AMSA's POLICY

ON

OFFSHORE RENEWABLE ENERGY INFRASTRUCTURE

1. Purpose

1.1 The purpose of this policy is to outline AMSA's position on Offshore Renewable Energy Infrastructure (OREI). This includes (but is not limited to) wind farms and devices that generate electricity from wave, tide or current action.

1.2 This policy seeks to assist developers understand AMSA's aim and role and its expectations from the OEI sector. AMSA is a relevant agency for consultation in the context of offshore infrastructure activities, under the Offshore Electricity Infrastructure Act framework.

1.3 The policy offers guidance to all offshore energy developers on safety of navigation, Search and Rescue (SAR) and ship operations matters in the vicinity of OREI. In this regard, the policy addresses:

(a) The lighting and marking of OREIs.

(b) Search and Rescue and other emergency response.

(c) Safe navigation and operations in and around OREIs.

1.4 This policy:

(a) Aims to provide consistency advice to all OREI developers on maritime safety matters.

(b) Does not address any pollution response and subsequent cost recovery matters. Nor does it address any legal aspects, such as any jurisdictional crossover of statutes and government agencies.

2. General

2.1 In 2022, the Commonwealth Government announced six proposed areas for offshore renewable energy projects in Australian Commonwealth waters. Any installations in these areas are to be regulated under the Offshore Electricity Infrastructure Act 2021 (Cth) (OEI Act)[1]. The act permits developers to apply for feasibility, research & demonstration, and transmission and infrastructure licences for wind, solar, wave energy projects and undersea interconnectors. A commercial licence enables the developer to carry out the offshore infrastructure project.

2.2 AMSA recognises there will be several stakeholders involved with OREIs. Various government agencies, commercial organisations and other industry bodies will need to

[1] https://www.ashurst.com/en/news-and-insights/legal-updates/australian-government-announces-its-first-offshore-renewable-energy-areas/).

work together to ensure maritime safety and efficient operations. Close cooperation between all parties will be vital in this regard.

2.3 Developers of any OREI must endeavour to engage early with AMSA following the issue of any feasibility, research and development or transmission and infrastructure licences. Such early liaison will ensure AMSA's advice and concerns are communicated at the planning stage. AMSA should be contacted via email: NavSafety@amsa.gov.au

3. Business need

3.1 AMSA provides the infrastructure for safety of navigation in Australian waters, combats ship-sourced pollution and promotes the safety and protection of our marine environment.

3.2 The number of OREI proposals is increasing, as is the request for advice from AMSA, particularly on navigation safety matters. Wind farms can be very large, typically hundreds of square nautical miles in size. The sites can be irregular in shape, and they can be near busy shipping traffic lanes and are often close to population centres.

3.3 The key areas requiring AMSA's input are the lighting and marking of OREI, the layout and remote shutdown capability for SAR purposes, the safety of navigation and operations in and around OREI's.

LIGHTING and MARKING of OREI

4. General

4.1 There is guidance (international best practice) available for the lighting and marking of OREIs for safety of marine navigation purposes. The lighting and marking of OREIs should be in accordance with the latest edition of IALA Guideline G1162 (The marking of man-made offshore structures). G1162 The marking of offshore man-made structures - IALA AISM (iala-aism.org).

4.2 All developers should consult this policy for details on lighting and marking requirements, at the early planning stage, following the issue of any feasibility or research & demonstration licences. Developers should also consider similar liaison with the Civil Aviation Safety Authority (CASA), for marking OREIs from an aviation perspective.

4.3 To assist AMSA in evaluating the effectiveness of all safety of navigation measures within, and in the vicinity of, a proposed layout, developers should provide AMSA with comprehensive plans and drawings. In addition, developers are encouraged to provide computer models or generated images and animations of each proposed layout. This will enable a clear appraisal of the proposal and allow AMSA to carefully consider implications for safe navigation and SAR.

5. OREI layout numbering, ID marking and blade marking

5.1 OREI devices should be numbered, so that surface vessels and aircraft can identify and locate individual devices and can navigate easily around and within an array layout. These installation numbers can also be used by vessels and aircraft in an emergency to

report their position by reference to a nearby device number. Details of relevant guidance can be found:

- in Annex 1 of this document
- G1162 The marking of offshore man-made structures - IALA AISM (iala-aism.org)
- United Kingdom's Maritime and Coastguard Agency (UK MCA) - Offshore Renewable Energy Installations: Requirements, guidance and operational considerations for SAR and Emergency Response

5.2 When considering the marking of a route or traffic lane through a windfarm, the AtoN required could include additional lights, Automatic Identification System (AIS) AtoN, racons, and/or buoys. IALA publication G1078 The Use of AtoN in the Design of Fairways and Channels should be referred to, for further information.

SEARCH and RESCUE

This section is based broadly on policy documents of the UK MCA. These documents include Offshore Renewable Energy Installations: Requirements, guidance and operational considerations for SAR & Emergency Response and Marine Guidance Notice (MGN) 654. For further information on SAR within or in the vicinity of OREI, developers should refer to these documents.

6. General

6.1 AMSA can be involved in a maritime or aviation SAR response in waters within Australia's SAR region, including those occupied by OREIs. A SAR response can be degraded due to the presence of OREI's. Therefore, AMSA has a significant interest in their layout and operation.

6.2 It is vital OREI's are sited, constructed, equipped, and operated so as to minimise their impact on any SAR or emergency response and salvage operation. OREI developers are required to provide evidence of suitable risk mitigation measures relating to emergency response in their management plans. Management plans are to be submitted to and assessed by the OIR[2].

6.3 Based on international experience[3] and empirical evidence, principal measures strongly recommended for effective SAR in / around any OREI are:

- Linear layout of individual turbines, with at least 2 lines of orientation (see appendix 2 for layout examples).
- SAR lanes
- Helicopter refuge areas
- Clear and unique identification markings visible to surface vessels and SAR aircraft

[2] Prior to the submission of the management plan for a commercial licence the OIR requires all OREI developers to submit a design notification scheme (DNS) for assessment. Comments from the OIR on the DNS relating to risk mitigation and integrity management must be addressed within the developer's management plan.

[3] The International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO) have formed a joint working group (JWG) on harmonization of aeronautical and maritime search and rescue.

- Hover reference marking of wind turbine blades (see Figure 1 in Annex 1)
- Aviation hazard and aviation SAR lighting of wind turbines
- Lighting and marking of OREIs in accordance with IALA guidance
- Control and rapid shutdown of individual and groups of OREI devices (wind turbines in particular)

6.4 The layouts of all OREI's with floating and/or surface piercing devices and structures must be designed to allow safe transit of surface vessels, including rescue craft and SAR helicopters through OREIs. Consideration should also be made for helicopter operations at low altitude in bad weather.

Multiple lines of orientation are ideal, as they provide alternative options for passage planning and SAR operations for vessels and aircraft to counter the effects of the environment (e.g. sea state, tide, and visibility) on manoeuvring.

6.5 Based on international experience, a layout should have at least two lines of orientation. See figure 4 in appendix 2 for example.

NAVIGATIONAL SAFETY

This section is based broadly on policy documents published by the UK MCA. These documents include Offshore Renewable Energy Installations: Requirements, guidance & operational considerations for SAR & Emergency Response, Marine Guidance Notice (MGN) 654. For further information on the safety of navigation within or in the vicinity of OREI, developers should refer to these documents.

7 Navigational safety

7.1 As a general rule, surface navigation should be permitted within the OREI area, if safe to do so. However, restrictions may be placed on the size and/or type of vessel allowed to navigate through an OREI area and their activities (e.g. fishing or tourism). This should be determined by AMSA's navigational safety team on a case-by-case basis, based on navigational safety risk assessments conducted by the developer. Considerations should include the number and layout of the turbines, and results of a risk assessment provided by the developers. AMSA will work closely with the OIR when establishing safety zones and restrictions on activities.

7.2 During the planning stage, a traffic analysis of the area concerned should be undertaken. Traffic data over a period of at least 12 months should be used. This should include all vessel types found in the area. Data should be used to model the impact OREI activities will have on the safety of navigation during the construction and operation phases.

7.3 The OREI developer should conduct a formal risk assessment to evaluate the safety of navigation within or near the OREI and assess 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.

7.4 **General:** When planning a voyage through or near an OREI, it remains the master's responsibility to assess all hazards and risks, including the proximity to windfarms and turbines.

Turbines within a wind farm should generally be spaced at least 500 metres or more apart depending on the size of the turbine.

Vessels involved in turbine maintenance and safety duties may be encountered within or around a wind farm. Mariners should be alert to the likely presence of such vessels and be aware that the structures may occasionally obscure them. This is particularly relevant at night. Large vessels may also become obscured. AMSA recommends all vessels carrying out maintenance be fitted with Class A AIS unit.

A new mandatory safety code for ships carrying industrial personnel – aimed at ensuring the safety of people transported to work on offshore facilities by setting minimum safety standards, has been adopted by IMO's Maritime Safety Committee (MSC 106) and is expected to enter into force on 1 July 2024.

7.5 **Transformer stations and anchoring:** In or adjacent to larger wind farms offshore electrical transformer-stations may be present. These are of similar appearance to small offshore production platforms. Submarine cables link turbines to this substation from where the generated power is exported to the shore. Whether all submarine cables are charted depends upon the scale of the chart; in some cases, only the export cable may be shown. Therefore, it is strongly recommended all vessels operating within a wind farm avoid anchoring except in emergencies as the anchor could easily become fouled. Anchoring prohibited areas should be provided to the AHO for publication on nautical charts.

7.6 **Effect on communications and radar:** The performance of shipborne radar can be affected significantly. At close range, turbines may produce multiple reflected and side lobe echoes, that can mask real targets. The structures can also produce blind spots and shadow areas.

VHF maritime communication is not expected to be impacted by physical deployment of OREI but could be impacted by the associated VHF communication infrastructure deployed at these installations, to support other systems. These radiocommunication capabilities could include command and control systems, emergency warning and information systems (EWIS), security communications or general radiocommunications (land mobile).

The Australian Communications and Media Authority (ACMA) is responsible for the assignment of radiocommunication licences that support these systems. AMSA is responsible for the authorisation of all shipborne and non-shipborne automatic

identification system (AIS) in Australia, which operate on two frequencies (161.975 and 162.025 MHz).

Operators of OREI should ensure radiocommunication site management is undertaken to prevent interference being caused to, or from radiofrequencies in the VHF maritime mobile band.

7.7 **Charting:** All windfarms in Australian waters will be charted by the Australian Hydrographic Office (AHO). Whether all submarine cables associated with the wind farm appear on a chart will depend on the scale of the chart. As with all submarine cables, mariners should note the hazards associated with anchoring or trawling in their vicinity.

7.8 **Decommissioning:** AMSA should be consulted at all stages of an OREI lifespan, including decommissioning. When consulted, AMSA will refer to current AMSA policy and IMO Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone IMO Res.A 672(16)

8. Floating device tracking

8.1 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 due to failure of its moorings.

8.2 Where possible, it is expected that floating energy installations are fitted with tracking devices so they can be monitored, particularly if they break free from their moorings.

8.3 The developer should have a plan in place for the notification, tracking, locating and recovery of such devices, should they break free. AMSA should be notified and updated until the installation is safely recovered.

9 Safety Zones or Protection Zones & Enforcement

9.1 During construction, maintenance and decommissioning, temporary safety or protection zones may be established (following approval from the Offshore Infrastructure Regulator (OIR). Navigating within these areas will be guided by the Offshore Infrastructure Regulator (OIR)'s requirements. Notices to Mariners and broadcast of radio navigation warnings are to be used to inform mariners of the zone. Nautical Charts and publications should be used to depict any permanent safety or protection zones. These zones should be monitored by support craft employed by developers as guard vessels. A safety zone can extend up to 500m from the outer edge of eligible safety zone infrastructure as described in section 136 of the Offshore Electricity Infrastructure Act 2021.

9.2 At any time and on a case-by-case basis, national authorities may consider applying to the Offshore Infrastructure Regulator to establish safety or protection zones in order to prohibit or restrict vessels from entering areas of man-made structures. Such information must be identified on the nautical charts and publications and promulgated through Maritime Safety Information (MSI).

9.3 The nominal safety zone around an operational wind turbine is expected to have a 50-metre radius however due to the scale of coverage of charts and Electronic Navigational Charts (ENC's), showing a limit of this size may not be achievable.

9.4 The establishment of safety zones for other types of OREI's may be more prescriptive as wave and tidal devices may not be fixed in position, may extend horizontally for considerable distances on or below the surface and may have potentially dangerous moving parts. These types of devices can be difficult to detect both visually and by radar.

9.5 Safety zones are determined via a notifiable instrument and will be published on the OIR's website (oir.gov.au).

9.6 Protection zones are determined by a legislative instrument and will be published on the Federal Register of Legislation (Legislative Instruments - All -Title (legislation.gov.au). A register of protection zones will also be published on the OIRs website.

10. Assessing distances between wind farm boundaries and shipping routes

10.1 Developers should discuss appropriate risk reduction measures with AMSA. Advice will be based on AMSA's navigational expertise, international best practice, and a navigational safety risk assessment (carried out by the developer).

10.2 Risk mitigation measures should be implemented to AMSA's satisfaction. These include, but are not limited to:

a) Ships routeing systems including Areas To Be Avoided (ATBA) and Traffic Separation Schemes (TSS's). These may or may not be adopted by IMO

b) Vessel Traffic Services

c) Visual and electronic aids to navigation

d) Safety zones

10.3 Guidelines developed by the UK's MCA have been broadly adopted by AMSA:

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

The three annexes that follow draw out the main technical points made in the IALA and UK MCA Guidelines. They should be taken into account by developers during planning stages.

Annex 1 – Lighting and marking of OREI

1. OREI layout numbering

1.1 OREI devices should be numbered so that surface vessels and aircrafts can identify and locate individual devices and can navigate easily around and within an array. These installation numbers can also be used by vessels and aircrafts in an emergency to report their position by reference to a nearby device number. The numbering also contributes to situational awareness of SAR vessels and aircraft and enable them to navigate visually to a device or location within an array to conduct rescue operations. It also assists with safety of navigation of vessels or aircraft passing by or through an array.

1.2 OREI layout numbering schemes are recommended to follow a 'spreadsheet' format whereby an array is numbered in a navigationally logical and sequential manner, using a combined alphabetical and numerical order. This should start with a development name/code (usually three letters long) and then row/column numbering starting with letter 'A' and then a turbine number. For numbers less than 10, they should be preceded by a leading zero e.g. 01. From a SAR perspective, the numbering should be aligned with the 'SAR access lanes' such that progression through the development is indicated by increment/decrement of turbines in a logical fashion. We strongly encourage the numbering and orientation be discussed with AMSA.

1.3 Letters 'O' and 'I' should not be used to avoid any confusion or misunderstanding with numbers 0 and 1. If electrical-connection identifiers are to be included on the outside of turbines, the numbers should be placed in brackets underneath the device numbers. For example:

ABC (OREI site-designator code letters)

A01 (Row 'A' first turbine)

(B1) (Electrical connection identifier, if required)

2. Wind turbine generator (WTG) tower and nacelle ID marking

2.1 Individual wind turbines are marked for safety of navigation and SAR situational awareness purposes with ID number plates, providing a combined 360° visibility around the tower base or railing, usually somewhere close to the level of the entrance door area. The ID numbers should be clearly readable 3 metres above Highest Astronomical Tide (HAT) at a distance of at least 150 metres from the turbine.

2.2 Each ID plate should 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 is to be hooded or baffled, to avoid light pollution or confusion with navigational marks.

2.3 IALA guidelines specify the requirements for the marking of isolated structures as well as for groups of structures (wind farms) and these will differ.

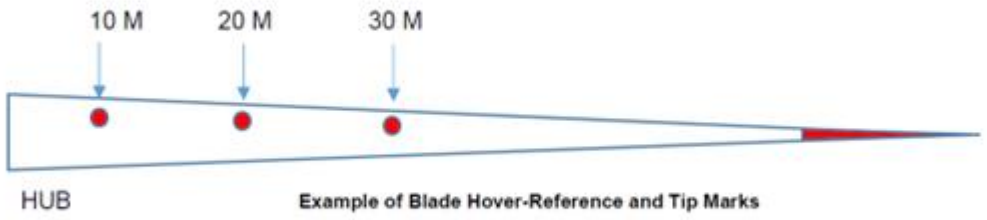
3. Wind turbine blade hover reference marking

3.1 Wind Turbine Generator (WTG) blades should be marked to provide a SAR helicopter pilot with a hover reference point when hovering over a nacelle during a rescue. This is necessary because SAR helicopters are often large, and the pilot (sitting on the right-hand side of the aircraft) may not be able to use objects or markings on the nacelle for reference, due to the pilot's location. The WTG are the pilot's normal vision-arc and so are the best place for such markings.

3.2 Each blade should have three marks - one each at the 10, 20 and 30 metre interval (starting from the hub end of the blade) and placed near the trailing edge of the blades so that, when they are feathered, and the blades are parked in the 'bunny ears' ('Y' position) or offset 'Y' (one or two blades angled forward into the wind), the marks lie upwards in view of the helicopter pilot.

3.3 The marks should be painted in a contrasting shade to the blades overall colour - red is most suitable. The diameter of the marks (dots are preferred) should be at least 600 millimetres but may need to be larger according to the overall size and shape of the turbine and blades.

3.4 All markings on blades and nacelles are to be maintained in operational condition throughout the life of the wind farm. This means that all markings and numbers should be legible and clearly visible.



Example of Blade Hover-Reference and Tip Marks

Figure 1

Annex 2 – SAR requirements for OREI

1. Layouts for SAR operations

1.1 For windfarms, SAR operations may require a helicopter to be able to fly from one end of the windfarm to the other, or to a helicopter refuge area, in the case of large windfarms. SAR helicopters will usually enter from outside the windfarm at altitudes below 500 feet. SAR helicopters will either conduct searches amongst turbines or access a specific location within the windfarm, at low altitude. The SAR lanes will also provide safer and more predictable paths through a windfarm for rescue vessels. These paths will be termed ‘SAR access lanes’. Spacing between internal turbines and those on the boundary of the ‘SAR access lanes’, should be discussed with AMSA during the design phase.

1.2 If weather conditions are such that a SAR helicopter has to fly under Instrument Meteorological Conditions (IMC) flight rules, using instrument navigation techniques and electronic systems, the aircraft may not be able to enter any wind turbine lane, in particular those that are less than 500 metres wide (measured between blade tips, that are transverse to the turbine lanes). Access to wind turbine lanes is assessed on a case-by-case basis by pilots and depending on the conditions, access may remain unachievable even at 500 metres apart. AMSA recommends lanes be no less than 500 metres wide to increase the likelihood of safe helicopter access in any weather conditions.

1.3 For rescue vessels, a vessel should be able to enter the windfarm area from outside and proceed on a consistent track to exit the array without encountering any devices or structures on or close to that track. Minimum spacing between devices will depend on the size and overall shape of the array. Discussions with AMSA on the spacing between devices is therefore advised prior to submission of a DNS to the OIR. Outcomes of such consultation with AMSA are to be included in the management plans of all developers.

2. Control of OREI for SAR operations

2.1 Wind farms may be required to be shut down rapidly (individual turbines, a row or rows of turbines or part or the entire field), to reduce visual distraction, physical collision and turbulence risk to SAR helicopters and/or rescue vessels during SAR operations. For example, during searches conducted within or passing through the wind farm or when winching persons from nacelles, vessels or the water. There may also be a requirement for turbines to be yawed to a favourable position for SAR operations. Whereby all hubs in adjacent rows are rotated outwards to maximise the available space between blades.

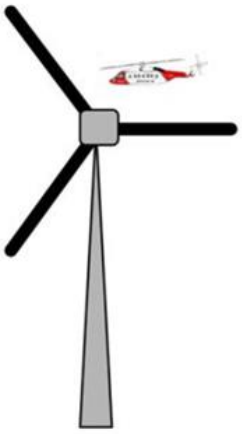
2.2 Surface, sub surface or seabed OREI’s, excluding cable arrays, unless compromised by the incident, may be required to be shut down or de-powered during surface rescue vessel operations to reduce the risks to SAR crafts. Where a surface OREI is to be approached by a SAR helicopter, it may be that the device must be shut down or otherwise stopped (if possible) to enable a safer rescue to be conducted e.g. to rescue a person from the water near to or on a device.

2.3 AMSA must be notified of any limitations associated with the control of turbines with respect to weather limitations, time delays for shutdown, manoeuvring of turbine nacelles and the reliability of control and indication circuits.

2.4 Control of all OREI's should be available from a 24-hour contact point which has immediate ability to control all devices. SAR Authorities such as the JRCC must be able to quickly communicate with the OREI operators 24-hour contact point.

2.5 Any request to shut down or position change of an OREI should be actioned within a reasonable amount of time, typically within 10 minutes. Any delays or failure to carry out the instruction will have adverse effects to SAR operations. SAR helicopters and/or rescue vessels must be able to operate within or within the vicinity of the OREI.

2.6 If helicopter rescue is to take place from/to a WTG, the WTG blades will have to be feathered and the rotor brakes applied (and where feasible blades should be pinned). It may be possible for a SAR helicopter to winch from a nacelle with the blades in a variety of positions, however, the Retreating Blade Horizontal position (figure 3) downwind or bunny ears (figure 4) is normally preferred.



Retreating Blade Horizontal Position:

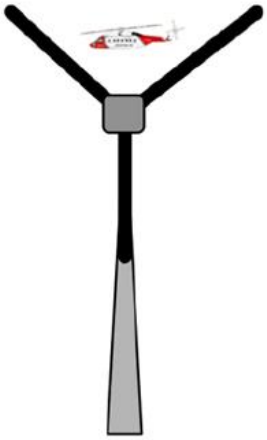
The retreating blade horizontal position provides good references with the blade in the pilot and winch operators 2 o'clock position whilst maintaining a clear area for the tail rotor should the crew wish to offset the aircraft for wind or to improve visual references or escape headings.

This is normally the preferred option for winch transfers to the turbine from a S92.

WTG blades set to Retreating Blade Horizontal position for winching

Figure 2

Bunny Ears (Y Blade)
Position:



The Y blade position also offers good references with the blade in the pilot and winch operator's 2 o'clock position. The retreating turbine blade aft of the helicopter in the winching position slightly compromises the tail rotor area.

This position is commonly referred to as "Bunny Ears" or possibly the "SAR Position" and is often the preferred option for winch transfers to the turbine from the AW 189.

WTG blades set to Bunny Ears or 'Y' position for winching

Figure 3

3. Windfarm helicopter refuge areas

3.1 Where proposed windfarms are very large eg. more than 10NM in any direction, AMSA may request a helicopter refuge area be included in the design, within the windfarm. Helicopter refuge areas are to allow SAR helicopters access to a defined area of safe airspace to: manoeuvre in preparation to enter, or when exiting wind farms, to safely turn within a windfarm or, in the event of an emergency requiring the helicopter to escape from the wind farm.

3.2 This request will be assessed on a case-by-case basis during initial discussions with developers and will depend on the context of the development.

4. Adjacent developments and extensions

4.1 Windfarms which are extended, or adjacent developments are constructed close to each other, could be perceived by an external observer to be one windfarm. In such cases, developers should ensure layouts are of the same general orientation.

4.2 Adjacent developments may create anomalies in both orientation and numbering, which may create confusion and/or distraction during SAR operations. Developers must provide AMSA with solutions for such occurrences.

4.3 It is possible that a helicopter refuge area will be requested between adjacent developments.

5. Chart and positional information

5.1 Accurate charts and positions (in WGS84 datum with, latitude and longitude in degrees, and minutes and decimal minutes to 4 decimal places) of all turbines/devices and structures within an OREI are vital to safe SAR response. Developers should provide the AHO, SAR providers and rescue vessel providers accurate charts of the OREI. This includes the OREI and its immediate area, all turbines/devices clearly marked and located, and with critical distances e.g. between turbines/devices and structures, and heights/depth of structures, marked.

5.2 Positional information should also be shared by the developer in a format that is compatible with common modern Flight Management System (FMS) and rescue vessel' electronic chart systems. This is to ensure that turbines'/devices and structures' coordinates can be programmed into the FMS/Nav Plotter for use during SAR operations. AMSA can advise on this during the planning stages.

5.3 Finalised layouts (as-built positions) should also be provided to AMSA's Response Centre (ARC) Australia as a vector file e.g. ESRI ArcGIS shapefile or .csv file (or similar), including OREI positions and SAR lanes.

5.4 Specific positional information requested is:

- Clear indications on paper and electronic charts of the spacing between turbines/OREI devices in lateral and vertical planes including turbine and other structures heights/depths.
- For WTG two minimum distances must be shown: (i) between turbine towers and (ii) between blade tips, when the blades are transverse to a lane.
- For tide, wave, sea current devices and floating wind turbines, the minimum distance shown should be the narrowest distance expected between devices (depending on their size and shape and their likely movement by wave and tide forces). The 'swinging' radius of each device should also be shown (if this changes at various stages of the tide, this should also be indicated).
- Supply of latitude and longitude of entry/exit positions and accurate drawings showing the SAR access lanes through wind farms/OREI devices agreed with AMSA. This includes position of access points (on the centre line of the SAR lane, 0.5nm from the boundary), bearings of the lanes and distance of the lane (between access points) and minimum width.

5.5 Example of a linear layout with 2 clear lines of orientation:

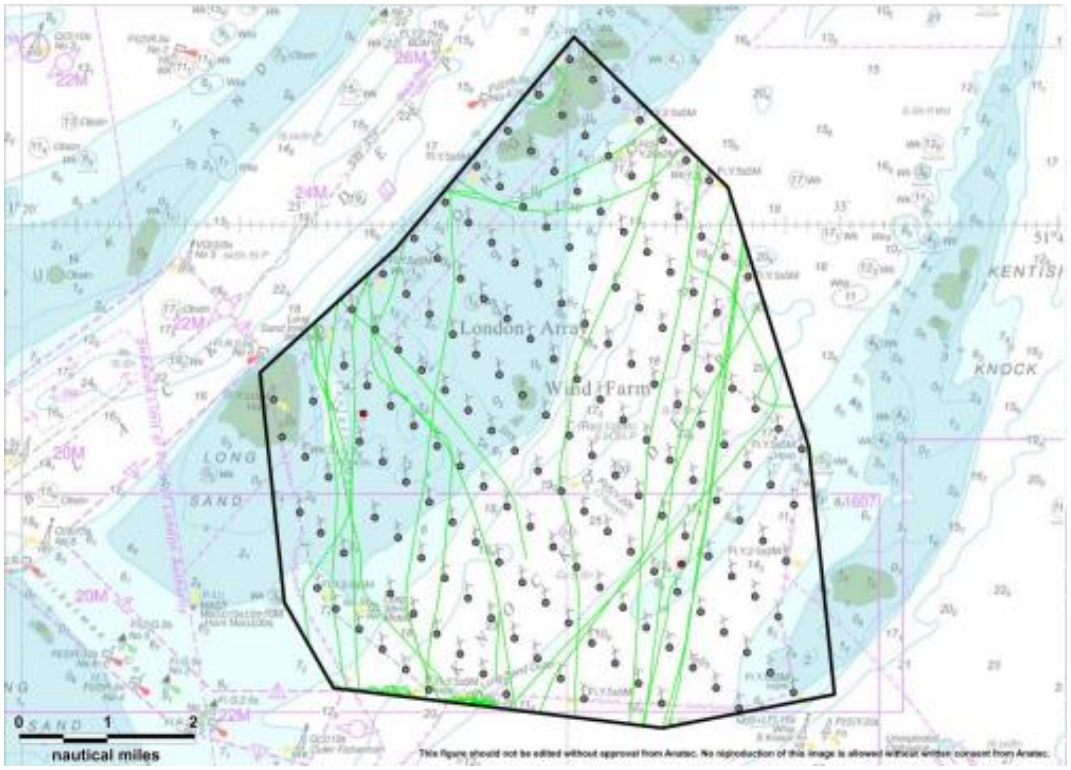

London Array
Wind Farm
KNOCK
LONG
SAND
0 SAND 1 2
nautical miles

Figure 4

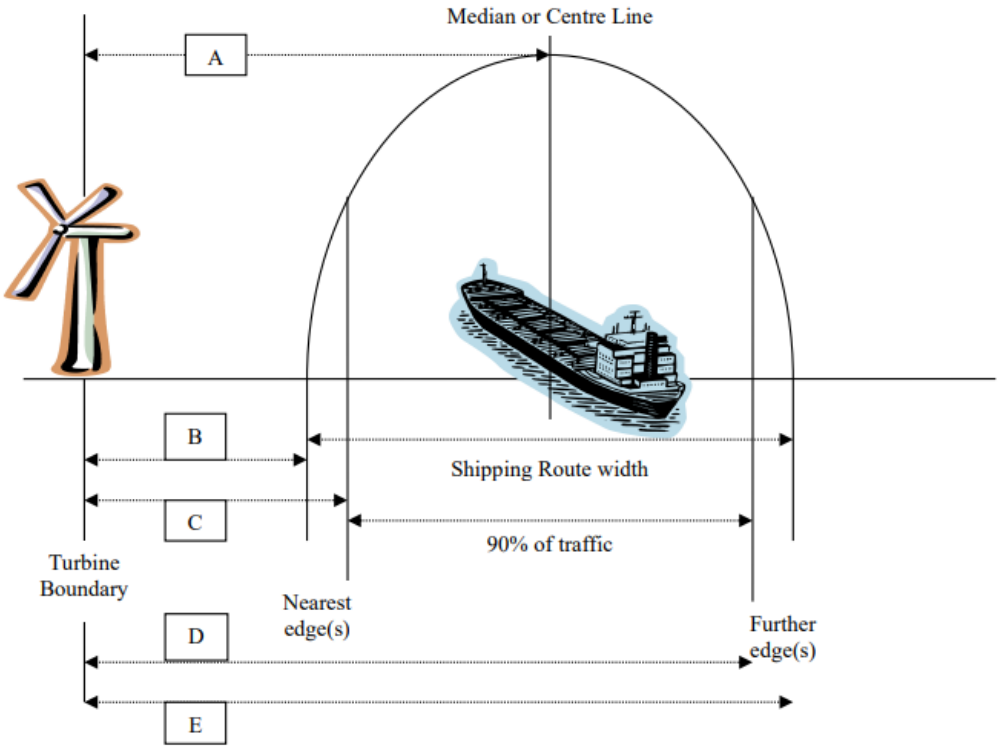
Annex 3 – Navigational Safety Requirements for OREI

The below tables are taken from the UK MCA's Marine Guidance Notice (MGN) 654 and should be used as guidance only. Distances between wind farm boundaries and shipping routes will be considered through the OEI licensing and OEI management plan assessment process, on a case-by-case basis, with input from AMSA and relevant navigation stakeholders.

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

1. Interactive Boundaries

1.1 The below template can be used for assessing distances between wind farm boundaries and shipping routes – see figure 5 and table 1.



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)

Figure 5

2. Wind Farm Shipping Route Template

2.1 The wind farm "Shipping route" guidance template below is to be used, to decide the distances between wind farm boundaries and shipping routes. These will be done on a case-by-case basis, by consultation between AMSA and relevant stakeholders. It is important to recognise that the template is not a prescriptive tool; it is to be used in conjunction with expert opinion advice and will be developed on a case-by case basis, taking into account:

- Size and manoeuvring characteristics of the vessels expected to transit the proposed lanes.
- Provisions and safety margins that may be required in case of propulsion failure of vessels transiting, including availability of towage and other support services.
- The depth of water and the ability of vessels to anchor to arrest drift in the event of mechanical failure
- Expected constraints of weather, sea and tidal conditions that may be expected in the location.
- Other traffic, for example concentrations of fishing vessels, that will affect available sea-room to manoeuvre.
- Existence of submarine cables, pipelines, and obstructions.
- Radar interference.

Distance of turbine boundary from shipping route (90% of traffic, as per Distance C)	**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'
1nm to <2nm 1852m to <3704m	Minimum distance to parallel an IMO routeing measure, as per Distance B. S-Band radar inference ARPA affected (or other automatic target tracking means)	**MEDIUM**	

2nm to 3.5nm (3704m – 6482m)	Preferred distance to parallel boundary of an IMO routing measure, as per Distance B Compliance with COLREG becomes less challenging	**LOW**	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'
>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**

Table 1

2.2 Distance from an IMO Routeing Measure is measured from the routeing boundary i.e. Distance B.

2.3 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.

References and further reading

- Safety of Navigation: Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response.
- Offshore Renewable Energy Installations: Requirements, guidance and operational considerations for SAR and Emergency Response
- MGN 372 – Guidance to Mariners Operating in the Vicinity of UK OREI's
- MCA – The High-Speed Offshore Service Craft Code (HSOSC)
- G1162 The marking of offshore man-made structures - IALA AISM (iala-aism.org)
- Methodology for Assessing Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI)
- ICAO-IMO JWG-SAR-24-IP.3 - Search and Rescue Helicopter Operations in Windfarms (United Kingdom)
- ICAO-IMO JWG-SAR-26-MP.27-Rev.1 - SAR Operations within, and in the vicinity of, Offshore Windfarms (United Kingdom)
- ICAO-IMO JWG-SAR-29-WP.11 - SAR Operations within, and in the vicinity of, Offshore Windfarms (United Kingdom) (1)
- https://www.oir.gov.au/guidance-and-regulation/safety-and-protection-zonesThe Netherlands (Offshore Wind and Fisheries)
- The Netherlands (Offshore Wind and Fisheries)
- The Netherlands (Offshore Wind and Transport)
- Estonia (Transport and Offshore Wind)
- Vattenfall Shows Damage Caused by Cargo Ship Adrift at Hollandse Kust Zuid Offshore Wind Farm
- Offshore Wind Farms Can Interfere with Ship Radar and Navigation, Says New Report
- Conflict fiche 7: Maritime transport and offshore wind – European MSP
- Offshore Electricity Infrastructure Act 2021
- Small workboats used on offshore wind farms: combined report on Windcat 9 and Island Panther incidents
- Investigation on Improving Strategies for Navigation Safety in the Offshore Wind Farm in Taiwan Strait. Journal of Marine Science and Engineering
- Improving the coexistence of offshore wind farms and shipping: an international comparison of navigational risk assessment processes | SpringerLink
- Review on Risk Assessment on transit and co-use of offshore wind farms in Dutch coastal water (officielebekendmakingen.nl)
- THE SHIPPING INDUSTRY AND MARINE SPATIAL PLANNING
- NCSR_7-INF.15_-Report_from_the_World_Association_for_Waterborne_Transport_Infrastructure_-_PIANC__on_Inter..._France_and_the_Netherland..._.pdf
- https://infrastructure.planninginspectorate.gov.ukHornsea-%20Safety Justification for Single Layout.pdf