AECOM

APPENDIX Y

Aircraft Detection Lighting System (ADLS) Analysis

Prepared for

Beacon Wind LLC

Photo credit: Matt Goldsmith, Equinor

June 2023

Beacon Wind Project

AECOM

Offshore Massachusetts

Aircraft Detection Lighting System (ADLS) Efficacy Analysis

January 5, 2022

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Summary

Capitol Airspace conducted an Aircraft Detection Lighting System (ADLS) efficacy analysis for the Beacon Wind project (blue area, ***Figure 1***) off the coast of Massachusetts. At the time of this analysis, 157 potential wind turbine locations[1] had been identified (black points, ***Figure 1***). This analysis utilized historic air traffic data obtained from the Federal Aviation Administration (FAA) in order to determine the total duration that an ADLS-controlled obstruction lighting system would have been activated. The results of this analysis can be used to predict an ADLS's effectiveness in reducing the total amount of time that an obstruction lighting system would be activated.

An ADLS utilizes surveillance radar to track aircraft operating in proximity to the wind project. The ADLS will activate the obstruction lighting system when aircraft enter the light activation volume and will deactivate the system when all aircraft depart. As a result, the ADLS provides nighttime conspicuity on an as-needed basis thereby reducing the amount of time that obstruction lights will be illuminated. Depending on the number of nighttime flights transiting a wind project's light activation volume, an ADLS could result in a significant reduction in the amount of time obstruction lights are illuminated.

Historical air traffic data indicates that ADLS-controlled obstruction lights for 1,116-foot tall (340.2 meter) wind turbines[2] would have been activated for a total of 2 hours 42 minutes and 9 seconds over a one-year period based on 2019 data. Light activation duration decreases for a one-year period based on 2020 data to 20 minutes and 26 seconds over a one-year period. Considering the local sunrise and sunset times, an ADLS-controlled obstruction lighting system could result in over a 99 percent reduction in system activated duration as compared to a traditional always-on obstruction lighting system.

[1] 157 foundation positions (155 wind turbines and 2 offshore substation facilities). The analysis modeled 157 wind turbines.

[2] This analysis was initiated prior to the Project's PDE reduction. The current maximum PDE is a 1,083 ft (330 meter) turbine.

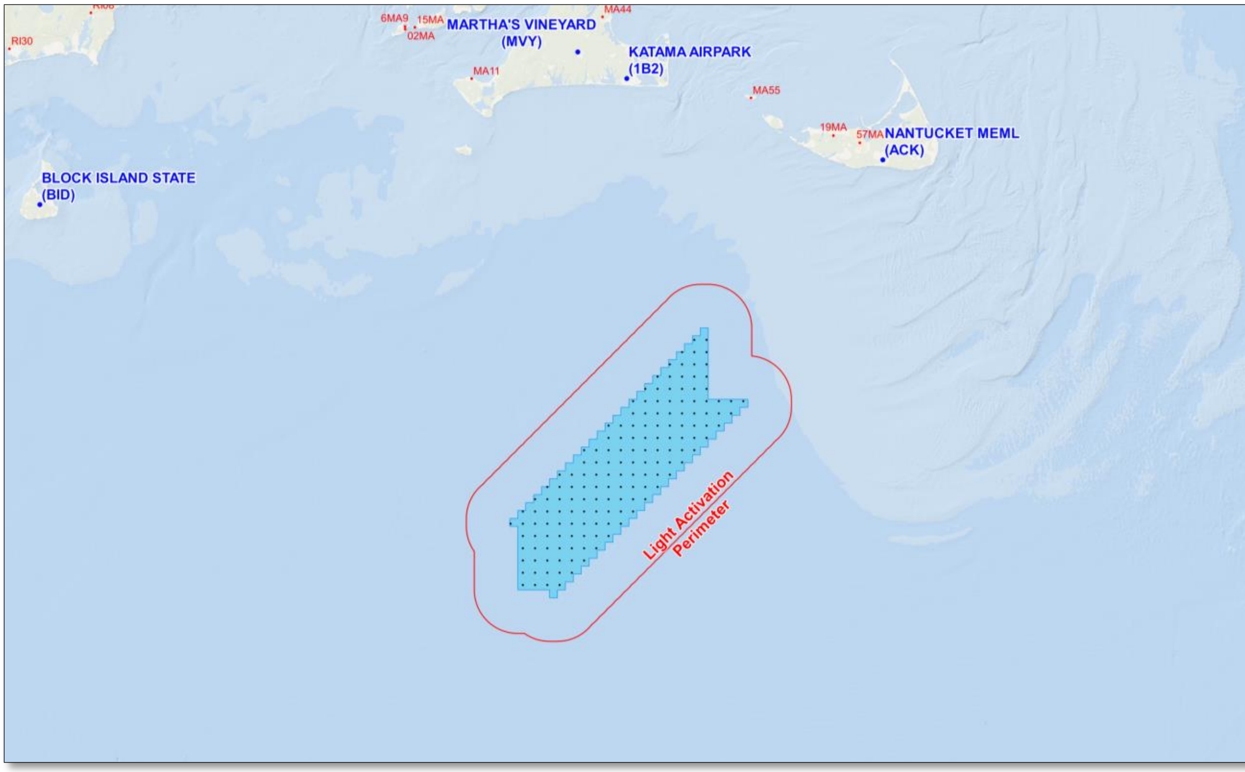

Figure 1: Public-use (blue) and private-use (red) airports in proximity to the Beacon Wind project

Methodology

Capitol Airspace analyzed FAA National Offload Program (NOP) radar returns in proximity to the Beacon Wind project for the 2019 and 2020 calendar years. FAA NOP data only includes secondary radar returns which are created if the identified aircraft is equipped with a transponder. [3] Aircraft operations without an active transponder were not captured as part of this dataset.

The following process was used to determine the frequency of nighttime aviation operations in proximity to the Beacon Wind project:

1. **Define Three-Dimensional Light Activation Volume –** In accordance with FAA Advisory Circular 70/7460-1M, obstruction lights controlled by an ADLS must be activated and illuminated prior to an aircraft reaching three nautical miles from, and 1,000 feet above, any obstruction. However, the actual light activation volume will vary depending on the ADLS. At the time of this analysis, a specific ADLS had not been selected for the Beacon Wind project. In order to account for varying radar systems as well as aircraft speeds and descent rates, Capitol Airspace assessed a 3.55 nautical mile buffer (solid red outline, ***Figure 2***) around the wind project at altitudes up to 3,500 feet above the highest wind turbine (4,700 feet above mean sea level [AMSL] based on 1,116-foot tall (340.2 meter) wind turbines).
2. **Calculate Sunrise and Sunset –** Sunrise and sunset times were calculated for each day of the year based on the United States Naval Observatory definition of sunrise and sunset. Sunrise time was calculated at the westernmost edge of the light activation perimeter. Sunset time was calculated at the easternmost edge of the light activation perimeter. The data was validated through comparison to the ***United States Naval Oceanography Portal***.
3. **Select Nighttime Radar Returns –** Since traditional obstruction lights can rely on ambient light sensors to identify darkness, nighttime was considered to occur between 30 minutes prior to sunset until 30 minutes after sunrise. This represents the time during which a traditional obstruction lighting system would likely be activated. All radar returns within the light activation volume that occurred during this period were evaluated. In accordance with guidance provided by the FAA, if an ADLS loses track of an aircraft, a 30-minute timer should be initiated to keep the obstruction lights activated while the aircraft can clear the wind project area. Since the application of ADLS requires site specific radar surveillance systems that will be focused on the project area, Capitol Airspace does not anticipate a likelihood of dropped tracks.
4. **Remove Time Overlap –** To remove the duration of overlap occurring when more than one flight transits the light activation volume at the same time, each nighttime flight was compared to every other nighttime flight. Where overlapping flights were found, the overlapping flight's duration within the light activation volume was removed from the total obstruction lighting system activation time.

[3] NOP data excludes certain military flights due to the sensitive nature of some operations.

Results

2019 FAA NOP Data

FAA NOP data indicates that as many as 378 flights had at least one radar return within the light activation volume (red outline, ***Figure 2***) during the 2019 calendar year. However, most of these flights occurred during daytime. Using local sunrise and sunset times, Capitol Airspace determined that as many as 32 flights (purple tracks, ***Figure 3***) had at least one radar return within the light activation volume during the nighttime period when a traditional obstruction lighting system would be activated. Each of the 32 flights was further evaluated to determine the amount of time it remained within the light activation volume. Over a one-year period, these flights would have resulted in a total obstruction light system activated duration of 2 hours 42 minutes and 9 seconds for 1,116-foot tall (340.2 meter) wind turbines.

Considering that the Beacon Wind project ADLS light activation perimeter observed approximately 4,683 hours of nighttime during the 2019 calendar year, an ADLS-controlled obstruction lighting system could result in over a 99 percent reduction in system activated duration as compared to a traditional always-on obstruction lighting system (***Table 1***).

Month	Nighttime Observed (HH:MM:SS)	Light System Activated Duration
January	477:36:30	00:08:41 (0.03%)
February	402:45:09	00:00:00 (0.00%)
March	405:38:58	00:00:37 (0.00%)
April	351:48:08	00:06:34 (0.03%)
May	327:43:01	00:00:08 (0.00%)
June	299:29:15	00:00:05 (0.00%)
July	318:25:47	00:05:29 (0.03%)
August	349:39:19	00:10:03 (0.05%)
September	377:19:14	00:01:03 (0.00%)
October	431:44:04	00:01:17 (0.00%)
November	453:26:20	02:04:59 (0.46%)
December	487:49:24	00:03:13 (0.01%)
Total	**4683:25:09**	**02:42:09 (0.06%)**

Table 1: Typical duration of light system activation time during each month of 2019

2020 FAA NOP Data

FAA NOP data indicates that as many as 390 flights had at least one radar return within the light activation volume (red outline, ***Figure 2***) during the 2020 calendar year[4]. However, most of these flights occurred during daytime. Using local sunrise and sunset times, Capitol Airspace determined that as many as 31 flights had at least one radar return within the light activation volume during the nighttime period when a traditional obstruction lighting system would be activated. Each of the 31 flights was further evaluated to determine the amount of time it remained within the light activation volume. Over a one-year period, these flights would have resulted in a total obstruction light system activated duration of 20 minutes and 26 seconds for 1,116-foot tall (340.2 meter) wind turbines.

Considering that the Beacon Wind project ADLS light activation perimeter observed approximately 4,699 hours of nighttime during the 2020 calendar year, an ADLS-controlled obstruction lighting system could result in over a 99 percent reduction in system activated duration as compared to a traditional always-on obstruction lighting system (***Table 2***).

Month	Nighttime Observed (HH:MM:SS)	Light System Activated Duration
January	477:48:33	00:01:36 (0.01%)
February	416:48:47	00:00:00 (0.00%)
March	404:35:21	00:00:00 (0.00%)
April	350:50:04	00:01:04 (0.01%)
May	326:59:37	00:00:00 (0.00%)
June	299:22:16	00:02:12 (0.01%)
July	318:57:59	00:03:14 (0.02%)
August	350:35:13	00:03:14 (0.02%)
September	378:20:06	00:01:51 (0.01%)
October	432:45:16	00:06:58 (0.03%)
November	454:10:54	00:00:17 (0.00%)
December	487:57:36	00:00:00 (0.00%)
Total	**4699:11:42**	**00:20:26 (0.01%)**

Table 2: Typical duration of light system activation time during each month of 2020

Please contact ***Dan Underwood*** or ***Candace Childress*** at (703) 256-2485 with any questions regarding the findings of this analysis.

[4] Typically, one year of air traffic data is analyzed for the report. The project requested a specific review of both 2019 and 2020 data. The results of the two years of analysis provides a range of potential light system activated duration.

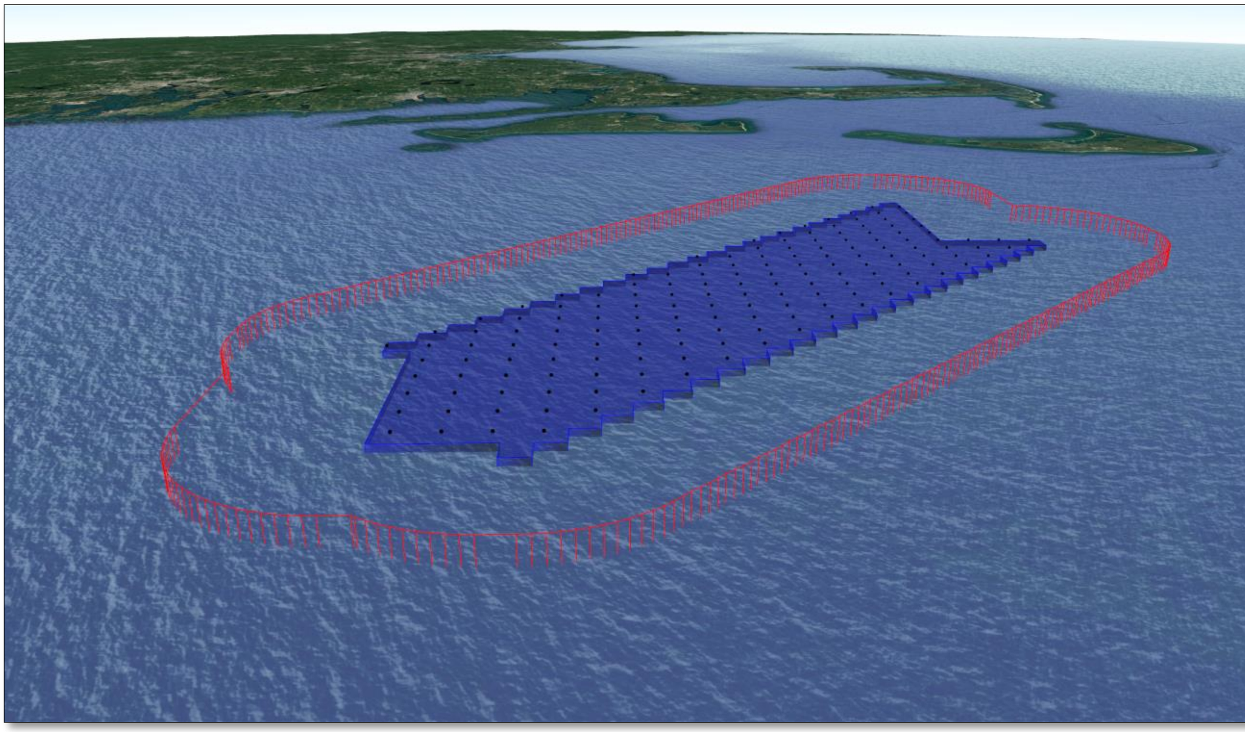

Figure 2: Beacon Wind project (blue) and light activation volume (red outline)

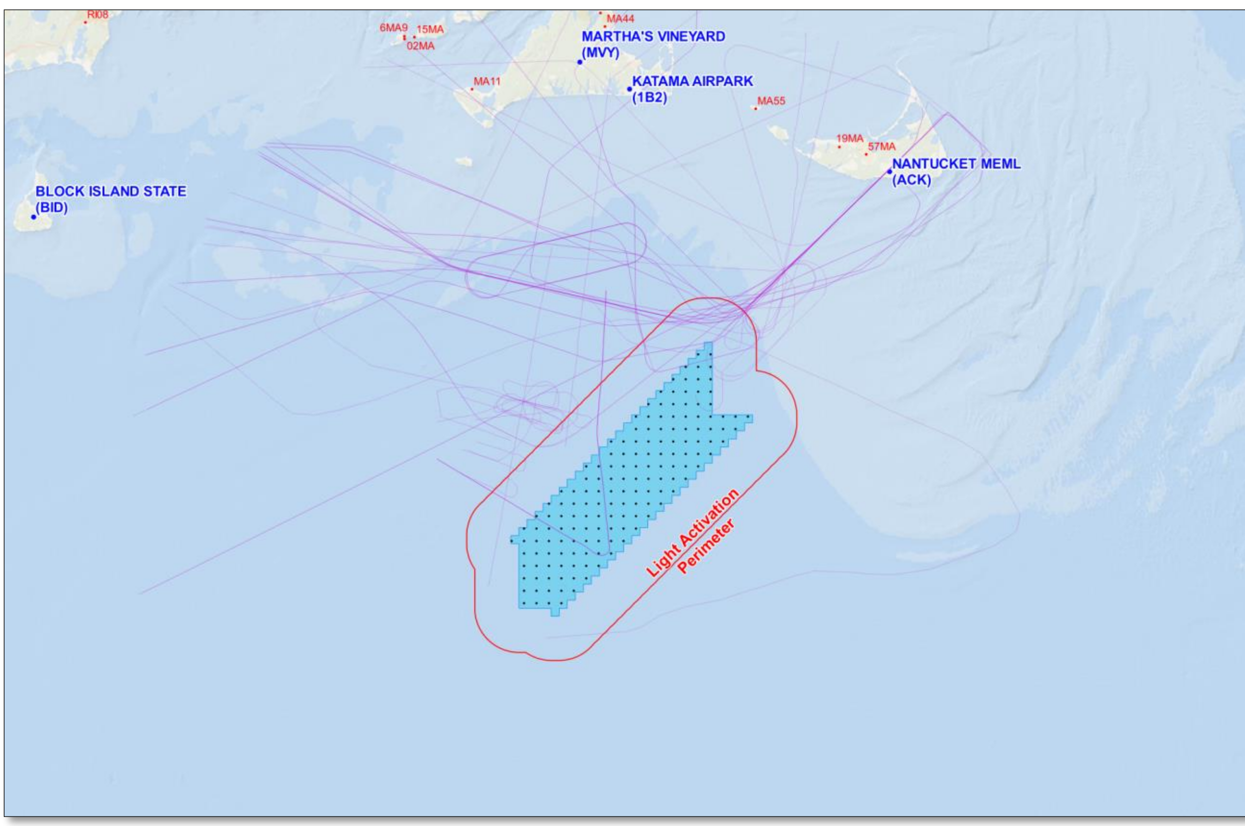

Figure 3: Flight tracks (purple) that would have activated ADLS obstruction lights (based on 1,116-foot tall** (340.2 meter)* ***wind turbines and 2019 FAA NOP data)

Photo credit: Matt Goldsmith, Equinor