaching vessel.

(*g*) A vessel aground shall give the bell signal and if required the gong signal prescribed in paragraph (*f*) of this Rule and shall, in addition, give three separate and distinct strokes on the bell immediately before and after the rapid ringing of the bell. A vessel aground may in addition sound an appropriate whistle signal.

(*h*) A vessel of less than 12 metres in length shall not be obliged to give the above-mentioned signals but, if she does not, shall make some other efficient sound signal at intervals of not more than 2 minutes.

(*i*) A pilot vessel when engaged on pilotage duty may in addition to the signals prescribed in paragraphs (*a*), (*b*) or (*f*) of this Rule sound an identity signal consisting of four short blasts.

Rule 36. SIGNALS TO ATTRACT ATTENTION

If necessary to attract the attention of another vessel, any vessel may make light or sound signals that cannot be mistaken for any signal authorized elsewhere in these Rules, or may direct the beam of her searchlight in the direction of the danger, in such a way as not to embarrass any vessel.

Rule 37. DISTRESS SIGNALS

When a vessel is in distress and requires assistance she shall use or exhibit the signals prescribed in Annex IV to these Regulations.

PART E. EXEMPTIONS

Rule 38. EXEMPTIONS

Any vessel (or class of vessels), provided that she complies with the requirements of the International Regulations for Preventing Collisions at Sea, 1960, the keel of which is laid or which is at a corresponding stage of construction before the entry into force of these Regulations may be exempted from compliance therewith as follows:

(*a*) the installation of lights with ranges prescribed in Rule 22, until four years after the date of entry into force of these Regulations;

(*b*) the installation of lights with colour specifications as prescribed in Section 7 of Annex I to these Regulations, until four years after the date of entry into force of these Regulations;

(*c*) the repositioning of lights as a result of conversion from Imperial to metric units and rounding off measurement figures, permanent exemption;

(*d*) (i) the repositioning of masthead lights on vessels of less than 150 metres in length, resulting from the prescriptions of Section 3(*a*) of Annex I, permanent exemption;

(ii) the repositioning of masthead lights on vessels of 150 metres or more in length, resulting from the prescriptions of Section 3(*a*) of Annex I to these Regulations, until nine years after the date of entry into force of these Regulations;

(*e*) the repositioning of masthead lights resulting from the prescriptions of Section 2(*b*) of Annex I, until nine years after the date of entry into force of these Regulations;

(*f*) the repositioning of sidelights resulting from the prescriptions of [Sections 2(*g*) and][1] 3(*b*) of Annex I, until nine years after the date of entry into force of these Regulations;

(*g*) the requirements for sound signal appliances prescribed in Annex III, until nine years after the date of entry into force of these Regulations.

ANNEX I

POSITIONING AND TECHNICAL DETAILS OF LIGHTS AND SHAPES

1. *Definition*

The term "height above the hull" means height above the uppermost continuous deck.

2. *Vertical positioning and spacing of lights*

(*a*) On a power-driven vessel of 20 metres or more in length the masthead lights shall be placed as follows:

(i) the forward masthead light, or if only one masthead light is carried, then that light, at a height above the hull of not less than 6 metres, and, if the breadth of the vessel exceeds 6 metres, then at a height above the hull not less than such breadth, so, however, that the light need not be placed at a greater height above the hull than 12 metres;

(ii) when two masthead lights are carried, the after one shall be at least 4.5 metres vertically higher than the forward one.

(*b*) The vertical separation of masthead lights of power-driven vessels shall be such that in all normal conditions of trim the after light will be seen over and separate from the forward light at a distance of 1000 metres from the stem when viewed from sea level.

(*c*) The masthead light of a power-driven vessel of 12 metres but less than 20 metres in length shall be placed at a height above the gunwale of not less than 2.5 metres.

[1] By a procès-verbal of rectification dated 1 December 1973, the word "Section" appearing in the original English text has been replaced by the words in brackets — Par un procès-verbal de rectification daté du 1er décembre 1973, le mot «Section» apparaissant dans le texte original anglais a été remplacé par les mots entre crochets.

(*d*) A power-driven vessel of less than 12 metres in length may carry the uppermost light at a height of less than 2.5 metres above the gunwale. When, however, a masthead light is carried in addition to sidelights and a sternlight, then such masthead light shall be carried at least 1 metre higher than the sidelights.

(*e*) One of the two or three masthead lights prescribed for a power-driven vessel when engaged in towing or pushing another vessel shall be placed in the same position as the forward masthead light of a power-driven vessel.

(*f*) In all circumstances the masthead light or lights shall be so placed as to be above and clear of all other lights and obstructions.

(*g*) The sidelights of a power-driven vessel shall be placed at a height above the hull not greater than three quarters of that of the forward masthead light. They shall not be so low as to be interfered with by deck lights.

(*h*) The sidelights, if in a combined lantern and carried on a power-driven vessel of less than 20 metres in length, shall be placed not less than 1 metre below the masthead light.

(*i*) When the Rules prescribe two or three lights to be carried in a vertical line, they shall be spaced as follows:

(i) on a vessel of 20 metres in length or more such lights shall be spaced not less than 2 metres apart, and the lowest of these lights shall, except where a towing light is required, not be less than 4 metres above the hull;

(ii) on a vessel of less than 20 metres in length such lights shall be spaced not less than 1 metre apart and the lowest of these lights shall, except where a towing light is required, not be less than 2 metres above the gunwale;

(iii) when three lights are carried they shall be equally spaced.

(*j*) The lower of the two all-round lights prescribed for a fishing vessel when engaged in fishing shall be at a height above the sidelights not less than twice the distance between the two vertical lights.

(*k*) The forward anchor light, when two are carried, shall not be less than 4.5 metres above the after one. On a vessel of 50 metres or more in length this forward anchor light shall not be less than 6 metres above the hull.

3. *Horizontal positioning and spacing of lights*

(*a*) When two masthead lights are prescribed for a power-driven vessel, the horizontal distance between them shall not be less than one half of the length of the vessel but need not be more than 100 metres. The forward light shall be placed not more than one quarter of the length of the vessel from the stem.

(*b*) On a vessel of 20 metres or more in length the sidelights shall not be placed in front of the forward masthead lights. They shall be placed at or near the side of the vessel.

4. *Details of location of direction-indicating lights for fishing vessels, dredgers and vessels engaged in underwater operations*

(*a*) The light indicating the direction of the outlying gear from a vessel engaged in fishing as prescribed in Rule 26(*c*)(ii) shall be placed at a horizontal distance of not less than 2 metres and not more than 6 metres away from the two all-round red and white lights. This light shall be placed not higher than the all-round white light prescribed in Rule 26(*c*)(i) and not lower than the sidelights.

(*b*) The lights and shapes on a vessel engaged in dredging or underwater operations to indicate the obstructed side and/or the side on which it is safe to pass, as prescribed in Rule 27(*d*)(i) and (ii), shall be placed at the maximum practical horizontal distance, but in no case less than 2 metres, from the lights or shapes prescribed in Rule 27(*b*)(i) and (ii). In no case shall the upper of these lights or shapes be at a greater height than the lower of the three lights or shapes prescribed in Rule 27(*b*)(i) and (ii).

5. *Screens for sidelights*

The sidelights shall be fitted with inboard screens painted matt black, and meeting the requirements of Section 9 of this Annex. With a combined lantern, using a single vertical filament and a very narrow division between the green and red sections, external screens need not be fitted.

6. *Shapes*

(*a*) Shapes shall be black and of the following sizes:

(i) a ball shall have a diameter of not less than 0.6 metre;

(ii) a cone shall have a base diameter of not less than 0.6 metre and a height equal to its diameter;

(iii) a cylinder shall have a diameter of at least 0.6 metre and a height of twice its diameter;

(iv) a diamond shape shall consist of two cones as defined in (ii) above having a common base.

(*b*) The vertical distance between shapes shall be at least 1.5 metre.

(*c*) In a vessel of less than 20 metres in length shapes of lesser dimensions but commensurate with the size of the vessel may be used and the distance apart may be correspondingly reduced.

7. *Colour specification of lights*

The chromaticity of all navigation lights shall conform to the following standards, which lie within the boundaries of the area of the diagram specified for each colour by the International Commission on Illumination (CIE).

The boundaries of the area for each colour are given by indicating the corner co-ordinates, which are as follows:

(i) *White*

x	0.525	0.525	0.452	0.310	0.310	0.443
y	0.382	0.440	0.440	0.348	0.283	0.382

(ii) *Green*

x	0.028	0.009	0.300	0.203
y	0.385	0.723	0.511	0.356

(iii) *Red*

x	0.680	0.660	0.735	0.721
y	0.320	0.320	0.265	0.259

(iv) *Yellow*

x	0.612	0.618	0.575	0.575
y	0.382	0.382	0.425	0.406

8. *Intensity of lights*

(*a*) The minimum luminous intensity of lights shall be calculated by using the formula:

$$I = 3.43 \times 10^6 \times T \times D^2 \times K^{-D}$$

where I is luminous intensity in candelas under service conditions,
T is threshold factor 2×10^{-7} lux,
D is range of visibility (luminous range) of the light in nautical miles,
K is atmospheric transmissivity.

For prescribed lights the value of K shall be 0.8, corresponding to a meteorological visibility of approximately 13 nautical miles.

(*b*) A selection of figures derived from the formula is given in the following table:

Range of visibility (luminous range) of light in nautical miles D	*Luminous intensity of light in candelas for* K = 0.8 I
1	0.9
2	4.3
3	12
4	27
5	52
6	94

NOTE. The maximum luminous intensity of navigation lights should be limited to avoid undue glare.

9. *Horizontal sectors*

(*a*) (i) In the forward direction, sidelights as fitted on the vessel must show the minimum required intensities. The intensities must decrease to reach practical cut-off between 1 degree and 3 degrees outside the prescribed sectors.

(ii) For sternlights and masthead lights and at 22.5 degrees abaft the beam for sidelights, the minimum required intensities shall be maintained over the arc of the horizon up to 5 degrees within the limits of the sectors prescribed in Rule 21. From 5 degrees within the prescribed sectors the intensity may decrease by 50 per cent up to the prescribed limits; it shall decrease steadily to reach practical cut-off at not more than 5 degrees outside the prescribed limits.

(*b*) All-round lights shall be so located as not to be obscured by masts, topmasts or structures within angular sectors of more than 6 degrees, except anchor lights, which need not be placed at an impracticable height above the hull.

10. *Vertical sectors*

(*a*) The vertical sectors of electric lights, with the exception of lights on sailing vessels, shall ensure that:

(i) at least the required minimum intensity is maintained at all angles from 5 degrees above to 5 degrees below the horizontal;

(ii) at least 60 per cent of the required minimum intensity is maintained from 7.5 degrees above to 7.5 degrees below the horizontal.

(*b*) In the case of sailing vessels the vertical sectors of electric lights shall ensure that:

(i) at least the required minimum intensity is maintained at all angles from 5 degrees above to 5 degrees below the horizontal;

(ii) at least 50 per cent of the required minimum intensity is maintained from 25 degrees above to 25 degrees below the horizontal.

(*c*) In the case of lights other than electric these specifications shall be met as closely as possible.

11. *Intensity of non-electric lights*

Non-electric lights shall so far as practicable comply with the minimum intensities, as specified in the Table given in Section 8 of this Annex.

12. *Manoeuvring light*

Notwithstanding the provisions of paragraph 2(*f*) of this Annex, the manoeuvring light described in Rule 34(*b*) shall be placed in the same fore and aft vertical plane as the masthead light or lights and, where practicable, at a minimum height of 2 metres vertically above the forward masthead light, provided that it shall be carried not less than 2 metres vertically above or below the after masthead light. On a vessel where only one masthead light is carried, the manoeuvring light, if fitted, shall be carried where it can best be seen, not less than 2 metres vertically apart from the masthead light.

13. *Approval*

The construction of lanterns and shapes and the installation of lanterns on board the vessel shall be to the satisfaction of the appropriate authority of the State where the vessel is registered.

ANNEX II

ADDITIONAL SIGNALS FOR FISHING VESSELS FISHING IN CLOSE PROXIMITY

1. *General*

The lights mentioned herein shall, if exhibited in pursuance of Rule 26(*d*), be placed where they can best be seen. They shall be at least 0.9 metre apart but at a lower level than lights prescribed in Rule 26(*b*)(i) and (*c*)(i). The lights shall be visible all round the horizon at a distance of at least 1 mile but at a lesser distance than the lights prescribed by these Rules for fishing vessels.

2. *Signals for trawlers*

(*a*) Vessels when engaged in trawling, whether using demersal or pelagic gear, may exhibit:

(i) when shooting their nets: two white lights in a vertical line;

(ii) when hauling their nets: one white light over one red light in a vertical line;

(iii) when the net has come fast upon an obstruction: two red lights in a vertical line.

(*b*) Each vessel engaged in pair trawling may exhibit:

(i) by night, a searchlight directed forward and in the direction of the other vessel of the pair;

(ii) when shooting or hauling their nets or when their nets have come fast upon an obstruction, the lights prescribed in 2(*a*) above.

3. *Signals for purse seiners*

Vessels engaged in fishing with purse seine gear may exhibit two yellow lights in a vertical line. These lights shall flash alternately every second and with equal light and occultation duration. These lights may be exhibited only when the vessel is hampered by its fishing gear.

ANNEX III

TECHNICAL DETAILS OF SOUND SIGNAL APPLIANCES

1. *Whistles*

(*a*) *Frequencies and range of audibility.* The fundamental frequency of the signal shall lie within the range 70-700 Hz.

The range of audibility of the signal from a whistle shall be determined by those frequencies, which may include the fundamental and/or one or more higher frequencies, which lie within the range 180-700 Hz (± 1 per cent) and which provide the sound pressure levels specified in paragraph 1(*c*) below.

(*b*) *Limits of fundamental frequencies.* To ensure a wide variety of whistle characteristics, the fundamental frequency of a whistle shall be between the following limits:

(i) 70-200 Hz, for a vessel 200 metres or more in length;

(ii) 130-350 Hz, for a vessel 75 metres but less than 200 metres in length;

(iii) 250-700 Hz, for a vessel less than 75 metres in length.

(*c*) *Sound signal intensity and range of audibility.* A whistle fitted in a vessel shall provide, in the direction of maximum intensity of the whistle and at a distance of 1 metre from it, a sound pressure level in at least one ⅓rd-octave band within the range of frequencies 180-700 Hz (± 1 per cent) of not less than the appropriate figure given in the table below.

Length of vessel in metres	*⅓rd-octave band level at 1 metre in dB referred to* 2×10^{-5} N/m²	*Audibility range in nautical miles*
200 or more	143	2
75 but less than 200	138	1.5
20 but less than 75	130	1
Less than 20	120	0.5

The range of audibility in the table above is for information and is approximately the range at which a whistle may be heard on its forward axis with 90 per cent probability in conditions of still air on board a vessel having average background noise level at the listening posts (taken to be 68 dB in the octave band centred on 250 Hz and 63 dB in the octave band centred on 500 Hz).

In practice, the range at which a whistle may be heard is extremely variable and depends critically on weather conditions; the values given can be regarded as typical but under conditions of strong wind or high ambient noise level at the listening post the range may be much reduced.

(*d*) *Directional properties.* The sound pressure level of a directional whistle shall be not more than 4 dB below the sound pressure level on the axis at any direction in the horizontal plane within ±45 degrees of the axis. The sound pressure level at any other direction in the horizontal plane shall be not more than 10 dB below the sound pressure level on the axis, so that the range in any direction will be at least half the range on the forward axis. The sound pressure level shall be measured in that ⅓rd-octave band which determines the audibility range.

(*e*) *Positioning of whistles.* When a directional whistle is to be used as the only whistle on a vessel, it shall be installed with its maximum intensity directed straight ahead.

A whistle shall be placed as high as practicable on a vessel, in order to reduce interception of the emitted sound by obstructions and also to minimize hearing damage risk to personnel. The sound pressure level of the vessel's own signal at listening posts shall not exceed 110 dB (A) and so far as practicable should not exceed 100 dB (A).

(*f*) *Fitting of more than one whistle.* If whistles are fitted at a distance apart of more than 100 metres, it shall be so arranged that they are not sounded simultaneously.

(*g*) *Combined whistle systems.* If due to the presence of obstructions the sound field of a single whistle or of one of the whistles referred to in paragraph 1(*f*) above is likely to have a zone of greatly reduced signal level, it is recommended that a combined whistle system be fitted so as to overcome this reduction. For the purposes of the Rules a combined whistle system is to be regarded as a single whistle. The whistles of a combined system shall be located at a distance apart of not more than 100 metres and arranged to be sounded simultaneously. The frequency of any one whistle shall differ from those of the others by at least 10 Hz.

2. *Bell or gong*

(*a*) *Intensity of signal.* A bell or gong, or other device having similar sound characteristics shall produce a sound pressure level of not less than 110 dB at 1 metre.

(*b*) *Construction.* Bells and gongs shall be made of corrosion-resistant material and designed to give a clear tone. The diameter of the mouth of the bell shall be not less than 300 mm for vessels of more than 20 metres in length, and shall be not less than 200 mm for vessels of 12 to 20 metres in length. Where practicable, a power-driven bell striker is recommended to ensure constant force but manual operation shall be possible. The mass of the striker shall be not less than 3 per cent of the mass of the bell.

3. *Approval*

The construction of sound signal appliances, their performance and their installation on board the vessel shall be to the satisfaction of the appropriate authority of the State where the vessel is registered.

ANNEX IV

DISTRESS SIGNALS

1. The following signals, used or exhibited either together or separately, indicate distress and need of assistance:

a) a gun or other explosive signal fired at intervals of about a minute;

b) a continuous sounding with any fog-signalling apparatus;

c) rockets or shells, throwing red stars fired one at a time at short intervals;

d) a signal made by radiotelegraphy or by any other signalling method consisting of the group ...———... (SOS) in the Morse Code;

e) a signal sent by radiotelephony consisting of the spoken word "Mayday";

f) the International Code Signal of distress indicated by N.C.;

g) a signal consisting of a square flag having above or below it a ball or anything resembling a ball;

h) flames on the vessel (as from a burning tar barrel, oil barrel, etc.);

i) a rocket parachute flare or a hand flare showing a red light;

j) a smoke signal giving off orange-coloured smoke;

k) slowly and repeatedly raising and lowering arms outstretched to each side;

l) the radiotelegraph alarm signal;

m) the radiotelephone alarm signal;

n) signals transmitted by emergency position-indicating radio beacons.

2. The use or exhibition of any of the foregoing signals except for the purpose of indicating distress and need of assistance and the use of other signals which may be confused with any of the above signals is prohibited.

3. Attention is drawn to the relevant sections of the International Code of Signals, the Merchant Ship Search and Rescue Manual and the following signals:

(*a*) a piece of orange-coloured canvas with either a black square and circle or other appropriate symbol (for identification from the air);

(*b*) a dye marker.

For the Government of the Kingdom of Afghanistan:
Pour le Gouvernement du Royaume d'Afghanistan :

For the Government of the People's Republic of Albania:
Pour le Gouvernement de la République populaire d'Albanie :

For the Government of the Democratic and Popular Republic of Algeria:
Pour le Gouvernement de la République algérienne démocratique et populaire :

For the Government of the Argentine Republic:
Pour le Gouvernement de la République Argentine :

For the Government of the Commonwealth of Australia:
Pour le Gouvernement du Commonwealth d'Australie :

For the Government of the Republic of Austria:
Pour le Gouvernement de la République d'Autriche :

For the Government of the State of Bahrain:
Pour le Gouvernement de l'Etat de Bahreïn :

For the Government of Barbados:
Pour le Gouvernement de la Barbade :

For the Government of the Kingdom of Belgium:
Pour le Gouvernement du Royaume de Belgique :

Sous réserve de ratification[1]

[J. VAN DEN BOSCH][2,3]

For the Government of the Kingdom of Bhutan:
Pour le Gouvernement du Royaume du Bhoutan :

For the Government of the Republic of Bolivia:
Pour le Gouvernement de la République de Bolivie :

For the Government of the Republic of Botswana:
Pour le Gouvernement de la République du Botswana :

For the Government of the Federative Republic of Brazil:
Pour le Gouvernement de la République fédérative du Brésil :

Subject to ratification[4]

[SÉRGIO CORRÊA DA COSTA][5]

For the Government of the People's Republic of Bulgaria:
Pour le Gouvernement de la République populaire de Bulgarie :

Subject to ratification[4]

[A. NIKOLOV]

For the Government of the Union of Burma:
Pour le Gouvernement de l'Union birmane :

[1] Subject to ratification.

[2] Names of signatories appearing between brackets were not legible and have been supplied by the Inter-Governmental Maritime Consultative Organization — Les noms des signataires donnés entre crochets étaient illisibles et ont été fournis par l'Organisation intergouvernementale consultative de la navigation maritime.

[3] Unless otherwise indicated, signatures were affixed on 20 October 1972 (information supplied by the Inter-Governmental Maritime Consultative Organization) — Sauf indication contraire, les signatures ont été apposées le 20 octobre 1972 (information fournie par l'Organisation intergouvernementale consultative de la navigation maritime).

[4] Sous réserve de ratification.

[5] Signature affixed on 23 May 1973 (information supplied by Inter-Governmental Maritime Consultative Organization) — Signature apposée le 23 mai 1973 (information fournie par l'Organisation intergouvernementale consultative de la navigation maritime).

For the Government of the Republic of Burundi:
Pour le Gouvernement de la République du Burundi :

For the Government of the Byelorussian Soviet Socialist Republic:
Pour le Gouvernement de la République socialiste soviétique de Biélorussie :

For the Government of the Federal Republic of Cameroon:
Pour le Gouvernement de la République fédérale du Cameroun :

For the Government of Canada:
Pour le Gouvernement du Canada :

For the Government of the Central African Republic:
Pour le Gouvernement de la République centrafricaine :

For the Government of the Republic of Chad:
Pour le Gouvernement de la République du Tchad :

For the Government of the Republic of Chile:
Pour le Gouvernement de la République du Chili :

For the Government of the People's Republic of China:
Pour le Gouvernement de la République populaire de Chine :

For the Government of the Republic of Colombia:
Pour le Gouvernement de la République de Colombie :

For the Government of the People's Republic of the Congo:
Pour le Gouvernement de la République populaire du Congo :

For the Government of the Republic of Costa Rica:
Pour le Gouvernement de la République du Costa Rica :

For the Government of the Republic of Cuba:
Pour le Gouvernement de la République de Cuba :

For the Government of the Republic of Cyprus:
Pour le Gouvernement de la République de Chypre :

For the Government of the Czechoslovak Socialist Republic:
Pour le Gouvernement de la République socialiste tchécoslovaque :

For the Government of the Republic of Dahomey:
Pour le Gouvernement de la République du Dahomey :

For the Government of the Kingdom of Denmark:
Pour le Gouvernement du Royaume du Danemark :

Subject to ratification[1]
[ERLING KRISTIANSEN]
17. Nov. 1972

For the Government of the Dominican Republic:
Pour le Gouvernement de la République Dominicaine :

For the Government of the Republic of Ecuador:
Pour le Gouvernement de la République de l'Equateur :

[1] Sous réserve de ratification.

For the Government of the Arab Republic of Egypt:
Pour le Gouvernement de la République arabe d'Égypte :

For the Government of the Republic of El Salvador:
Pour le Gouvernement de la République d'El Salvador :

For the Government of the Republic of Equatorial Guinea:
Pour le Gouvernement de la République de la Guinée équatoriale :

For the Government of the Empire of Ethiopia:
Pour le Gouvernement de l'Empire d'Ethiopie :

For the Government of the Federal Republic of Germany:
Pour le Gouvernement de la République fédérale d'Allemagne :

Subject to ratification[1]
[Dr. BREUER]

For the Government of Fiji:
Pour le Gouvernement de Fidji :

For the Government of the Republic of Finland:
Pour le Gouvernement de la République de Finlande :

Subject to ratification[1]
[AXEL ASPELIN]

For the Government of the French Republic:
Pour le Gouvernement de la République française :

Sous réserve d'acceptation[2]
le 9 novembre 1972
[J. DENOYELLE]

[1] Sous réserve de ratification.
[2] Subject to acceptance.

For the Government of the Gabonese Republic:
Pour le Gouvernement de la République gabonaise :

For the Government of the Republic of The Gambia:
Pour le Gouvernement de la République de Gambie :

For the Government of the Republic of Ghana:
Pour le Gouvernement de la République du Ghana :

Subject to ratification[1]
[C. K. T. DZIWORSHIE]

For the Government of the Kingdom of Greece:
Pour le Gouvernement du Royaume de Grèce :

Subject to ratification[1]
[N. BROUMAS][2]

For the Government of the Republic of Guatemala:
Pour le Gouvernement de la République du Guatemala :

For the Government of the Republic of Guinea:
Pour le Gouvernement de la République de Guinée :

For the Government of the Republic of Guyana:
Pour le Gouvernement de la République de Guyane :

For the Government of the Republic of Haiti:
Pour le Gouvernement de la République d'Haïti :

[1] Sous réserve de ratification.
[2] Signature affixed on 17 May 1973 (information supplied by the Inter-Governmental Maritime Consultative Organization) — Signature apposée le 17 mai 1973 (information fournie par l'Organisation intergouvernementale consultative de la navigation maritime).

For the Government of the Holy Sea:
Pour le Gouvernement du Saint-Siège :

For the Government of the Republic of Honduras:
Pour le Gouvernement de la République du Honduras :

For the Government of the Hungarian People's Republic:
Pour le Gouvernement de la République populaire hongroise :

For the Government of the Republic of Iceland:
Pour le Gouvernement de la République d'Islande :

Subject to approval[1]
[PÁLL RAGNARSSON]

For the Government of the Republic of India:
Pour le Gouvernement de la République de l'Inde :

[M. RASGOTRA][2]

For the Government of the Republic of Indonesia:
Pour le Gouvernement de la République d'Indonésie :

Subject to acceptance[3]
[HAMIMJAR S. ATMADJA]

For the Government of the Empire of Iran:
Pour le Gouvernement de l'Empire d'Iran :

For the Government of the Republic of Iraq:
Pour le Gouvernement de la République d'Irak :

[1] Sous réserve d'approbation.
[2] Signature affixed on 30 May 1973 (information supplied by the Inter-Governmental Maritime Consultative Organization) — Signature apposée le 30 mai 1973 (information fournie par l'Organisation intergouvernementale consultative de la navigation maritime).
[3] Sous réserve d'acceptation.

For the Government of Ireland:
Pour le Gouvernement de l'Irlande :

Subject to ratification[1]
[DONAL O'SULLIVAN][2]

For the Government of the State of Israel:
Pour le Gouvernement de l'Etat d'Israël :

For the Government of the Italian Republic:
Pour le Gouvernement de la République italienne :

Sous réserve de ratification[3]
[VITTORIO ARTEMISIO]

For the Government of the Republic of the Ivory Coast:
Pour le Gouvernement de la République de Côte d'Ivoire :

For the Government of Jamaica:
Pour le Gouvernement de la Jamaïque :

For the Government of Japan:
Pour le Gouvernement du Japon :

For the Government of the Hashemite Kingdom of Jordan:
Pour le Gouvernement du Royaume hachémite de Jordanie :

For the Government of the Republic of Kenya:
Pour le Gouvernement de la République du Kenya :

[1] Sous réserve de ratification.
[2] Signature affixed on 30 May 1973 (information supplied by the Inter-Governmental Maritime Consultative Organization) — Signature apposée le 30 mai 1973 (information fournie par l'Organisation intergouvernementale consultative de la navigation maritime).
[3] Subject to ratification.

For the Government of the Khmer Republic:
Pour le Gouvernement de la République khmère :

[HAN KANG]

Sous réserve de ratification[1]

For the Government of the Republic of Korea:
Pour le Gouvernement de la République de Corée :

Subject to acceptance[2]

[KYUNG NOK CHOI]

For the Government of the State of Kuwait:
Pour le Gouvernement de l'Etat du Koweït :

[A. R. MULLA HUSSEIN]

Subject to acceptance[2]

For the Government of the Kingdom of Laos:
Pour le Gouvernement du Royaume du Laos :

For the Government of the Lebanese Republic:
Pour le Gouvernement de la République libanaise :

For the Government of the Kingdom of Lesotho:
Pour le Gouvernement du Royaume du Lesotho :

For the Government of the Republic of Liberia:
Pour le Gouvernement de la République du Libéria :

For the Government of the Libyan Arab Republic:
Pour le Gouvernement de la République arabe libyenne :

[1] Subject to ratification.
[2] Sous réserve d'acceptation.

For the Government of the Principality of Liechtenstein:
Pour le Gouvernement de la Principauté de Liechtenstein :

For the Government of the Grand Duchy of Luxembourg:
Pour le Gouvernement du Grand-Duché de Luxembourg :

For the Government of the Malagasy Republic:
Pour le Gouvernement de la République malgache :

For the Government of the Republic of Malawi:
Pour le Gouvernement de la République du Malawi :

For the Government of Malaysia:
Pour le Gouvernement de la Malaisie :

For the Government of the Republic of Maldives:
Pour le Gouvernement de la République des Maldives :

For the Government of the Republic of Mali:
Pour le Gouvernement de la République du Mali :

For the Government of Malta:
Pour le Gouvernement de Malte :

For the Government of the Islamic Republic of Mauritania:
Pour le Gouvernement de la République islamique de Mauritanie :

For the Government of Mauritius:
Pour le Gouvernement de Maurice :

For the Government of the United Mexican States:
Pour le Gouvernement des Etats-Unis du Mexique :

For the Government of the Principality of Monaco:
Pour le Gouvernement de la Principauté de Monaco :

For the Government of the Mongolian People's Republic:
Pour le Gouvernement de la République populaire mongole :

For the Government of the Kingdom of Morocco:
Pour le Gouvernement du Royaume du Maroc :

For the Government of the Republic of Nauru:
Pour le Gouvernement de la République de Nauru :

For the Government of the Kingdom of Nepal:
Pour le Gouvernement du Royaume du Népal :

For the Government of the Kingdom of the Netherlands:
Pour le Gouvernement du Royaume des Pays-Bas :

For the Government of New Zealand:
Pour le Gouvernement de la Nouvelle-Zélande :

Subject to ratification[1]
[T. H. McCombs][2]

For the Government of the Republic of Nicaragua:
Pour le Gouvernement de la République du Nicaragua :

For the Government of the Republic of the Niger:
Pour le Gouvernement de la République du Niger :

For the Government of the Federal Republic of Nigeria:
Pour le Gouvernement de la République fédérale du Nigéria :

For the Government of the Kingdom of Norway:
Pour le Gouvernement du Royaume de Norvège :

Subject to ratification[1]
[Neuberth Wie]

For the Government of the Sultanate of Oman:
Pour le Gouvernement du Sultanat d'Oman :

For the Government of Pakistan:
Pour le Gouvernement du Pakistan :

For the Government of the Republic of Panama:
Pour le Gouvernement de la République du Panama :

[1] Sous réserve de ratification.
[2] Signature affixed on 1 June 1973 (information supplied by the Inter-Governmental Maritime Consultative Organization) — Signature apposée le 1 juin 1973 (information fournie par l'Organisation intergouvernementale consultative de la navigation maritime).

For the Government of the Republic of Paraguay:
Pour le Gouvernement de la République du Paraguay :

For the Government of the People's Democratic Republic of Yemen:
Pour le Gouvernement de la République démocratique populaire du Yémen :

For the Government of the Republic of Peru:
Pour le Gouvernement de la République du Pérou :

For the Government of the Republic of the Philippines:
Pour le Gouvernement de la République des Philippines :

For the Government of the Polish People's Republic:
Pour le Gouvernement de la République populaire de Pologne :

Subject to ratification[1]
[ARTUR STAREWICZ]

For the Government of the Portuguese Republic:
Pour le Gouvernement de la République portugaise :

Sous réserve de ratification[2]
[B. CADETE]

For the Government of the State of Qatar:
Pour le Gouvernement de l'Etat du Qatar :

For the Government of the Socialist Republic of Romania:
Pour le Gouvernement de la République socialiste de Roumanie :

[1] Sous réserve de ratification.
[2] Subject to ratification.

For the Government of the Rwandese Republic:
Pour le Gouvernement de la République rwandaise :

For the Government of the Republic of San Marino:
Pour le Gouvernement de la République de Saint-Marin :

For the Government of the Kingdom of Saudi Arabia:
Pour le Gouvernement du Royaume de l'Arabie Saoudite :

For the Government of the Republic of Senegal:
Pour le Gouvernement de la République du Sénégal :

For the Government of the Republic of Sierra Leone:
Pour le Gouvernement de la République de Sierra Leone :

For the Government of the Republic of Singapore:
Pour le Gouvernement de la République de Singapour :

For the Government of the Somali Democratic Republic:
Pour le Gouvernement de la République démocratique somalie :

For the Government of the Republic of South Africa:
Pour le Gouvernement de la République sud-africaine :

For the Government of the Spanish State:
Pour le Gouvernement de l'Etat espagnol :

For the Government of the Republic of Sri Lanka (Ceylon):
Pour le Gouvernement de la République de Sri Lanka (Ceylan) :

For the Government of the Democratic Republic of the Sudan:
Pour le Gouvernement de la République démocratique du Soudan :

For the Government of the Kingdom of Swaziland:
Pour le Gouvernement du Royaume du Souaziland :

For the Government of the Kingdom of Sweden:
Pour le Gouvernement du Royaume de Suède :

[GÖRAN STEEN]

Subject to ratification[1]

For the Government of the Swiss Confederation:
Pour le Gouvernement de la Confédération suisse :

[R. BÄR]

Sous réserve de ratification[2]

24.I.73

For the Government of the Syrian Arab Republic:
Pour le Gouvernement de la République arabe syrienne :

For the Government of the United Republic of Tanzania:
Pour le Gouvernement de la République-Unie de Tanzanie :

For the Government of the Kingdom of Thailand:
Pour le Gouvernement du Royaume de Thaïlande :

[1] Sous réserve de ratification.
[2] Subject to ratification.

For the Government of the Togolese Republic:
Pour le Gouvernement de la République togolaise :

For the Government of Trinidad and Tobago:
Pour le Gouvernement de la Trinité-et-Tobago :

For the Government of the Republic of Tunisia:
Pour le Gouvernement de la République tunisienne :

For the Government of the Republic of Turkey:
Pour le Gouvernement de la République turque :

For the Government of the Republic of Uganda:
Pour le Gouvernement de la République de l'Ouganda :

For the Government of the Ukrainian Soviet Socialist Republic:
Pour le Gouvernement de la République socialiste soviétique d'Ukraine :

For the Government of the Union of Soviet Socialist Republics:
Pour le Gouvernement de l'Union des Républiques socialistes soviétiques :

For the Government of the United Arab Emirates:
Pour le Gouvernement des Emirats arabes unis :

For the Government of the United Kingdom of Great Britain and Northern Ireland:
Pour le Gouvernement du Royaume-Uni de Grande-Bretagne et d'Irlande du Nord :

Subject to acceptance[1]
[A. C. MANSON]

For the Government of the United States of America:
Pour le Gouvernement des Etats-Unis d'Amérique :

Subject to acceptance[1]
[WILLIAM L. MORRISON]
[STUART S. BECKWITH]

For the Government of the Republic of the Upper Volta:
Pour le Gouvernement de la République de Haute-Volta :

For the Government of the Eastern Republic of Uruguay:
Pour le Gouvernement de la République orientale de l'Uruguay :

For the Government of the Republic of Venezuela:
Pour le Gouvernement de la République du Venezuela :

For the Government of the Republic of Viet-Nam:
Pour le Gouvernement de la République du Viet-Nam :

For the Government of the Independent State of Western Samoa:
Pour le Gouvernement de l'Etat indépendant du Samoa-Occidental :

For the Government of the Yemen Arab Republic:
Pour le Gouvernement de la République arabe du Yémen :

[1] Sous réserve d'acceptation.

For the Government of the Socialist Federal Republic of Yugoslavia:
Pour le Gouvernement de la République fédérative socialiste de Yougoslavie :

For the Government of the Republic of Zaire:
Pour le Gouvernement de la République du Zaïre :

For the Government of the Republic of Zambia:
Pour le Gouvernement de la République de Zambie :

DECLARATIONS AND RESERVATIONS MADE UPON ACCESSION

CANADA

"The Government of Canada considers that the provisions of Rule 10, 'Traffic Separation Schemes', do not provide for compulsory use of the adopted schemes. The Government of Canada considers that the compulsory routeing of ships is necessary to avoid collisions between ships and the resulting damage to the marine environment.

"The Government of Canada notes that there are no exceptions to Rule 10(*b*), (*c*) and (*h*) for vessels engaged in fishing with nets, lines, trawls, trolling lines or other apparatus, or for vessels engaged in special operations such as survey, cable, buoy, pipeline or salvage operations, and that the exceptions in Rule 10(*e*) are not broad enough to adequately provide for vessels engaged in special operations. The Government of Canada considers that the practical application of Rule 10 would be complicated without realistic exceptions for fishing vessels and for vessels engaged in special operations.

"The Government of Canada therefore does not consider that it is prohibited from providing for the compulsory use of traffic separation schemes or providing for such exceptions to Rule 10(*b*), (*c*), (*e*) and (*h*)."

DÉCLARATIONS ET RÉSERVES FAITES LORS DE L'ADHÉSION

CANADA

[TRADUCTION[1] — TRANSLATION[2]]

Le Gouvernement canadien estime que les dispositions de la règle 10 intitulée «Dispositifs de séparation du trafic» ne prévoient pas l'utilisation obligatoire des dispositifs adoptés. Il considère que l'organisation obligatoire du trafic maritime est nécessaire pour éviter les abordages entre les navires et les dommages qui en résultent pour le milieu marin.

Le Gouvernement canadien note qu'il n'existe d'exceptions aux paragraphes *b*, *c* et *h* de la règle 10 ni pour les navires en train de pêcher avec des filets, des lignes, des chaluts, des lignes traînantes ou autres engins ni pour les navires occupés à des travaux spéciaux tels que levée, pose de câbles, de bouées, de canalisations ou opérations de sauvetage, et que les exceptions prévues au paragraphe *e* de la règle 10 ne sont pas assez générales pour couvrir suffisamment le cas des navires occupés à des travaux spéciaux. Le Gouvernement canadien considère que l'application pratique de la règle 10 sera difficile si l'on ne prévoit pas d'exceptions réalistes pour les navires de pêche et pour les navires occupés à des travaux spéciaux.

Le Gouvernement canadien ne considère donc pas qu'il lui est interdit de prévoir l'utilisation obligatoire des dispositifs de séparation du trafic ou de prévoir des dérogations aux paragraphes *b*, *c*, *e*, *h* de la règle 10.

[1] Traduction fournie par l'Organisation intergouvernementale consultative de la navigation maritime.
[2] Translation supplied by the Inter-Governmental Maritime Consultative Organization.

GERMAN DEMOCRATIC REPUBLIC

RÉPUBLIQUE DÉMOCRATIQUE ALLEMANDE

[GERMAN TEXT — TEXTE ALLEMAND]

„Die Regierung der Deutschen Demokratischen Republik ist der Auffassung, daß die Bestimmungen des Artikels 2 der Konvention im Widerspruch zu dem Prinzip stehen, wonach alle Staaten, die sich in ihrer Politik von den Zielen und Grundsätzen der Charta der Vereinten Nationen leiten lassen, das Recht haben, Mitglied von Konventionen zu werden, die die Interessen aller Staaten berühren.

„Die Regierung der Deutschen Demokratischen Republik läßt sich in ihrer Haltung zu den Bestimmungen des Artikels 3 der Konvention, soweit sie die Anwendung der Konvention auf Kolonialgebiete und andere abhängige Territorien betreffen, von den Festlegungen der Deklaration der Vereinten Nationen über die Gewährung der Unabhängigkeit an die kolonialen Länder und Völker (Res. Nr. 1514 (XV) vom 14. Dezember 1960) leiten, welche die Notwendigkeit einer schnellen und bedingungslosen Beendigung des Kolonialismus in allen seinen Formen und Äußerungen proklamieren."

[TRANSLATION[1]]

The Government of the German Democratic Republic considers that the provisions of Article 2 of the Convention are inconsistent with the principle that all States pursuing their policies in accordance with the purposes and principles of the Charter of the United Nations shall have the right to become parties to conventions affecting the interests of all States.

The position of the Government of the German Democratic Republic on Article 3 of the Convention, as far as the application of the Convention to colonial and other dependent territories is concerned, is governed by the provisions of the United Nations Declaration on the Granting of Independence to Colonial Countries and Peoples (Resolution 1514 (XV) of 14 December 1960)[2] proclaiming the necessity of bringing to a speedy and unconditional end colonialism in all its forms and manifestations.

[TRADUCTION[1]]

Le Gouvernement de la République démocratique allemande estime que les dispositions de l'article 2 de la Convention ne sont pas compatibles avec le principe selon lequel tous les Etats dont la politique est conforme aux buts et principes de la Charte des Nations Unies ont le droit de devenir parties aux conventions touchant les intérêts de tous les Etats.

La position du Gouvernement de la République démocratique allemande à l'égard des dispositions de l'article 3 de la Convention, dans la mesure où il concerne l'application de la Convention aux territoires coloniaux et aux autres territoires dépendants, s'inspire des dispositions de la Déclaration des Nations Unies sur l'octroi de l'indépendance aux pays et peuples coloniaux [Rés. 1514 (XV) du 14 décembre 1960[2]] par laquelle est proclamée la nécessité de mettre fin de manière rapide et sans condition au colonialisme sous toutes ses formes et dans toutes ses manifestations.

[1] Translation supplied by the Inter-Governmental Maritime Consultative Organization.

[2] United Nations, *Official Records of the General Assembly, Fifteenth Session, Supplement No. 16* (A/4684), p. 66.

[1] Traduction fournie par l'Organisation intergouvernementale consultative de la navigation maritime.

[2] Nations Unies, *Documents officiels de l'Assemblée générale, quinzième session, Supplément n° 16* (A/4684), p. 70.

HUNGARY

"The Presidential Council of the Hungarian People's Republic declares that Article 2, paragraph (2) of the Convention on the International Regulations for Preventing Collisions at Sea of 1972, which does not allow some States to become a Party to the Convention, is of discriminative nature. The Convention regulates such questions which concern all States and, therefore, under the principle of sovereign equality of States, it should be open for all States without any restriction and discrimination.

"The Presidential Council of the Hungarian People's Republic also declares that Article 3 of the Convention is at variance with the UN General Assembly's Resolution No. 1514/XV of December 14, 1960[1] on the granting of independence to the colonial countries and peoples, which declared the necessity of the unconditional elimination of all forms of colonialism."

HONGRIE

[TRADUCTION[1] — TRANSLATION[2]]

Le Conseil présidentiel de la République populaire hongroise déclare que le paragraphe 2 de l'article II de la Convention sur le Règlement international de 1972 pour prévenir les abordages en mer, qui ne permet pas à certains Etats de devenir Parties à la Convention, a un caractère discriminatoire. La Convention traite de questions qui intéressent tous les Etats et par conséquent, en vertu du principe de l'égalité souveraine entre les Etats, elle devrait être ouverte à la participation de tous les Etats sans aucune restriction ni discrimination.

Le Conseil présidentiel de la République populaire hongroise déclare également que l'article III de la Convention est en contradiction avec la résolution n° 1514/XV du 14 décembre 1960[3] de l'Assemblée générale des Nations Unies sur l'octroi de l'indépendance aux pays et aux peuples coloniaux, qui proclame la nécessité d'une élimination inconditionnelle de toutes les formes de colonialisme.

ROMANIA

[TRANSLATION[2]]

(*a*) The Council of State of the Socialist Republic of Romania considers that the provisions of Rule 18(2) of the Convention are not in accord with the principle whereby international treaties, the objectives and aims of which are of concern to the international community as a whole, should be open to participation by all States.

(*b*) The Council of State of the Socialist Republic of Romania considers that the maintenance in a state of dependence of certain territories, to which the provisions

ROUMANIE

«*a*) Le Conseil d'Etat de la République Socialiste de Roumanie considère que les prévisions de l'article 18, paragraphe 2 de la Convention ne sont pas en concordance avec le principe selon lequel les traités internationaux dont l'objet et le but intéressent la communauté internationale dans son ensemble doivent être ouverts à la participation de tous les Etats.

«*b*) Le Conseil d'Etat de la République Socialiste de Roumanie considère que le maintien de l'état de dépendance de certains territoires auxquels se réfère la ré-

[1] United Nations, *Official Records of the General Assembly, Fifteenth Session, Supplement No. 16* (A/4684), p. 66.
[2] Translation supplied by the Inter-Governmental Maritime Consultative Organization.

[1] Traduction fournie par l'Organisation intergouvernementale consultative de la navigation maritime.
[2] Translation supplied by the Inter-Governmental Maritime Consultative Organization.
[3] Nations Unies, *Documents officiels de l'Assemblée générale, quinzième session, Supplément n° 16* (A/4684), p. 70.

of Article III of the Convention refer, is not in accord with the Charter of the United Nations and the documents adopted by the United Nations concerning the granting of independence to colonial countries and peoples, including the Declaration on the principles of international law affecting friendly relations and co-operation between States in accordance with the Charter of the United Nations, unanimously adopted by the UN General Assembly Resolution 2625 (XXV) of 1970,[1] which solemnly proclaims the right of States to encourage achievement of the principle of the equality of rights of peoples and their right to take their own decisions, with a view to putting a swift end to colonialism.

glementation de l'article III de la Convention n'est pas en concordance avec la Charte de l'ONU et les documents adoptés par l'Organisation des Nations Unies sur l'octroi de l'indépendance aux pays et aux peuples coloniaux, y compris la Déclaration relative aux principes du droit international touchant les relations amicales et la coopération entre les Etats conformément à la Charte des Nations Unies, adoptée à l'unanimité par la résolution de l'Assemblée générale de l'ONU n° 2625 (XXV) de 1970[1], qui proclame solennellement le devoir des Etats de favoriser la réalisation du principe de l'égalité de droits des peuples et de leur droit à disposer d'eux-mêmes, dans le but de mettre rapidement fin au colonialisme.»

SYRIAN ARAB REPUBLIC *RÉPUBLIQUE ARABE SYRIENNE*

[ARABIC TEXT — TEXTE ARABE]

غير ان اقرار الجمهورية العربية السورية لهذه القواعد المنصوص عليها في الاتفاقية وابرامها لا يحوي باية حال معنى الاعتراف باسرائيل ولا يؤدي الى الدخول معها في معاملات مما تنظمه احكام هذه الاتفاقية •

[TRANSLATION[2]]

...the acceptance of the Syrian Arab Republic to the regulations stipulated in the said Convention and its ratification do not imply in any way the recognition in Israel and do not lead to its engagement with it in any dealings that may be regulated by the said Convention.

[TRADUCTION[2]]

...l'acceptation et la ratification par la République arabe syrienne du Règlement énoncé dans ladite convention n'impliquent en aucune manière la reconnaissance d'Israël et ne la conduisent à aucun rapport avec lui dans toute transaction qui pourrait découler de ladite convention.

[1] United Nations, *Official Records of the General Assembly, Twenty-fifth Session, Supplement No. 28* (A/8028), p. 121.

[2] Translation supplied by the Inter-Governmental Maritime Consultative Organization.

[1] Nations Unies, *Documents officiels de l'Assemblée générale, vingt-cinquième session, Supplément n° 28* (A/8028), p. 131.

[2] Traduction fournie par l'Organisation intergouvernementale consultative de la navigation maritime.

UNION OF SOVIET SOCIALIST REPUBLICS

UNION DES RÉPUBLIQUES SOCIALISTES SOVIÉTIQUES

[RUSSIAN TEXT — TEXTE RUSSE]

«1. Союз Советских Социалистических Республик заявляет, что положение пункта 2 статьи II Конвенции о международных правилах предупреждения столкновения судов в море 1972 года, согласно которому некоторые государства лишаются возможности стать участниками этой Конвенции, носит дискриминационный характер, и считает, что Конвенция в соответствии с принципом суверенного равенства государств должна быть открыта для участия всех заинтересованных государств без какой-либо дискриминации и ограничения и

«2. Союз Советских Социалистических Республик считает необходимым также заявить, что положения статьи III Конвенции о международных правилах предупреждения столкновений судов в море 1972 года, касающиеся распространения ее участниками действия Конвенции на территории, за международные отношения которых они несут ответственность, являются устаревшими и противоречат Декларации Генеральной Ассамблеи Организации Объединенных Наций о предоставлении независимости колониальным странам и народам (Резолюция 1514 (XV) от 14 декабря 1960 года), провозгласившей необходимость незамедлительно и безоговорочно положить конец колониализму во всех его формах и проявлениях».

[TRANSLATION[1]]

The Union of Soviet Socialist Republics declares that Article II, paragraph 2, of the 1972 Convention on the International Regulations for Preventing Collisions at Sea, under which certain States are precluded from becoming parties to that Convention, is of a discriminatory character, and considers that, in accordance with the principle of the sovereign equality of States, the Convention should be open to participation by all interested States without discrimination or restriction.

The Union of Soviet Socialist Republics also deems it necessary to declare that the provisions of Article III of the 1972 Convention on the International Regulations for Preventing Collisions at Sea, concerning the extension of its application to a territory for whose international relations a Contracting Party is responsible, are outdated and contrary to the Declaration of the General Assembly of the United Nations on the granting of independence to colonial

[TRADUCTION[1]]

Le Gouvernement de l'Union des Républiques socialistes soviétiques déclare que le paragraphe 2 de l'article II de la Convention sur le Règlement international de 1972 pour prévenir les abordages en mer, qui empêche certains Etats de devenir parties à la Convention, a un caractère de discrimination et il estime, conformément au principe de l'égalité souveraine des Etats, que la Convention doit être ouverte à la participation de tous les Etats intéressés sans discrimination ou restriction.

Le Gouvernement de l'Union des Républiques socialistes soviétiques tient également à déclarer que les dispositions de l'article III de la Convention sur le Règlement international de 1972 pour prévenir les abordages en mer, qui concernent l'extension de son application à un territoire dont les relations internationales sont confiées à la responsabilité d'une Partie contractante, sont périmées et contraires à la déclaration de l'Assemblée générale des

[1] Translation supplied by the Inter-Governmental Maritime Consultative Organization.

[1] Traduction fournie par l'Organisation intergouvernementale consultative de la navigation maritime.

countries and peoples (Resolution 1514 (XV) of 14 December 1960),[1] which proclaimed the necessity of bringing to a speedy and unconditional end colonialism in all its forms and manifestations.

CZECHOSLOVAKIA

...“that the provision of Article II, paragraph 2 of the Convention on the International Regulations for Preventing Collisions at Sea—COLREG (London, 1972) prevents some States from becoming parties to the Convention. It is therefore of the opinion that the Convention should be opened to all the interested countries in keeping with the principle of equal sovereignty of States.

“The Czechoslovak Socialist Republic deems it also necessary to declare that the provision of Article III of the Convention, dealing with the extension of its validity to territories for whose international relations the party to the Convention is responsible, is at variance with the United Nations General Assembly Declaration on the Granting of Independence to Colonial Countries and Peoples (Resolution 1514 (XV) of 14 December 1960)[1] which proclaimed the necessity of putting a speedy and unconditional end to colonialism in all its forms and manifestations.”

[1] United Nations, *Official Records of the General Assembly, Fifteenth Session, Supplement No. 16* (A/4684), p. 66.

Nations Unies sur l'octroi de l'indépendance aux pays et aux peuples coloniaux [résolution 1514 (XV) du 14 décembre 1960[1]], qui proclamait la nécessité de mettre fin rapidement et inconditionnellement au colonialisme sous toutes ses formes et dans toutes ses manifestations.

TCHÉCOSLOVAQUIE

[TRADUCTION[2] — TRANSLATION[3]]

...aux termes des dispositions du paragraphe 2 de l'article II de la Convention sur le Règlement international de 1972 pour prévenir les abordages en mer, certains États ne peuvent pas devenir Parties à la Convention. Le Gouvernement tchécoslovaque estime donc que la Convention devrait être ouverte à tous les pays intéressés, conformément au principe de l'égalité et de la souveraineté des États.

La République socialiste tchécoslovaque estime en outre nécessaire de déclarer que les dispositions de l'article III de la Convention relatives à l'extension de son application aux territoires dont les relations internationales sont assurées par une Partie à la Convention sont contraires à la Déclaration de l'Assemblée générale des Nations Unies sur l'octroi de l'indépendance aux pays et aux peuples coloniaux [résolution 1514 (XV) du 14 décembre 1960[1]], qui proclamait la nécessité de mettre rapidement et inconditionnellement fin au colonialisme sous toutes ses formes et dans toutes ses manifestations.

[1] Nations Unies, *Documents officiels de l'Assemblée générale, quinzième session, Supplément n° 16* (A/4684), p. 70.

[2] Traduction fournie par l'Organisation intergouvernementale consultative de la navigation maritime.

[3] Translation supplied by the Inter-Governmental Maritime Consultative Organization.

FINAL ACT OF THE INTERNATIONAL CONFERENCE ON REVISION OF THE INTERNATIONAL REGULATIONS FOR PREVENTING COLLISIONS AT SEA, 1972

1. Upon the invitation of the Inter-Governmental Maritime Consultative Organization a Conference was held in London from 4 October to 20 October 1972 for the purpose of revising the International Regulations for Preventing Collisions at Sea, 1960.

2. The Governments of the following States were represented by Delegations at the Conference:

Argentina
Australia
Belgium
Brazil
Bulgaria
Canada
Central African Republic
Chile
Cuba
Denmark
Federal Republic of Germany
Finland
France
Ghana
Greece
Iceland
India
Indonesia
Iran
Ireland
Italy
Japan
Khmer Republic
Korea, Republic of
Kuwait
Liberia
Mexico
Netherlands
New Zealand
Nigeria
Norway
Panama
Philippines
Poland
Portugal
Romania
South Africa
Spain
Sweden
Thailand
Union of Soviet Socialist Republics
United Kingdom of Great Britain and Northern Ireland
United States of America
Venezuela
Vietnam
Zaire, Republic of

3. The Governments of the following States were represented at the Conference by Observers:

Iraq
Lebanon
Libyan Arab Republic
Pakistan
Switzerland

The Government of Hong Kong also sent an Observer.

4. The following intergovernmental organizations sent Representatives to the Conference:

United Nations

Economic Commission for Europe (ECE)

International Civil Aviation Organization (ICAO)

5. The following non-governmental organizations were represented at the Conference by Observers:

International Association of Lighthouse Authorities (IALA)

International Confederation of Free Trade Unions (ICFTU)

International Chamber of Shipping (ICS)

International Maritime Pilots' Association (IMPA)

Oil Companies' International Marine Forum (OCIMF)

Permanent International Association of Navigation Congresses (PIANC)

6. The Conference elected Captain K. J. N. Wie, Head of the delegation of Norway, as President of the Conference.

7. Captain F. P. Sohnke (Federal Republic of Germany), Captain A. J. Nikolov (Bulgaria), Rear-Admiral J. A. Alvarez (Argentina), Captain H. S. Atmadja (Indonesia) and Captain W. Valkenier (Liberia) were elected as Vice-Presidents of the Conference.

8. The Secretary-General of the Conference was Mr. Colin Goad (Secretary-General of the Inter-Governmental Maritime Consultative Organization) and the Deputy Secretary-General of the Conference was Mr. J. Quéguiner (Deputy Secretary-General of the Organization). The Executive Secretary of the Conference was Captain A. Saveliev (Secretary of the Maritime Safety Committee of the Organization) and the Deputy Executive Secretary of the Conference was Captain Z. N. Sdougos (Head of the Marine Safety Division of the Organization).

9. The Conference established five Committees for the accomplishment of its work:

Committee I

Chairman: Captain G. W. R. Graves (Canada)

Vice-Chairmen: Captain F. Pèlerin (France)
Mr. H. Sagara (Japan)

Committee II

Chairman: Captain B. N. Repkin (Union of Soviet Socialist Republics)

Vice-Chairmen: Lieutenant-Commander E. Mitropoulos (Greece)
Captain M. W. Patel (India)

Steering Committee

Chairman: Captain K. J. N. Wie (Norway)
President of the Conference

Credentials Committee

Chairman: Baron de Gerlache de Goméry (Belgium)

Drafting Committee

Chairman: Captain E. O. Jones (United Kingdom).

10. The Conference had as the basis for its discussions the following documentation:

— The International Regulations for Preventing Collisions at Sea, 1960;

— A draft Agreement together with draft Regulations and Annexes which had been prepared in the Inter-Governmental Maritime Consultative Organization and communicated to governments prior to the opening of the Conference;

— Proposals and comments, including amendments to the documents mentioned above, submitted to the Conference by interested governments and organizations.

11. As a result of its deliberations, as contained in the records of the plenary sessions and in the records and reports of the respective Committees, the Conference adopted and opened for signature and accession: The Convention on the International Regulations for Preventing Collisions at Sea, 1972, to which are attached the Rules and other Annexes which constitute the International Regulations for Preventing Collisions at Sea, 1972.

The Convention and the Regulations constitute Attachment 1 to this Final Act.

12. The Conference also adopted Resolutions on the following subjects:

— participation at the Assembly of the Organization with the right to vote by all Contracting Parties whenever amendments to the Regulations are under consideration (Resolution I);

— early deposit of instruments of ratification, approval, acceptance or accession (Resolution II),

the texts of which are appended to this Final Act as Attachments 2 and 3.

13. The text of this Final Act, being a single original in the English, French, Russian and Spanish languages, together with the texts of the Convention on the International Regulations for Preventing Collisions at Sea, 1972, the Regulations attached thereto and the Resolutions of the Conference, which are in English and French, shall be deposited with the Inter-Governmental Maritime Consultative Organization. Official translations of the attached Convention, Regulations and Resolutions shall be prepared in the Russian and Spanish languages and shall be deposited together with this Final Act.

14. The Secretary-General of the Inter-Governmental Maritime Consultative Organization shall send a certified copy of this Final Act and, when they have been prepared, certified copies of the official translations of the Convention, the Regulations and Resolutions to each of the Governments invited to send Representatives to this Conference.

IN WITNESS WHEREOF the undersigned have affixed their signatures to this Final Act.

DONE at London this twentieth day of October, one thousand, nine hundred and seventy-two.

RESOLUTION I

The Conference,

Recognizing the need for participation by all Contracting Parties to the Convention on the International Regulations for Preventing Collisions at Sea, 1972, in the process of amending that Convention,

Particularly recognizing the need for participation in that process by Contracting Parties which are not Members of the Inter-Governmental Maritime Consultative Organization when consideration of amendments is undertaken by the Assembly of the Organization,

Considering that provision can be made by the Organization for such participation by States which are not Members of the Organization,

Resolves to recommend that the Assembly provide for participation with the right to vote by all Contracting Parties to the Convention including those which are not Members of the Organization whenever matters concerning amendment of the International Regulations for Preventing Collisions at Sea, 1972, are under consideration in the Assembly of the Organization.

RESOLUTION II

The Conference,

Mindful of the need for early entry into force of the Convention on the International Regulations for Preventing Collisions at Sea, 1972,

Resolves to recommend that those States which contemplate becoming Parties to the Convention:

(1) deposit their instruments of ratification, approval, acceptance or accession at as early a date as possible;

(2) if they have not deposited such instruments before 31 December 1973, give the Secretary-General of the Inter-Governmental Maritime Consultative Organization by not later than that date an indication of the period within which they expect to be able to do so.

FIVE ESTUARIES
OFFSHORE WIND FARM

PHONE	0333 880 5306
EMAIL	fiveestuaries@rwe.com
WEBSITE	www.fiveestuaries.co.uk
ADDRESS	Five Estuaries Offshore Wind Farm Ltd Windmill Hill Business Park Whitehill Way, Swindon, SN5 6PB
COMPANY NO	Registered in England and Wales company number 12292474