

## **RECOMMENDATIONS FOR AIDS TO NAVIGATION FROM THE JOINT INDUSTRY TASK FORCE**

### **Executive Summary:**

The Joint Industry Task Force recommends consistent and uniform navigational aids and marking across all offshore wind projects to minimize navigational risk for mariners. Recommendations include identification and marking of turbines to be sufficiently large, distinct and visible in all conditions to ensure mariners are able to easily identify turbines and their location within a wind energy area. Additionally, the use of other technologies used for navigational aids such as AIS on turbines, cell coverage in wind energy areas and smartly spaced fog signals should be used judiciously, particularly during the build out of the first commercial scale projects.

The Task Force expects mariners and agencies to learn from experiences once commercial scale projects have been built. These recommendations should be revisited after more information is learned.

### **Background and Purpose**

The Joint Industry Task Force (Task Force) has worked to compile several recommendations for aids to navigation for mariners in wind energy areas (WEAs). The navigational aids committee was convened in January 2020 to identify navigational aids and marking/lighting specifications that will be beneficial for mariners. These recommendations are specific to fixed turbines, such as turbines with monopole or jacket foundations, and it is expected that floating wind turbines will require separate recommendations unique to those structures.

Utilizing the existing available information from BOEM's [Draft Guidelines on Lighting and Marking](#), [USCG Aids to Navigation Manual](#) and [IALA Marking of Man-Made Offshore Structures](#), the committee wrote and disseminated a survey asking for additional clarification and recommendation from mariners on these general categories: AIS & Radar, Painting & Marking, Turbine Lighting, and Other. (See Appendix 1)

Mariners could submit surveys from February 27, 2020 until May 13, 2020 by mail or online. Additional surveys were submitted after May 13, 2020 and have been included in the summary of results.

During the May 2020 Task Force meeting, and committee follow-up, members discussed the survey results and helped RODA staff interpret the results. Findings indicated several recommendations summarized in this document, as well as areas that need further technological explanations, analysis and/or input from mariners.

### **Survey participants composition**

Forty surveys were collected and analyzed. Participants had the option to submit information about themselves including name, homeport, active fishery, and vessel or business name. Only sixteen individuals gave some degree of attribution which are summarized here:

- Fisheries represented: > 9
  - o Lobster, scallop, squid, surfclam, ocean quahog, groundfish, tuna, monkfish, other sport fish
- Sector type: both commercial and party/charter
- Region: southern New England and Mid-Atlantic
  - o MA, RI, NY, NJ

**Survey results, recommendations and additional comments**

Numbers in parentheses indicate the number of positive responses from the survey.

**1. AIS on structures in WEAs**

All survey respondents indicated that some proportion of AIS on turbines would be preferred. The two highest selected options were “AIS on every turbine – virtual” (14) and “AIS on perimeter of array and on any transit lanes” (14).

There is notable concern regarding cluttering if virtual AIS is on every tower, however a better understanding of AIS and radar interference, including the ability to turn off layers on chart plotters and radar units, could reduce that concern. Committee members have an elementary understanding of the capabilities of virtual AIS but expect that it will be helpful to reduce the clutter and will be easier to adjust as WEAs become operational and we learn more.

For the Joint Industry Task Force, the committee recommends drafting a Request For Information for virtual AIS technological capabilities in WEAs. As committee members are not subject matter experts in AIS, the group will look into hiring an expert to inform the group and model different configurations.

The committee recommends that for WEAs that will be built out in the near future, include AIS technology on every turbine. If there are too many signals that lead to increased confusion once operational, certain devices can be shut off.

**2. RACONS in WEAs**

Survey respondents indicated the fewest number of RACONS option for radar beacons in a WEA (activated on the four corners of the array) was preferred (18). Seven (7) respondents also indicated that there should be no RACONS in WEAs.

Understanding the interaction of multiple aids to navigation and preference for one system over another, or in addition to, was not fully captured by this survey. For example, would RACONS still be needed if turbines had AIS? What kind of interference is there between RACONS and radar systems? Is the radar signature of an array already a big enough signal? Additionally, USCG does not require RACONS and they may no longer be the most useful tool for improving navigational safety.

After discussion, the committee had no recommendations on the use of RACONS in WEAs.

### **3. Lettering size on turbines**

Survey respondents preferred lettering that is the “largest feasible marking that is visible 360 degrees”. This will be dependent on the diameter of the turbine foundation and therefore will vary based on the size of the turbine. A survey respondent also indicated that lettering and marking will probably be more beneficial for smaller vessels rather than larger fishing vessels with other equipment and tools onboard.

From experiences in Europe, many committee members indicated that the 1 meter IALA marking standard is insufficient. There is also a need for further clarification if each letter is 1m tall or the combination of stacked letters and numbers are 1m tall. Further modeling of the markings on turbines with different diameters could be beneficial to better understanding the best size lettering.

Based on available information and expected recommendations from the USCG, the committee recommends lettering at least 3 meters tall and visible 360 degrees above the turbine platform. Additionally, the committee recommends lettering below the turbine platform visible to vessels 360 degrees in very close proximity to a turbine. One meter lettering size below the platform is sufficient.

### **4. Height location of lettering and markings on turbines**

Survey respondents agreed that turbine identifying marking should be approximately 50 feet above the highest astronomical tide (HAT) water line (30).

The committee recommends that turbine markings should be 50 feet above the HAT water line.

### **5. Lighting and marking for visibility in all conditions**

Survey results were mixed as respondents could select multiple options; black lettering on yellow foundation background (18), photoluminescent reflective paint on yellow foundation background (9), combination of black and reflective paint – one above the other (5), combination of black and reflective paint – 2 reflective, 2 black lettering (14). In summary, some combination of reflective paint and black lettering on yellow background was preferred.

The committee recommends a combination of reflective paint, visible in poor conditions, and black paint, visible in bright conditions on a yellow background.

### **6. Lighting vs. reflective paint of alpha-numeric lettering on turbines**

Survey respondents were split on the recommendation for how lettering on turbines should be made visible at night. Twenty respondents recommended “artificial downward-facing light in addition to reflected paint” and eighteen respondents recommended following the IALA recommendations of using “either illumination or retro-reflective material”.

It is also noted that if artificial lighting is used, low-level lighting is important to reduce glare in vessel wheelhouse. From experiences of UK fishermen, if used, lighting must be properly angled to eliminate blinding of captains. See question 10 for Interior and Significant Peripheral structure lighting.

Committee members referenced that BOEM will likely limit the lighting for offshore structures based on wildlife and ecological concerns (i.e. Birds and aggregation of species such as squid, etc.)

The committee does not put forth any recommendations at this time. Further information on BOEM's requirements may require revisiting this topic.

**7. Directional consistency of individual turbine identifying markings in an array**

Survey respondents recommended either “numbers increasing with distance from shore - i.e. consistent with the offshore buoyage numbering system (26), or stated that it “doesn’t matter” (12). A respondent made the comment “with numbering increasing with distance from shore, safety would be maximized, particularly in heavy weather, as the mariner will be aware he is leaving the obstruction area when approaching shore.”

Wind energy companies in later stages of development have also drafted a possible gridded numbering and lettering system for the MA/RI lease block. This gridded layout for numbering would place a unique identifier for each 1x1nm square. This would make continuous yet unique identifiers for the entire block of leases in Southern New England. Committee members recommended looking at naming this zone to demonstrate that it is different from other build outs in other regions, i.e. the NY Bight and further south.

Additionally, committee members recommended including a company identifier to provide more information for mariners in need of search and rescue.

The committee recommends:

- a) Consistency between layouts from multiple developers is key. The gridded options presented by the developers and USCG may be a good solution.
- b) Numbering should advance seaward. But, there were numerous comments made that whatever system is used, as long as it is consistent, mariners should be able to adapt to it.
- c) Consideration of zones for each regional block of leases, as long as the markings do not become too cluttered.
- d) A company identifier should be provided.

**8. Special marking and lighting for transit lanes**

All survey respondents indicated that transit lanes should have special marking and lighting.

Further discussion around whether there should be preferred directionality in transit lanes indicated that this would be not necessary and may be overreaching for this group to recommend. Specific developers and specific leases may work with fishermen operating in the area to look into this.

The committee recommends that transit lanes through a WEA have specific marking and lighting characteristics.

**9. Consistent nomenclature and naming conventions across all agencies and all projects**

Survey respondents recommended consistency across all agencies and all projects (36). The Committee also discussed the importance of standard, simple and legible font for lettering.

The committee recommends standardization of nomenclature and naming conventions across all agencies and all projects.

**10. Turbine lighting for Significant Periphery Structures (SPS) and interior of array**

The majority of survey respondents indicated that the guidelines recommended by the USCG for turbine lighting on the corners (SPS) and interior of arrays are sufficient (34).

The committee recommends that interior, periphery, and SPS lighting follow the guidelines from the USCG Aids to Navigation Manual.

**11. Location of sound signals in a WEA**

Survey respondents had mixed recommendations; “at each corner” (15) and “along the perimeter” (22). A relevant comment has been included:

- “I am not in favor of the mariner initiating the sound signals in fog by radio, as described in the Light List.”

Committee discussions referenced that sound signals will be an important safety measure for small vessels without AIS or good radar. Additionally it will allow a mariner to know when they have exited an array.

USCG is moving towards implementing radio activated sound signals with designated VHF activation channels labeled on charts. Projects further along are looking into sound signals along the perimeter spaced 4nm apart with blasts that travel 2nm. This seemed reasonable to fishing industry committee members to ensure that a mariner will know where they are in relation to other perimeter structures and the edge of a WEA.

An additional question brought up is whether the fog signals will have unique sound characteristics. Outreach to USCG to answer this question is necessary.

The committee recommends sound signals spaced along the perimeter at a reasonable distance from another (not every turbine) to allow mariners to know where they are relative to the next sound signal and edge of the array. For example sound signals with a blast of 2nm should be spaced 4nm apart on the perimeter.

## 12. Chart Symbology

Survey respondents indicated that current chart symbology, i.e. used for the Block Island Wind Farm, is sufficient (21). Additional comments include:

- “Accurate waypoints for all these should be provided for free in any possible GPS format and device and Radars. The symbol on the chart is not very good. Why not just make a rotor so we know the center is the foundation, showing the tower makes it take more time to locate the base accurately. As printed, these take up too much space, the map is not 3D but these are trying to make it look 3D.”
- “No, should be marked like bells and buoys on charts. “
- “Bigger”

Discussion between committee members clarified that most mariners are using plotters now and will expect flash drives to be made available to update their systems with the location of turbines. On charts, individual turbine locations may need to be simplified when there is an array. Recommendations for shading of a wind energy area that is different than other shading on NOAA charts, and committee should confer with NOAA NOS to understand what they plan to do for charting.

Committee recommends:

- a) The current chart symbology for turbines is sufficient; but
- b) For large wind arrays, shading should be used to indicate where a WEA is.
- c) Flash drives with each turbine location should be provided to mariners.

## 13. Character explanation

Survey respondents mostly indicate that the current character explanation is clear and unambiguous (25). Additional comments include:

- “Need location in tds (LORAN-C time differences) as well as latitude/longitude”
- “All this information is sometimes hard for people not to use it. Clearly have all charts updated in plotting programs.”

Committee members highlighted that mariners mostly use plotters now, and flash drives with updated locations of turbines will be vital.

The committee supports the current explanation for turbine characteristics.

## 14. Cell phone coverage in wind farms

Survey respondents mostly indicated that cell coverage in a wind farm would help with safety, navigation, weather information, or communication with other vessels (25). Comments included that any additional tools for safety would be beneficial for mariners. Apps that would be used: Weather Channel, Predict Wind. Com, SF Lite,

Windy App, NOAA graphical forecast, buoy weather, marine traffic, weather radar, Navionics, Myradar, Fishweather. The OSW industry also notes that such coverage would be useful to their crews and operations.

Discussion included the benefits of geofencing of ongoing activity will improve real time safety measures and potential conflicts. Potential challenges include: maintenance and cost which could be shared amongst the developer companies.

The committee recommends that cellular coverage should be provided in WEAs.
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### **Concluding remarks**

Navigational aids, markings, lighting should be consistent across all projects to the extent possible. Recommendations could be adjusted as new technologies are better understood and once wind farms become operational.

#### **Summary of recommendations:**

1. The committee recommends that for WEAs that will be built out in the near future, include AIS technology on every turbine. If there are too many signals that lead to increased confusion once operational, certain devices can be shut off.
2. The committee had no recommendations on the use of RACONs in WEAs.
3. The committee recommends lettering at least 3 meters tall and visible 360 degrees above the turbine platform. Additionally, the committee recommends lettering below the turbine platform visible to vessels 360 degrees in very close proximity to a turbine. One meter lettering size below the platform is sufficient.
4. The committee recommends that turbine markings should be 50 feet above the highest astronomical tide water line.
5. The committee recommends a combination of reflective paint, visible in poor conditions, and black paint, visible in bright conditions on a yellow background.
6. The committee does not put forth any recommendations at this time for lighting of alpha-numeric identifying lettering on turbines.
7. For identifying turbine locations in contiguous wind arrays the committee recommends:
  - a. Consistency between layouts from multiple developers is key. The gridded options presented by the developers and USCG may be a good solution.
  - b. Numbering should advance seaward. But, there were numerous comments made that whatever system is used, as long as it is consistent, mariners should be able to adapt to it.
  - c. Consideration of zones for each regional block of leases, as long as the markings do not become too cluttered.
8. The committee recommends that transit lanes through a WEA have specific marking and lighting characteristics.
9. The committee recommends standardization of nomenclature and naming conventions across all agencies and all projects.

10. The committee recommends that interior, periphery, and SPS lighting follow the guidelines from the USCG Aids to Navigation Manual.
11. The committee recommends sound signals spaced along the perimeter at a reasonable distance from another (not every turbine) to allow mariners to know where they are relative to the next sound signal and edge of the array. For example sound signals with a blast of 2nm should be spaced 4nm apart on the perimeter.
12. Regarding chart symbology the committee recommends:
  - a. The current chart symbology for turbines is sufficient; but
  - b. For large wind arrays, shading should be used to indicate where a WEA is.
  - c. Flash drives with each turbine location should be provided to mariners.
13. The committee supports the current explanation for turbine characteristics.
14. The committee recommends cellular coverage in WEAs.