



16670
13 January 2009

Dr. Walter D. Cruickshank, Ph.D.
Deputy Director, Minerals Management Service
1849 C Street, NW
Washington, DC 20240

Dear Dr. Cruickshank:

On November 14, 2008, the Coast Guard forwarded a package to Minerals Management Service (MMS) to advise that we had reviewed the Cape Wind Energy Project Draft Environmental Impact Statement (DEIS) and its associated public comments that addressed either safety of navigation, impacts to Coast Guard missions, or the Coast Guard's Terms and Conditions. That package contained the Coast Guard's assessment of the DEIS and our responses to public comments that addressed the potential impacts the proposed project may have on navigation safety. The assessment found that the proposed project would: (1) have a moderate impact on navigation safety, but sufficient mitigation measures are available to reduce risk to an acceptable level, and (2) have a negligible or no adverse impact on Coast Guard missions, and may in some circumstances actually facilitate the prosecution of certain missions.

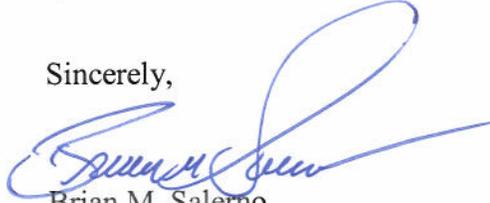
Our letter indicated that one issue involving mitigation measures remained outstanding. Several comments to the DEIS docket expressed concern that the wind turbine generators may impact marine radars on vessels operating in the vicinity of the wind farm. In order to better address and understand potential wind farm impacts on marine radar the Coast Guard contracted with an independent third party, Technology Service Corporation (TSC), to evaluate and report on the impact of wind turbine generators on typical marine radars in navigation scenarios that would likely occur in Nantucket Sound. TSC delivered their report to the Coast Guard on December 16, 2008. A copy has been sent for inclusion in your Final EIS.

Enclosure (1) to this letter provides our assessment of the potential impacts to marine radar from the proposed Cape Wind energy project. This document is available for inclusion in the Final EIS. We recommend that the impacts to marine radar from the proposed energy project be categorized as "moderate" per the impact categories set forth in your DEIS.

We understand that after publication of the FEIS there will be a period during which time the public may comment on the contents and findings. As a cooperating agency, the Coast Guard would like to review and respond to comments submitted to the docket that address either safety of navigation, impacts to Coast Guard missions, or the Terms and Conditions. Based on our review, the Coast Guard will provide MMS with any updates to our Terms and Conditions if deemed appropriate.

Thank you, and thanks to your staff as well, for the cooperation they have provided throughout this project. I trust that our fruitful partnership will continue throughout the Nantucket Sound Project, and look forward to working with you and your staff on future projects.

Sincerely,



Brian M. Salerno
Rear Admiral, U. S. Coast Guard
Assistant Commandant for Safety, Security
and Stewardship

Enclosure: Assessment of Potential Impacts to Marine Radar

Copy: The Honorable Dick Kempthorne
Secretary of the Interior

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1. Background: The Coast Guard, serving as a cooperating agency providing input in our areas of expertise to the lead Federal permitting agency, the Minerals Management Service (MMS), reviewed the Draft Environmental Impact Statement (DEIS) and applicable public comments submitted to the docket. The Coast Guard submits this assessment which discusses the potential impacts to marine radar as it relates to navigation safety from the Nantucket Sound Wind Farm (NSWF). The following references were used in the development of this assessment:

- (a) Commandant (CG-ACO) ltr of 2Aug07, Cape Wind Navigation Terms and Conditions
- (b) Cape Wind Revised Navigational Risk Assessment dtd 16Nov06
- (c) Commandant Instruction M16672.2 (series), Navigation Rules, International-Inland
- (d) Minerals Management Service's (MMS) Cape Wind Energy Project Draft Environmental Impact Statement (DEIS), January 2008

2. Statistics: The following Nantucket Sound Wind Facility statistics were used in the development of this assessment:

| | |
|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| • 130 turbines | • 24 square miles: Area of wind facility |
| • 277.5': Height of towers above sea level | • 16.75': Diameter of tower at sea level in water less than 40' deep • 18': Diameter of tower at sea level in water 40' deep or greater |
| • 341': Blade diameter | • 75': Lowest point of blade to sea level |
| • 440': Highest point of blade above sea level | • Visibility in fog <2NM 10-18% of the time |
| • 5.6 miles: Closest point of land (Cotuit, MA) | • .34 x .54 nautical miles: Spacing between turbines |
| • 1166 yards: Closest point of wind farm to the centerline of a marked channel (Tower I-16 & Cross Rip Shoals Federal Channel) | • 214: Gallons of oil in each Wind Turbine Generator (WTG) • 27,820: Total gallons of oil in all WTGs combined |
| | • 42,000: Maximum number of gallons, oil, stored in tanks at the Electrical Service Platform (ESP) |

3. Potential impacts of the proposed wind farm to marine radar in Nantucket Sound: The proposed wind farm of 130 steel towers within a 24 square mile water sheet will impact marine radar. The question before the Coast Guard is to determine the severity of that impact, the subsequent effect if any, on safe navigation, and if sufficient measures can be

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brought to bear to mitigate any adverse impacts such that navigation safety is maintained. Should those mitigation measures themselves have an adverse impact on some other component of maritime operations, that impact must also be assessed.

4. Risk Assessment Methodology: The Coast Guard Southeastern New England Captain of the Port's (COTP) initial direction to the applicant in 2002 was to prepare a qualitative risk assessment, and that approach has been reviewed—and affirmed—by subsequent COTPs. When analyzing as wide, varied, and complex an issue as navigation safety, even a quantitative risk assessment would require subjective assignment of numerical values to various risk and mitigation factors. Given the numerous variables of both risks and mitigations, a quantitative risk assessment would be of doubtful value. Given the abundance of professional expertise among the Coast Guard and maritime community, a qualitative risk assessment provided a thorough and comprehensive method of evaluating risk.

5. Discussion on the use of Marine Radar and Automatic Radar Plotting Aid (ARPA), and on Navigation and Navigation Rules: The use of available radar technology remains one of many tools employed by prudent mariners. In general terms, radar displays on a screen the range, bearing, and relative motion of moving as well as stationary objects that are within range. It began to be used regularly on marine vessels near the end of World War II. It has become one of the more important instruments, particularly when visibility is restricted, in aiding a mariner to navigate safely and to avoid collisions. Radar is required on many vessels (see the table below), and its proper use is mandated.

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| Type of Vessel | Radar Required? (General Answer) | Common Exception | Cite |
|---------------------|-------------------------------------|------------------------------------------------|--------------------|
| Fishing Vessel | No | Yes, if employing 16 people or more | 46 CFR 29.3 |
| Recreational Vessel | No | Yes, if over 1600 GT | 33 CFR 164 |
| Foreign Mega-Yacht | No | Yes, if carrying 12 or more passengers | 33 CFR 164 |
| Ferry | Yes | No, if carrying 49 passengers or less | 46 CFR Parts T & K |
| Towing Vessels | Yes | No, if vessel is less than 12 meters (39 feet) | 33 CFR 164 |
| Research Vessels | Yes | No, if vessel is less than 1600 GT | 33 CFR 164 |

- a. An ARPA is a tool that enhances the radar display. ARPA calculates, among other things, a tracked object's course, speed and closest point of approach (CPA) thereby helping a mariner determine if there is a danger of collision with another vessel or landmass. Development of ARPA started after the accident in which the SS ANDREA DORIA collided with the freight ship STOCKHOLM in dense fog and sank south of Martha's Vineyard. ARPA-enabled radars are now available even for small vessels. A typical ARPA gives a presentation of the current situation and uses computer technology to predict future situations. It computes relative movement between one's own vessel and a radar contact (or contacts), and enables an operator to see proposed maneuvers by one's own ship. ARPA is required on even fewer vessels than radar, and is typically required on larger commercial vessels. The ferries that operate between Cape Cod and the islands are equipped with ARPA.

To the extent the proposed wind farm would affect marine radar, it may also affect the performance of installed ARPA systems, and consequently the ARPA's potential usefulness to operators. Like radar, though, ARPA is one of many tools utilized by prudent mariners to ensure safe navigation.

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- b. Navigation is the process of directing the movement of a vessel, expeditiously and safely, from one point to another. Navigation involves art, math and science, and the tools and methods available for navigating continue to evolve. Regardless of navigation requirements, all vessel operators are expected to be prudent in navigating their vessel. Navigation safety is aimed at ensuring a vessel operator does not run aground, collide with another vessel(s), or collide with a fixed object.
 - c. The Navigation Rules (also known as the “Rules of the Road”) are the rules a vessel operator is required to abide by to avoid a collision with another vessel. The Convention on the International Regulations for Preventing Collisions at Sea, 1972, (COLREGS) as ratified by Congress and proclaimed by the President, *see* 33 U.S.C. 1601 *et. seq.*, and contained in reference (c), sets forth the navigation rules applicable to where the wind farm is proposed. The applicability of a given rule is dependent on the type of vessel, or the activity it is engaged in, and the circumstances surrounding a vessel at a given time. This may include other vessel traffic and their activities, weather, geography and proximity to designated channels to name a few. Radar and ARPA-enhanced radars are some of the many tools used in complying with the Navigation Rules, but should not be relied upon solely. (*See* Rule 6 (noting that, in determining safe speed, vessels with radar must consider the characteristics, efficiency and limitations of radar); and Rule 7 (cautioning that, when assessing risk of collision, assumptions “shall not be made on the basis of scanty information, especially scanty radar information”)).
 - d. The Coast Guard, in its analysis of the impact on navigation safety the proposed wind farm may have on radar, has the expectation that vessel operators will comply with the COLREGS and all other applicable laws and regulations. Further, the Coast Guard performed its analysis with the expectation that mariners will be prudent in their vessel operation to include the proper and accepted practices of radar and ARPA use.
6. Waterway Users and their Concerns: The following is a summary of the comments submitted to the MMS public docket concerning impacts on marine radar as it relates to navigation safety, categorized by waterway user groups. These comments, which include descriptions of various waterway users in Nantucket Sound, and their respective characteristics and concerns regarding any impact on radar and navigation safety, were also considered for the type and behavior of waterway traffic a radar operator may expect to discern using radar as a collision avoidance tool. Coast Guard responses are incorporated within some of the comments below, where appropriate.
- a. Commercial Fishing and Research Vessels: Currently, due to various economic reasons commercial fishing on Horseshoe Shoal (which is limited to certain times of the year, and certain species) is frequently conducted by a single vessel operator who both navigates from the pilothouse and operates fishing gear from the stern. That is, the single

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vessel operator leaves the pilothouse unattended for periods of time to tend to fishing gear behind the vessel, making it difficult if not impossible to properly monitor the vessel's radar. Although this practice does not conform to the COLREGS, it is common among certain segments of the commercial fishing community. Commercial fishing interest commenters were primarily opposed to the proposed wind farm because of the following:

- (1) The presence of the towers will affect the manner in which they fish, not necessarily their ability to fish. Said another way, the proposed wind farm will most affect commercial fishing in terms of economics, not safety. Clarifying comments from commercial fishermen to the Coast Guard after the Southeastern Massachusetts Port Safety and Security Forum's radar workshop suggested that commercial fishing could continue within the proposed wind farm but, to ensure navigation safety among the 130 towers, a second person would have to be on the vessel and in the pilothouse at all times (in conformance with the COLREGS). Having a second hired hand onboard may render commercial fishing in Horseshoe Shoal unprofitable. Economic impacts are outside the purview of the Coast Guard's review of the proposal.
 - (2) There was also a concern that fishermen using towed gear amongst the towers would be impacted from a safety perspective due to the possibility of gear snags on the bottom resulting in their vessel being pulled into a tower, an obstruction that did not exist before. Although this could be linked to the use of radar the avoidance of a tower should be no different than avoiding vessels in the area at anchor, aids to navigation or other fixed objects.
- b. **Recreational Boaters**: Comments from, or pertaining to, recreational boaters were centered around one of two notions:
- (1) As a group, recreational boaters are too incompetent, reckless, or both, to be able to safely navigate through the proposed wind farm, or
 - (2) The average recreational boater will be able to effectively navigate through the proposed wind farm without significant difficulty.

One argument made by some regarding recreational boaters is that the proposed wind farm would make it less convenient to navigate within the Horseshoe Shoal area of Nantucket Sound, and some recreational boaters may decide to avoid the wind farm footprint altogether and use existing channels and travel lanes around the Shoal.

- c. **Passenger Ferries**: Both high-speed and traditional ferries frequent Nantucket Sound. There are (uncharted) ferry routes on each side of the triangle-shaped proposed wind

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farm for transits between Hyannis on the mainland and the islands of Martha's Vineyard and Nantucket. The two major ferry operators are the Woods Hole, Martha's Vineyard and Nantucket Steamship Authority (Steamship Authority), a quasi-State-governmental organization, and its licensee, Hy-Line Ferry, which operates high speed ferries only.

- (1) One concern of the ferry operators is the ability to detect, by radar, vessels transiting on the other side of the proposed wind farm. The TSC study, consistent with data in other existing studies, showed that radar detection of vessels outside the proposed wind farm was not severely impacted.
- (2) Ferry operators were also concerned about small vessels, undetected on ferry radars, exiting the proposed wind farm and crossing one of the ferry routes adjacent to the proposed wind farm. The TSC study showed that vessels outside the proposed wind farm (such as ferries) could detect small vessels within the proposed wind farm, but discerning such vessels would require greater operator attention.
- (3) Similarly, ferry operators expressed concern that the proximity of their frequent transit routes to the wind farm would make already difficult to detect (small) targets, more difficult to discern or track within or as they exit the proposed wind farm.
 - (a) The Coast Guard finds that the distance of the ferry routes to the east are sufficiently separated from the proposed wind farm to result in few radar impacts.
 - (b) Similarly, the Coast Guard finds that the distance of the ferry routes to the south are sufficient even in the main channel (adjacent to the proposed wind farm). Through interviews of ferry captains operating between Martha's Vineyard and Nantucket it was learned that many ferries operate outside and to the south of the main channel to avoid Horseshoe Shoal altogether.
 - (c) The distance of the ferry routes to the northwest of the proposed wind farm is also considered sufficient, especially when considering that only highly-maneuverable high-speed ferries operate on this route and the proposed wind farm in that vicinity is in the shallowest area of Horseshoe Shoal where ferries already take precautions to remain a safe distance away.
- (4) Another closely related, stated concern of ferry operators was that in poor weather, with winds from due west or due east, ferries transiting between Hyannis and Nantucket must "tack" into or against the prevailing wind to provide a safer and more comfortable ride. These tacking maneuvers purportedly require ferries to transit close to, if not within, the proposed wind farm, thus potentially lessening reaction times for

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collision avoidance with any contact operating within or exiting the proposed wind farm should the presence of the wind turbines themselves limit the ability to use radar to detect and track contacts operating therein.

Track-lines provided from ferry operators did show that the ferries on occasion may make a tack into the wind farm; however, the greatest intrusion was approximately a half mile. Considering the space available to the east for tacking, and the half mile intrusion into the proposed wind farm area is only a small portion of any leg of a tack, ferry operators should be able to adjust their tacks with minimal impact. The wind towers may also provide a visual reference to aid in ensuring a ferry stays well clear of the shoals during such maneuvers. Prior to receiving the above information, the Coast Guard reviewed two years of written logs from six individual ferries and could not find a single indication of a ferry tacking. In interviews of ferry captains, one claimed that he did tack frequently in poor weather and his tacking track line would take him into the area of the proposed wind farm. Other ferry captains were familiar with the tacking maneuver, but one said he had tacked only once in the past two years, and no other ferry captain claimed the tacking maneuver would take him into the area of the proposed wind farm. One retired ferry captain indicated his awareness of the tacking maneuver during poor weather, but claimed that even when tacking, the ferry did not approach the area of the proposed wind farm.

- d. **Tug and Barge Operators:** The tug boat and barge operators, as well as research ships that operate regularly out of Woods Hole, did not express specific concerns.
- e. **Cruise Ships:** Large cruise ships did not express specific concerns. These ships do enter the area, but generally do not enter the channels adjacent to the proposed wind farm. Cruise ships typically enter from the southwest along Vineyard Sound between the Elizabeth Islands and Martha's Vineyard, anchoring north of Martha's Vineyard. They depart the area along a reverse route.
- f. **Other Deep Draft Ships:** No deep draft shipping interests outside the cruise ship industry commented on the proposed wind farm. No known such interests operate in Nantucket Sound itself.

7. **The Radar Studies:**

- a. The documents used in determining the impact of the proposed wind farm on marine radars included, but were not limited to, the following:
 - (1) *Report of the Effect on Radar Performance of the Proposed Cape Wind Project* dated December 16, 2008. Developed by Technology Service Corporation (TSC)

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under contract by the U.S. Coast Guard.

- (2) *Assessment of Likely Effects on Marine Radar Close to the Proposed Nantucket Sound Offshore Wind Farm* prepared for Cape Wind Associates LLC, Ref. No: 08-656 dated August 2008 by Marico Marine. (The “MARICO report”)
 - (3) *Results of the Electromagnetic Investigations and Assessments of Marine Radar, Communications and Positioning Systems Undertaken at the North Hoyle Wind Farm* by QuinetiQ and the Maritime and Coast Guard Agency (of the United Kingdom) dated November 22, 2004.
 - (4) *Deleterious Effects of Cape Cod Proposed Wind Farm on Marine Radars* dated March 22, 2008, by Dr. Eli Brookner. (The “Brookner report”)
- b. The research into the impacts of wind farms on marine radars is fairly consistent in finding that the radar observer will be presented with a more complicated and, at times, confusing navigational picture. There are three primary contributors to this more complicated picture: (1) beam width expansion; (2) side lobes; and (3) false echoes; all of which are also experienced without the presence of a wind farm.¹ The vertical extent of the tower, the shape and complexity of the nacelle, the orientation of the nacelle, and the orientation of the blades, all contribute to a changing, but generally large, radar cross section (RCS). This results in strong radar target reflections.
- c. As described in the TSC report, all radar antennas have a beam width that causes a target to expand in azimuth as the range from the antenna increases. Generally, smaller antennas have wider beam widths and greater target expansion. All of the referenced studies show radar presentations that demonstrate this effect.
- d. Side lobe reflections, also a function of radar antenna design, become more of an issue when the RCS of a target is large. They add to the width of the target presentation because they are perpendicular to the radar beam. As described in the TSC report, side lobe reflections are relatively small for modern radar antennas, even for the low-end radar sets modeled by TSC. The TSC and MARICO studies consider side lobe reflections to be a relatively small contributor to the overall challenge of navigating in and around a wind farm, while the Brookner report argues that side lobes will have a much greater impact.

¹ The phenomena of “shadowing” (or “blind spots”), involving a target being undetected behind a wind turbine, is discussed in the referenced reports. For moving targets and moving observing vessels, shadowing is considered to be transitory and generally less of a problem than false echoes, beam width expansion, and side lobes.

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- e. According to the TSC report, false echoes are produced when the radar beam bounces off the initial target to another target (or targets), is reflected back to the antenna, and then shows up as a spurious echo or echoes beyond the initial target. Depending on the geometry of the wind farm or other strong targets such as a large vessel, these spurious echoes may present numerous “blips” to be evaluated. Fortunately, these false echoes are transient and tend to disappear or move as the observing vessel or target vessel moves. This makes the observer’s task of evaluating targets easier.
- f. The referenced radar studies all show some radar presentations with a combination of beam width expansion, side lobes, and false echoes that are difficult to interpret. Actual targets may be temporarily lost in the beam width and side lobes, especially as the range to the target increases. Fortunately, the targets of greatest concern are generally those that are closest, where the beam width and side lobes are smaller.
- g. The MARICO assessment argues that the false echoes presented near a wind farm are often a result of shipboard structures that reflect strong radar returns, either from a wind farm, another vessel, or another offshore structure such as the WW II fort in the Kentish Flats area. This report further supports this argument with the observation that approximately 30% of the vessels studied did not experience a large number of false echoes. The TSC study did not model shipboard interfering structures, but found that false echoes occur due to reflections from one turbine to another. There is no disagreement, however, that false echoes do occur and that they may be more numerous when there are a number of targets with large RCSs.
- h. The TSC study report indicated the following:
 - (1) The proposed wind farm would not adversely impact the ability of a vessel outside the wind farm to detect, by radar, another vessel outside the wind farm, even if portions of the wind farm are between the two vessels.
 - (2) The proposed wind farm would not adversely impact the ability of a vessel inside the wind farm to detect, by radar, a vessel outside the wind farm.
 - (3) The proposed wind farm would impact a vessel outside the wind farm in its ability to detect, by radar, a vessel within the wind farm. Vessels within the wind farm are generally discernible, but the radar operator will likely have to pay closer attention to the radar scope to distinguish between a valid and false radar return.
 - (4) The proposed wind farm would likely impact a vessel’s ability, when inside the wind farm, to detect, by radar, another vessel within the wind farm. Again, vessels within

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the wind farm are discernible, but the radar operator will need to pay close attention to the radar scope to distinguish between a valid and false radar return.

- (5) Of particular note is the finding in the TSC report that the primary radar reflector (or radar cross-section) of a WTG is not the 277.5-foot tower, nor the 341-foot diameter blades, but the sharp-edged, multi-faceted nacelle that sits atop the turbine. Interestingly, the TSC study showed that as a vessel moves closer to a WTG its radar picture improves around those towers closest to it, i.e., the radar picture in the immediate vicinity of a vessel, even within the wind farm, is clear. As a vessel gets closer to a tower (or towers), the nacelles of the adjacent towers are too high to be reflected by the vessel's radar signal, and so cannot return as strong a reflection. It is the towers that are further away (and whose nacelles are within the radar signal) that cause greater beam width spread and provide more spurious echoes due to having more WTGs to reflect from as the radar "looks" deeper into the wind farm.

8. The Coast Guard Findings:

- a. The Coast Guard concurs with the findings of the TSC modeling study as stated in paragraph 7.h above. After considering these findings, the Coast Guard considered how the wind farm impacts to radar would affect a vessel operator in making navigation and collision avoidance decisions. The Coast Guard finds that vessels would be able to navigate safely within and in the vicinity of the proposed wind farm, and that the impact of the proposed wind farm on navigation safety is "moderate." This assessment assumed a vessel operator is in a restricted visibility situation and is complying with the COLREGS as well as operating his/her vessel prudently. The Coast Guard recognizes that the human factors involved with respect to an operator/radar observer performing multiple tasks, at times may present target detection challenges along with an "eyes-busy" and "hands-busy" situation. These findings take into account the reality of short-handed or single-handed operation and the fact that certain vessel operators will be more challenged than others when navigating under conditions of reduced visibility. The following findings from the TSC study and associated principles were considered important:
- (1) Since side lobes and target expansion tend to be more of a problem at some distance from the radar than close in, vessels in the vicinity of the radar may be detected more easily than vessels some distance away. Operators in the vicinity of the proposed wind farm should have little problem identifying vessels nearby that could pose a threat of collision in time to react to that contact. Contacts located where target expansion and side lobes become problematic are generally at a distance so as not to be of significant concern.

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- (2) Although the radars on vessels within the proposed wind farm should detect other targets within the proposed wind in time for an operator to take action to avoid a collision, it is recognized that the combination of multiple vessel contacts with the returns of multiple towers appearing for 360 degrees on the radar screen would likely impact a operator's ability to notice and track targets of concern. In other words, it would require a level of attention from operators inside the proposed wind farm that is problematic for the radar to be as effective a collision avoidance tool as would normally be expected under external wind farm navigation in restricted visibility.
- b. Keeping the findings of the TSC report (impact on marine radar itself) and the potential impacts on waterways users described above in mind, the Coast Guard finds the following:
- (1) The proposed wind farm would not significantly adversely impact the ability to safely navigate a vessel outside the wind farm or to detect, by radar, another vessel outside the wind farm, even if the wind farm is between the two vessels.
 - (2) The proposed wind farm would not significantly adversely impact the ability of a vessel inside the wind farm to detect, by radar, a vessel outside the wind farm.
 - (3) The proposed wind farm would significantly adversely impact the ability of a vessel, while outside the wind farm, to detect, by radar, a vessel within the wind farm. Vessels within the wind farm would be discernible, but the radar operator will likely have to pay closer attention to the radar scope to distinguish between a valid and false radar return. Mitigations to aid in avoiding collisions would be needed to offset this impact.
 - (4) The proposed wind farm would significantly adversely impact the ability of a vessel, while inside the wind farm, to detect, by radar, another vessel within the wind farm. Again, vessels within the wind farm would be discernible, but the radar operator would need to pay closer attention to the radar scope to distinguish between a valid and false radar return. Mitigations to aid the mariner in avoiding collisions would be needed to offset this impact were the wind farm to be approved by MMS.
9. Potential Mitigations:
- a. With the foregoing radar analysis and findings as background, the Coast Guard next examined what mitigation measures, if any, might reduce risks to the safety of navigation. Various documents already require or propose measures to mitigate adverse impacts, including impacts to marine radar. The Coast Guard's Terms and Conditions

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developed for this proposed wind farm allow for an adaptive management approach, recognizing that many of the mitigations and specific application of mitigations would be best determined during or after construction. Thus, our assessment and recommendation to MMS as to the proposed wind farm's impact on radar and subsequently on safe navigation was limited to identifying if reasonable mitigations are available to reduce the risks of any impacts. The Coast Guard has determined that there are reasonable mitigations available.

- b. It would be premature to discuss detailed and finite mitigation measures at this point in the permitting process for the proposed wind farm. However, in developing the foregoing assessment and recommendation, the Coast Guard considered the following:
- (1) Reference (a) contains a number of mitigation measures, primarily requirements for Cape Wind to maintain certain operational oversight, communications, and monitoring capabilities, including the capability to "monitor in real time marine traffic within and in the vicinity of the Nantucket Sound Wind Farm." Plans for achieving these capabilities must be submitted by Cape Wind LLC before beginning construction of its proposed wind farm, and those plans must be approved by MMS after consultation with the Coast Guard.
 - (2) Reference (c), which includes the International Regulations for Preventing Collisions at Sea (COLREGS), commonly referred to as the "Rules of the Road," sets forth Federal requirements governing vessel operation, movement, and collision avoidance in both international and inland waters. (The site of the proposed wind farm is in international waters.) The COLREGS contain a variety of required measures to mitigate hazards to navigation, such as proceeding at safe speed for the prevailing circumstances, maintaining a proper continuous lookout, etc. Full compliance with the COLREGS is expected, and the COLREGS are considered a valid, and primary, measure to mitigate potential radar impacts within and in the vicinity of the proposed wind farm.
 - (3) The Coast Guard has several regulatory and non-regulatory avenues available to enhance and protect navigation safety. Possibilities include creation of a specially marked channel (or channels) through the proposed wind farm, creation of routing measures such as the two way route currently in use in Buzzards Bay, and/or creation of a Regulated Navigation Area (RNA) to govern, or a voluntary system to help manage, speed, traffic patterns, communications, etc. within and in the vicinity of the proposed wind farm, particularly under conditions of reduced visibility. One potential application of Coast Guard authorities would be to implement an RNA that proscribes something similar to Rule 9's requirements for narrow channels, whereby vessels operating within any wind farm "shall not

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impede” the passage of vessels operating in the vicinity of, but outside of, the wind farm. It is anticipated that if the proposed wind farm is approved by MMS, the precise details of any such mitigation strategies would be further developed and refined with continued input from waterway users, through venues such as the Southeastern Massachusetts Port Safety and Security Forum, and potentially, through the Coast Guard using standard regulatory (rulemaking) processes, or other Coast Guard procedures.

- c. The Coast Guard has reviewed over two dozen potential mitigation measures that were identified as possibly applicable in the course of this assessment, ranging from the COLREGS to general education of Federal navigation safety requirements, and has determined that this mitigation “toolbox” – including those requirements set forth in the Coast Guard’s Terms and Conditions – provides the Coast Guard sufficient means to reduce risk to navigation safety substantially. Affected waterways users may need to adjust somewhat to account for navigating within, and in the vicinity of, the proposed wind farm. Nevertheless, vessels operating within or near the proposed wind farm should be able to do so safely even in restricted visibility. Although there may be degradation in the effectiveness in the use of radar, radar is not the only measure a mariner has at his/her disposal or should be using. Due to the unique operating environment that the wind farm presents, all of the possible mitigations available will be assessed and, if deemed appropriate, required of Cape Wind in accordance with the Terms and Conditions. Some of the mitigations associated with the proposed wind farm include 13 specific mitigation measures proposed by Cape Wind LLC in Section 7.0 of reference (b). Those related to navigation safety were focused primarily on aids to navigation (light, signals, etc.) and public education and outreach. Cape Wind’s proposed aids-to-navigation system is graphically displayed in Figure 4-17 to reference (b).
- d. Given the risk mitigation strategies and tools discussed above, and the characteristics of the waterway users in Nantucket Sound, buffer zones are not needed. This is significant in determining the impact on navigational safety for this project because of the channels that exist along the borders of the proposed wind farm and the associated obstructions, many marked by aids-to-navigation that are near the edges of these channels. Two factors came into play in making the determination that buffer zones are not needed. First, for vessels transiting in the vicinity of the proposed wind farm, the impact on radar was minimal for the distances an operator would need to track and make navigational decisions. The other factor is that deep draft vessels do not operate in the vicinity of the proposed wind farm. Unlike the vessels that do operate in the vicinity of the proposed wind farm, which need relatively short distances to maneuver, deep draft vessels need significantly greater areas to maneuver due to stopping distances, turning radius, etc. This circumstance does not exist in Nantucket Sound.

U.S. COAST GUARD
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- e. It is important to keep in mind that a key component to any potential future mitigation measure —perhaps the key component—is waterway user input. It is difficult, if not impossible, to engage waterway users in a constructive dialogue regarding potential mitigation measures and their expected effectiveness before knowing whether or not the proposed wind farm is approved. The lead Federal permitting agency, MMS, advocates an “adaptive management” approach to the permitting process. Between issuing an initial lease/permit and actual construction of the proposed wind farm, technical, economic, or other factors may change the complexion of the proposed wind farm and/or the character of mitigations. The Coast Guard stands ready to continue its dialogue with the public, waterway stakeholders, and cooperating agencies should MMS grant any lease, easement, or right of way for the wind farm proposed by Cape Wind.

10. Recommended changes to Coast Guard Terms and Conditions:

The Coast Guard’s assessment of impact on navigation safety falls within the “moderate” impact level as defined in reference (d). Based on this assessment, no substantive changes to the terms and conditions are recommended at this time. The Coast Guard still reserves the right to amend its terms and conditions as necessary.