From: Helen Croxson [mailto:Helen.Croxson@mcga.gov.uk]
Sent: 08 February 2019 19:38
To: Hornsea Project Three
Cc: Peter Lowson
Subject: Re: Hornsea 3 Offshore Windfarm Project (EN010080-001331)

Hornsea Three Project Team,

Please find attached responses from MCA for deadline 6.

Kind regards

Helen

Helen Croxson, Offshore Renewables Advisor
Navigation Safety Branch, Bay 2/25
Maritime & Coastguard Agency
Spring Place, 105 Commercial Road, Southampton, SO15 1EG
Tel: 0203 8172426
Mobile: [redacted]
Email: Helen.Croxson@mcga.gov.uk

Please note I currently work Tuesdays, Wednesdays and Thursdays.

Maritime & Coastguard Agency

MCA report following aviation trials and exercises in relation to offshore windfarms

Owner: Offshore Energy Liaison Officer, HM Coastguard, MCA

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Contents

1. Introduction

The MCA has engaged with offshore renewables since the first installations were constructed and continue to work closely with industry to ensure developments are designed and constructed in a way which ensures the safety of navigation is preserved, and Search and Rescue capability is maintained whilst progress is made towards government targets for renewable energy. This document provides a summary of recent SAR helicopter exercises, trials and discussions plus includes additional justification for the specific requirements outlined in the Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for Search and Rescue and Emergency and Response (MGN 543 Annex V), updated to v2.0 in November 2018.

2. Background

The number of offshore renewable energy developments, particularly windfarms, has increased rapidly over recent years and many more are planned to be constructed in the near future. The vast number of Offshore Renewable Energy Installations (OREI) installed creates a significant and escalating constraint for the MCA and therefore careful consideration is required to ensure HM Coastguard can maintain its obligation to respond to civil maritime SAR within the UK Search and Rescue Region (Coastguard Act 1925).

From 2015 all UK Search and Rescue helicopters were being operated by the MCA on behalf of the Department for Transport. A UK SAR helicopter contractor provides the aircraft, bases, crew and training. This provision, operating out of 10 bases, is a key resource to HM Coastguard when responding to maritime incidents, which may include those to an OREI or within a development or the vicinity. To ensure this capability is maintained to a satisfactory standard, the MCA works closely with stakeholders to fully inform on requirements and through regular dialogue with developers. However, once sites are constructed, then the resultant impact on constraining SAR helicopter operations in windfarms now stays fixed with any future alleviations or easements even more unlikely as the scale of windfarm population increases.

Since 2015 and up to the date of this document release, the MCA has conducted a number of execises, with the UK SAR helicopter contractor, at offshore windfarms and every SAR crew has had the opportunity to fly simulator trials at a windfarm modelled on an existing development. Four exercises, in particular, have provided valuable knowledge to the MCA and the UK SAR helicopter contractor and these are summarised in this document.

Offshore windfarms are increasing in size and individual Wind Turbine Generators (WTG) are larger and taller therefore SAR requirements have changed and evolved as experience has grown. As the industry continues to develop, the procedures and requirements currently in place may be refined further and therefore SAR and aviation experts will continue to investigate and consider suitable updates.

It is vital that all developers enter into early discussions with the MCA to ensure compliance with their requirements and so any compromises or mitigations can be fully explored. Failure to do so may result in the MCA objecting to parts or all of the development.

3. Scope

While this document will consider additional justification for elements of MGN 543 Annex V, it does not replace that document, or the requirements contained within. This document concentrates on elements associated with lines of orientation, SAR lanes and helicopter refuge areas. These are expanded on in this document. MCA requirements exist for several factors such as navigation safety and access for resources during SAR, however, this document only considers the impacts to SAR helicopters.

Developers have, on occasion, challenged these requirements with the MCA and while this is accepted given MGN 543 is written to allow as much flexibility as possible, the MCA still has to consider these on a case by case basis. This document will not address individual developer questions or specifics but concentrate on general points of note arising through recent discussions.

The document has some technical detail included however is not intended to be complex and has been written to be understood by anyone, including those who may not be familiar with SAR helicopter operations.

4. SAR Requirements

The following summarises key areas which are further expanded in this document, based on experience to date.

4.1 Lines of Orientation

Developers should plan for at least two lines of orientation unless they can clearly demonstrate that fewer is acceptable and safe for SAR helicopter and rescue boat operations: this may include the requirement for a greater ‘lane width’ if invoked. For SAR helicopters, two lines of orientation allow multiple directions for an aircraft to enter a windfarm depending on conditions and requirements, plus increase the number of access points to better reach locations within the development. Multiple lines of orientation, creating a predictable pattern, is more efficient and safer to navigate as a SAR aircraft, while maritime search patterns are predominantly linear which is also better accommodated by straight alignment.

4.2 SAR Lanes

SAR lanes would normally align with the direction outlined in 4.1 and allow a straight corridor between OREIs. The SAR lanes should have their positions, minimum spacing, length and orientation noted and available in the Emergency Response Cooperation Plan (ERCoP). A SAR aircraft would normally navigate to access positions, pre-determined as a point 0.5nm from the

nearest OREI and on the centreline of the lane, then transit along the lane on the given bearing before exiting into safe airspace, either at the end of a lane or into a refuge area (see below).

4.3 Helicopter Refuge Areas

Where wind farms are proposed to become very large e.g. more than c.10 NM in any direction, a requirement may be imposed on the developer for helicopter refuge areas to be built in to the design within the wind farm area. Where assessed as being required, refuge areas provide a number of benefits for a SAR aircraft. A refuge area is designed for sufficient space which may allow the crew to reorientate themselves and to turn into before entering another SAR lane e.g. during a search. It may allow an aircraft to enter a windfarm from part way along, at perpendicular angles, rather than transitting down a whole lane e.g. to access a single turbine, saving time and reducing risk. The lane also provides a safe/clear area of airspace/waterspace which the SAR aircraft may be able to navigate to during an aircraft emergency or to winch from a vessel, if this is deemed to be preferred.

4.4 Turbine preparation

To enable a SAR aircraft to winch a casualty from a Wind Turbine Generator (WTG), it needs to be configured in a specific position as required by the crew or HM Coastguard. This includes rotating the nacelle, so the nose cone heading is 90° to the wind, meaning the helicopter will be positioned into wind with the door on the right-hand side of the aircraft, over the nacelle. The blades also need to be positioned as required, ideally in the retreating blade horizontal position and either locked in place or if this is not possible, braked. Ideally the nacelle should be positioned prior to the aircraft arriving as not doing so may lead to significant delays. It is imperative that the OREI Operator notifies the SAR heliocter of any turbines that are not braked when they have been so requested.

5. Learnings

MGN 543 Annex V and other documentation and procedures have been written by MCA SAR subject matter specialists based on experience and many years working with the offshore renewables industry. However, the industry is developing quickly and being constructed in areas not previously considered and therefore requirements are changing. The MCA, through HM Coastguard, is evolving with these developments and regularly seeking opportunities to expand their awareness and operational capabilities.

In conjunction with the UK SAR helicopter contractor and developers, the MCA has carried out several exercises in recent years. These are very beneficial in providing actual evidence of operating in a complicated environment and the MCA is grateful to industry for allowing turbines to be shutdown for this purpose. Four exercises, in particular, were of most benefit for the purposes of refining requirements: Humber Gateway in 2016, Gwynt y Mor in 2017 plus Walney Extension and Burbo Bank Extension in 2018. The exercises have allowed the SAR helicopter contractor to further develop their procedures and understanding of operating within, or in the vicinity of, offshore windfarms.

The exercises were conducted in favourable weather, however, were flown simulating poorer visibility, which would be a far more challenging environment. The following summarises the key learnings.

5.1 General

5.1.1 Communication is key in any emergency and there are various options for a helicopter when onscene. The crews found that communications with the windfarms, either via a Marine Coordinator or vessel onscene, has generally been very good. Information has been readily available and appropriate requests actioned, however it has been noted that delays have existed regarding WTG preparation (see below). All possibilities should be tested regularly, including any options for speaking directly to technicians.

5.1.2 During winching operations, it is vital that communications are kept to an absolute minimum. Windfarm personnel, including vessels and the Marine Coordinator, should be fully aware of this.

5.1.3 Following certain questions on arrival, the heights of WTGs were passed to the aircraft in metres whereas crew work in feet. While a conversation on board could take place, an update to the ERCoP template and all current ERCoPs should be made to account for heights in feet as well as metres.

5.1.4 In all occasions, it took a significant period of time for the crew to prepare the aircraft for entry into the development. This was to account for area familiaration, instrument preparation and confirmation that the windfarm was prepared for entry. The process was very heavy on fuel consumption which would be a significant consideration for any future taskings and/or to larger farms.

5.2 SAR lanes and refuge areas

5.2.1 Relevant positions and OREI details pre-determined and available to the developer and HM Coastguard proved valuable to the crew. Access positions for SAR lanes saves time in the aircraft and can be included in a pre-brief allowing less on-scene time.

5.2.2 The availability of SAR lanes was vital for allowing the aircraft to operate through the windfarm, particularly in poorer visibility. In all exercises, the crew were working very hard at navigating safely through the windfarm. Equipment worked well and the various systems on the aircraft assisted in determining OREI positions however the crew were still relying on visual confirmations of passing OREI. This was time consuming and would also likely degrade the effectiveness of a search. A favourable layout mitigates this degradation to a degree by having predictable routes between OREI.

5.2.3 Searching within a windfarm would be complex, with the lane width likely to be greater than the visual detection range for a person in the water. As a result, it may be preferable to use the

Forward Looking Infra Red (FLIR) system to search sections of a lane at a time. This would be slower but probably more effective overall. However, the FLIR system is degraded in precipitation and any water mositure conditions and is therefore not effective in fog.

5.2.4 The aircraft would ideally transit through a SAR lane at a slow speed to enable safe passage and effective search. This is not an issue on its own however can be more complex when environmental conditions are considered. With a following wind, to maintain a constant groundspeed the aircraft would fly at a lower airspeed which may be undesirable; alternatively, if a constant airspeed was maintained, this would result in a higher groundspeed which may also be undesirable. With a cross wind, the aircraft would need to be orientated to account for the wind. To a certain extent this would not be a problem however eventually, forward progress would be slower and radar returns (for detection and navigation) would be hampered, or impractical. Multiple lines of orientation improve options to a SAR crew with regards to access to and from a windfarm, and search possibilities.

5.2.5 Installation radar returns, the primary method of windfarm navigation, were good at the optimum scale which allowed for crew confidence when navigating through the windfarm. However, as turbine spacing increases, the radar scale may have to change, and this may affect OREI definition.

5.2.6 While uncommon, aircraft failures are always discussed by the crew and plans determined before conducting any flight. This was no different when entering a windfarm. Failures can be wide ranging in type and consequence, but the main ones considered were engine, GPS or radar failure, or a combination. Each crew may have differing plans, but the exercises showed that while climbing may be a suitable option, the preference would be to follow a SAR lane out of the windfarm: this choice becomes mandatory when suffering a single engine failure condition. The SAR lane is known to have no fixed obstructions and may present less risk than climbing vertically (with GPS, system or radar failure) out of the lane given the aircraft will be in a relatively stable condition. It was only when multiple contiguous failures were considered e.g. GPS and radar, that a vertical climb may be the preferred option. When SAR lanes are long, a refuge area may provide a quicker option for an aircraft to get to safe airspace in the event of a technical failure.

5.2.7 WTGs being used for the exercises have been located on the perimeter, giving the crew safer escape options, in the event of an emergency. However, access into a windfarm for the purposes of rescue, either from the water or an individual OREI, is entirely possible in most weathers. However, the safety of this process and the time taken would vary depending on the layout and availability of SAR lanes. Multiple lines of orientation are by far the best way to ensure this, however, on occasions when a developer can demonstrate that fewer is acceptable, a refuge area would increase the access options to the centre of a windfarm.

5.3 Accessing a WTG

5.3.1 These exercises have shown that positioning of nacelles and blades can take a significant amount of time, particularly if a WTG needs to ‘unwind’ itself before repositioning. On occasions

when the WTGs have not been positioned correctly in the first instance, a correction has created a significant delay.

5.3.2 Unfamiliar terminology has also resulted in some confusion over required orientation. During exercises, using “nose cone heading” has worked well for rotating the nacelle to the desired position while “retreating blade horizontal” is used by HM Coastguard and SAR aircraft to describe the required blade position.

5.3.3 Although common practice and well understood, the exercises showed the benefit of having red spots painted on the blade surfaces. These provide good fore, aft and lateral hover references and without them, it would likely be significantly more difficult to assess drift from the established hover position, especially in any Degraded Visual Environment (DVE). They were also valuable with a suitable horizon reference for accurate height control.

5.3.4 The SAR aircraft crews have attempted approaches with the blades in a number of positions, however, the retreating blade horizontal position is preferred. In addition to this position providing good references as mentioned above, the blade which is downwind (horizontal) is clear of the aircraft tail.

5.3.5 Modern WTGs with helihoist baskets offer an excellent winching area for the SAR aircraft. Exercises around turbines which do not have this provision, show that winching may be more complex and, in most circumstances, not possible. A SAR aircraft crew will always risk assess any situation prior to winching and as per emergency response arrangements, an operator should be prepared for an alternative means of rescue.

5.3.6 Options may exist for the winchman to be lowered directly into a nacelle with the clam doors open however significant questions remain over the safety of this process with regards to a likelihood of the doors being damaged or breaking free. If this failure does occur, due to helicopter downwash, the MCA are unsure if the doors would fail into the nacelle or into the sea.

5.4 Turning within a windfarm

5.4.1 One element often raised by developers, particularly as windfarms and the spacing between turbines gets larger, is the potential for SAR helicopters to turn within a windfarm. Significant effort has been taken by the MCA and the UK SAR helicopter contractor to investigate this topic both through theoretical assessments, simulator trials and live flying.

5.4.2 The exercises show that in good weather and visibility there would likely be few restrictions on a SAR aircrafts capability to navigate effectively through a windfarm and potentially turn between turbines and lanes.

5.4.3 However, with reduced visibility and/or stronger wind conditions, navigating through a windfarm and attempting any turns becomes far more restrictive.

5.4.4 Paper calculations can show that an aircraft may be able to turn within a set radius, but when wind conditions are combined with this, the distance increases. Consideration is also required for the mandatory safety margins when operating within windfarms (150m from WTGs).

5.4.5 Simulator trials within a windfarm, in poor visibility, were disorientating when turning and when there was strong wind, the aircraft was difficult to control, particularly when confined by WTGs.

5.4.6 It is accepted that newer developments will have greater spacing which may improve options for turning, however, calculations and exercises within the largest windfarm built to date suggest that the aircraft crew would be sticking to the SAR lanes and only turning when in clear airspace, either outside a development or within a helicopter refuge area.

5.5 Additional considerations

5.5.1 Night Vision Imaging Systems (NVIS) used by the crew on board the aircraft are very high specification and include automatic gain controls to deal with variable light. However, LED aviation hazard lights are often not visible and therefore the inclusion of Infra Red capability is important.

5.5.2 It has been suggested by a developer that the use of AIS on certain turbines may assist a SAR helicopter navigating through it. It would only be suitable if the AIS would normally be 'off', but available during SAR if required.

5.5.3 This possibility has been given some initial consideration and while it wouldn't replace the requirements for SAR lanes and refuge areas, it may provide a useful additional mitigation and be beneficial for the crew when navigating through a windfarm, or to a particular OREI. Further work will be completed in due course to understand more about this capability.

6. Summary

Offshore windfarms are a challenging environment for a SAR helicopter to operate within but with careful consideration, an operational scope can be managed safely ensuring that this important capability isn't restricted or inhibited.

The MCA will continue to work with developers, particularly as new technology may improve access and possibilities for SAR. It is vital that conversations begin early and continue throughout the life-cycle of a windfarm.

Exercises and trials will continue and MGN 543 Annex V will be reviewed as required to enable improvements to be captured. Any operators who can offer opportunities for a SAR aircraft to exercise within a windfarm would be very much appreciated to continue to inform the MCA and UK SAR helicopter contractor on safe helicopter operations.

Any questions on content of this document, or to discuss other elements relating to SAR within windfarms, should be addressed to the MCA's Offshore Energy Liaison Officer.