Sunrise Wind Farm Project

Appendix Y2
Air Traffic Flow Analysis /ADLS Analysis

Prepared for:

Sunrise Wind | Powered by Ørsted & Eversource

December 30, 2021

Revision 1 – January 28, 2022

Revision 2 – May 3, 2022

Revision 3 – August 19, 2022

Sunrise Wind Farm Project

Stantec Consulting Services Inc

Air Traffic Flow Analysis

October 07, 2020

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Summary

Capitol Airspace conducted an air traffic flow analysis for the Sunrise Wind Farm Project (SRWF) wind project (black outline, ***Figure 1***) located on the Outer Continental Shelf off the coast of Rhode Island & Massachusetts. At a minimum of 636 to a maximum of 968 feet above mean sea level (AMSL), proposed wind turbines in the northwestern and northeastern sections of the study area would require an increase to Boston Consolidated (A90) Terminal Radar Approach Control (TRACON) and Providence (PVD) TRACON minimum vectoring altitudes (MVA).[1] The purpose for this analysis was to determine the number of operations potentially affected by the airspace changes required to accommodate wind development up to 968 feet AMSL.

The Federal Aviation Administration (FAA) conducts aeronautical studies to ensure that proposed structures do not affect the safety of air navigation and the efficient utilization of navigable airspace by aircraft. Proposed structures undergoing aeronautical study that exceed obstacle clearance surfaces will be identified as having an adverse effect. If the FAA determines that the adverse effect would impact a significant volume of operations, it may result in FAA objections to proposed wind development. For instrument flight rules (IFR) operations the significant volume threshold is one per week; for visual flight rules (VFR) operations the threshold is one per day.

Historical air traffic data indicates that the required changes to Boston Consolidated (A90) TRACON MVA sectors and Providence (PVD) TRACON MVA sectors should not affect a significant volume of radar vectoring operations. As a result, it is possible that Boston Consolidated (A90) TRACON and Providence (PVD) TRACON would be willing to increase the affected MVAs in order to accommodate wind development up to 968 feet AMSL. This mitigation option is subject to FAA approval.

[1] *Since the time the analysis herein was conducted, Sunrise Wind has elected to reduce the number of turbines from 122 to up to 94 at 102 potential positions and has chosen a WTG model within the original study parameters. Furthermore, the total structure height of the OCS–DC was reduced from 361 ft (110.0 m) to up to 295 ft (90 m). These reductions are anticipated to result in the same or lower levels of impact than those presented in this report.*

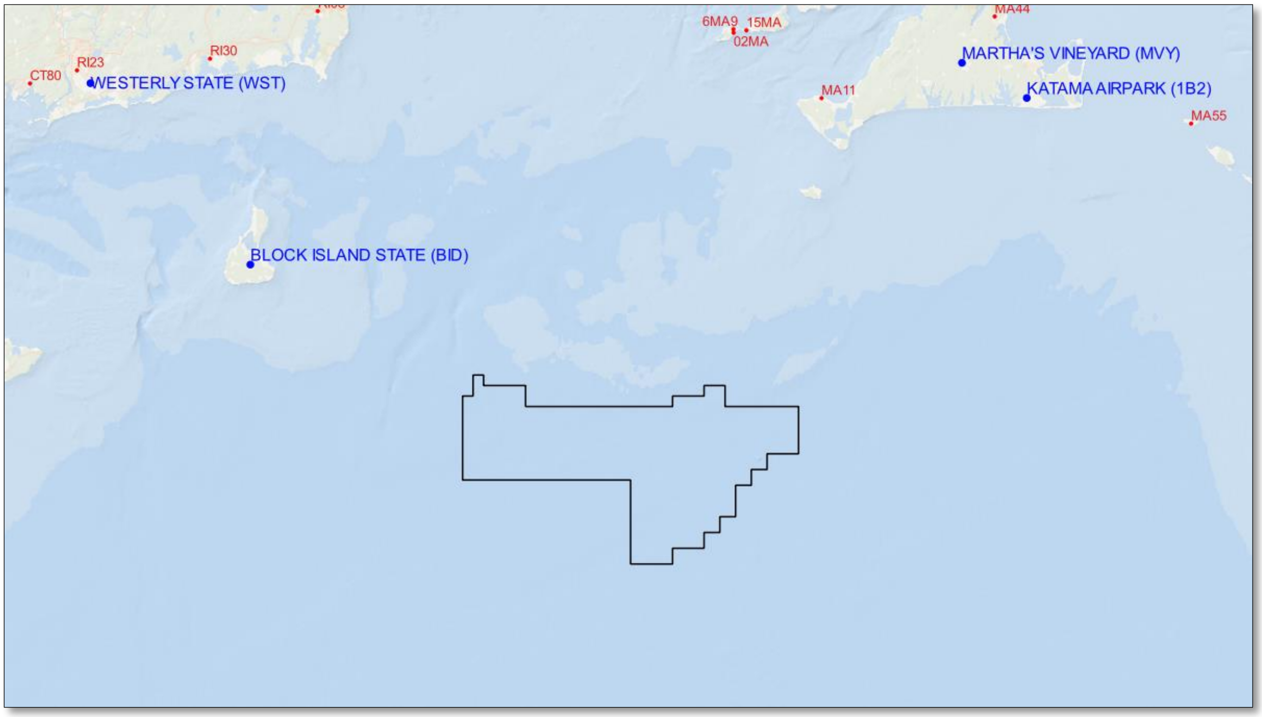

Figure 1: Public-use (blue) and private-use (red) airports in proximity to the SRWF wind project

Methodology

At 636 to 968 feet AMSL, proposed wind turbines in the northwestern and northeastern sections of the study area (red areas, ***Figure 2*** & ***Figure 3***) will exceed MVA sector obstacle clearance surfaces (e.g. hatched blue, ***Figure 2*** & ***Figure 3***). As a result, the FAA must modify sector boundaries or establish isolation areas with increased MVAs. These sector modifications result in a three-dimensional volume of affected airspace where radar vectoring would be unavailable.

In order to quantify the number of radar vectoring operations potentially affected by MVA sector modifications, Capitol Airspace evaluated FAA National Offload Program (NOP) radar returns covering the period between July 1, 2018 and June 30, 2019. The FAA NOP data contained 258,096,392 radar returns associated with 889,350 flights receiving air traffic control services.[2] Each flight that had at least one radar return within the affected airspace was analyzed for altitude and direction trends.

Flights that maintained one or more specific headings within the affected airspace operated in a manner consistent with receiving radar vectoring services. These flights also maintained or climbed/descended to maintain an altitude within the affected airspace. The historical presence of these flights within the affected airspace is an indicator that the required MVA sector modifications could affect future air traffic control operations.

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

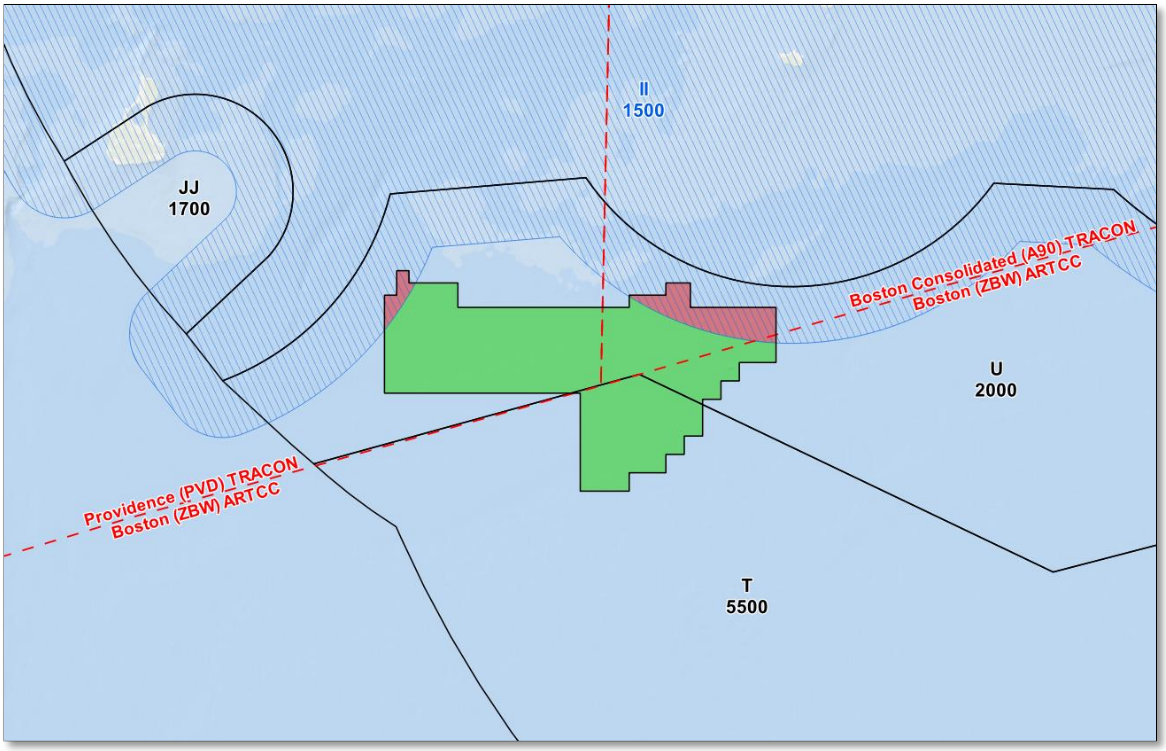

Figure 2: Boston Consolidated (A90) TRACON FUSION 3 MVA sectors (black) with Sector II obstacle evaluation area (hatched blue)

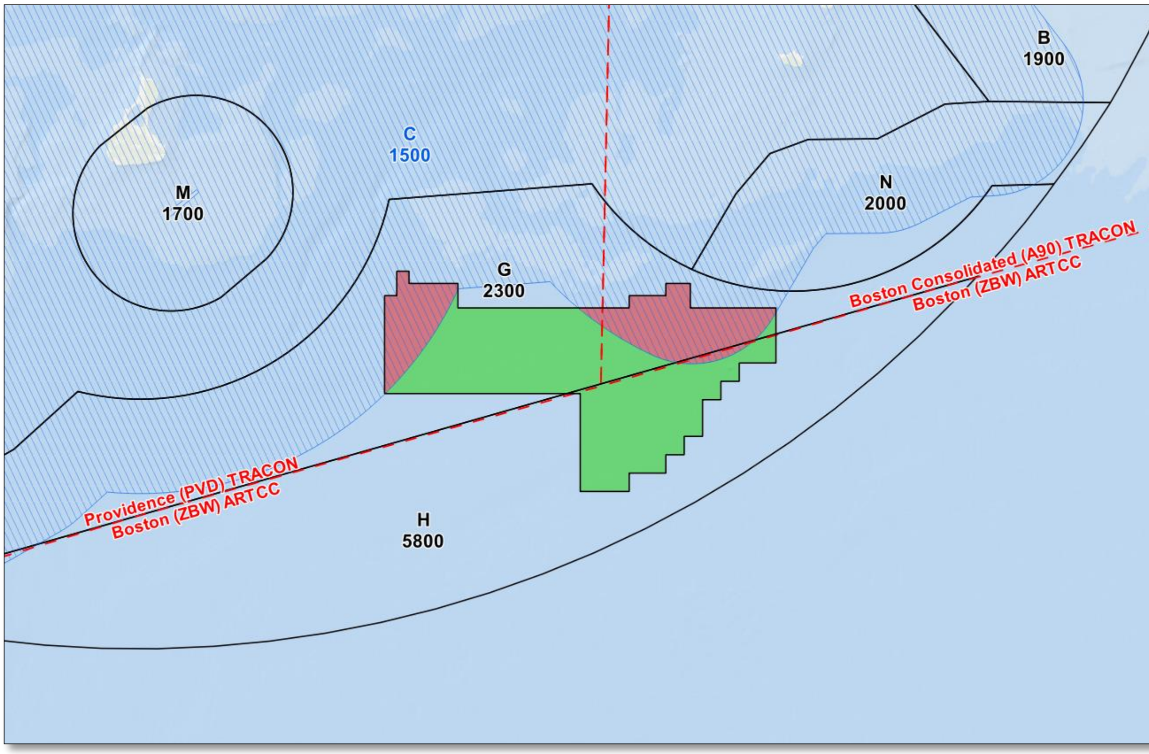

Figure 3 Providence (PVD) TRACON FUSION 5 MVA sectors (black) with Sector C obstacle evaluation area (hatched blue)

Findings

Boston Consolidated (A90) TRACON

In order to accommodate wind development up to 968 feet AMSL, the FAA must increase existing MVAs from 1,500 feet AMSL up to as high as 2,000 feet AMSL. This increase would affect both the FUSION 3 and FUSION 5 MVA charts.

FUSION 3 (A90_MVA_FUS3_2020)

Sector II

The current MVA is 1,500 feet AMSL; the obstacle clearance surface is 549 feet AMSL. At 636 to 968 feet AMSL, proposed wind turbines in the northwestern and northeastern sections of the study area (red areas, ***Figure 2***) would exceed this surface and require an increase to the MVA from 1,500 to as high as 2,000 feet AMSL.

Flight track data indicates that only two flights (purple tracks, ***Figure 4***) operated within the affected airspace (dashed blue outlines, ***Figure 4***). This flight total represents an average of *0.04 flights per week* which is below the FAA's threshold for a significant volume of operations. Additionally, it is not likely that all of these flights were receiving radar vectoring services.

FUSION 5 (A90_MVA_FUS5_2019)

Sector FF

The current MVA is 1,500 feet AMSL; the obstacle clearance surface is 549 feet AMSL. At 636 to 968 feet AMSL, proposed wind turbines in the northwestern and northeastern sections of the study area would exceed this surface and require an increase to the MVA from 1,500 to as high as 2,000 feet AMSL.

Flight track data indicates that only six flights (purple tracks, ***Figure 5***) operated within the affected airspace (dashed blue outlines, ***Figure 5***). This flight total represents an average of *0.12 flights per week* which is below the FAA's threshold for a significant volume of operations. Additionally, it is not likely that all of these flights were receiving radar vectoring services.

As a result of these findings, it is possible that Boston Consolidated (A90) TRACON would not object to modifying Sectors II and FF in order to accommodate wind development up to 968 feet AMSL. This mitigation option is subject to FAA approval.

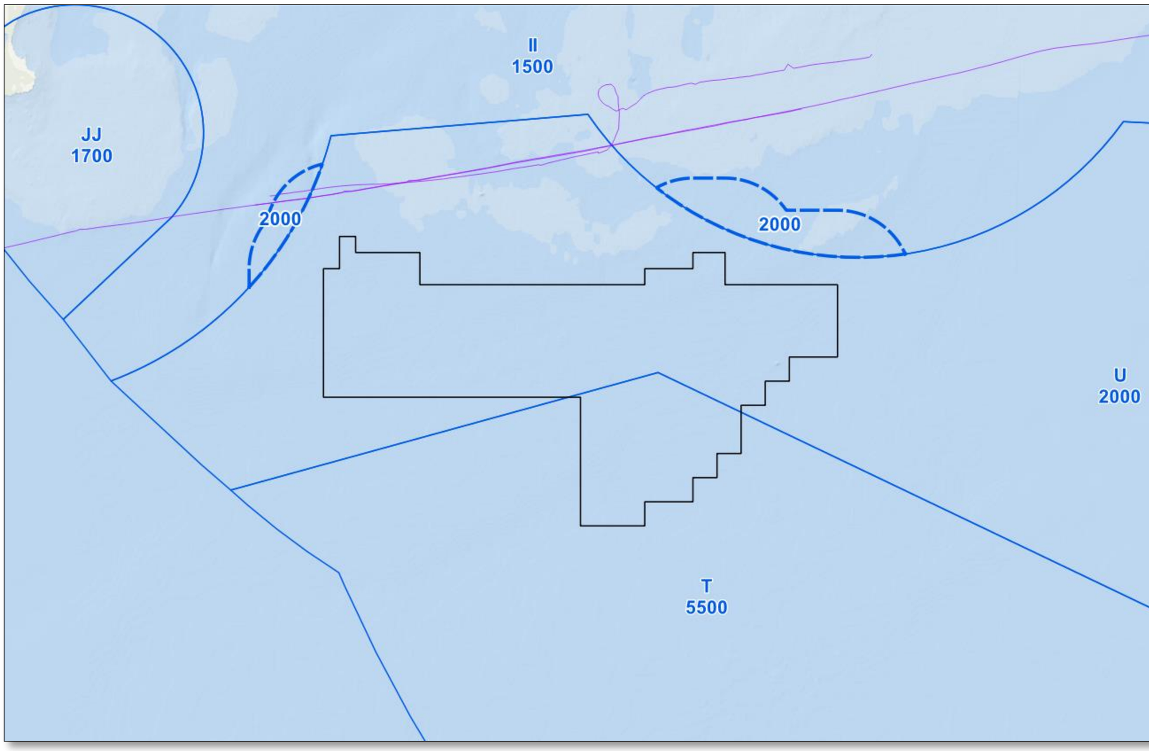

Figure 4: Historical flight tracks (purple) that operated within the FUSION 3 affected airspace (dashed blue outlines)

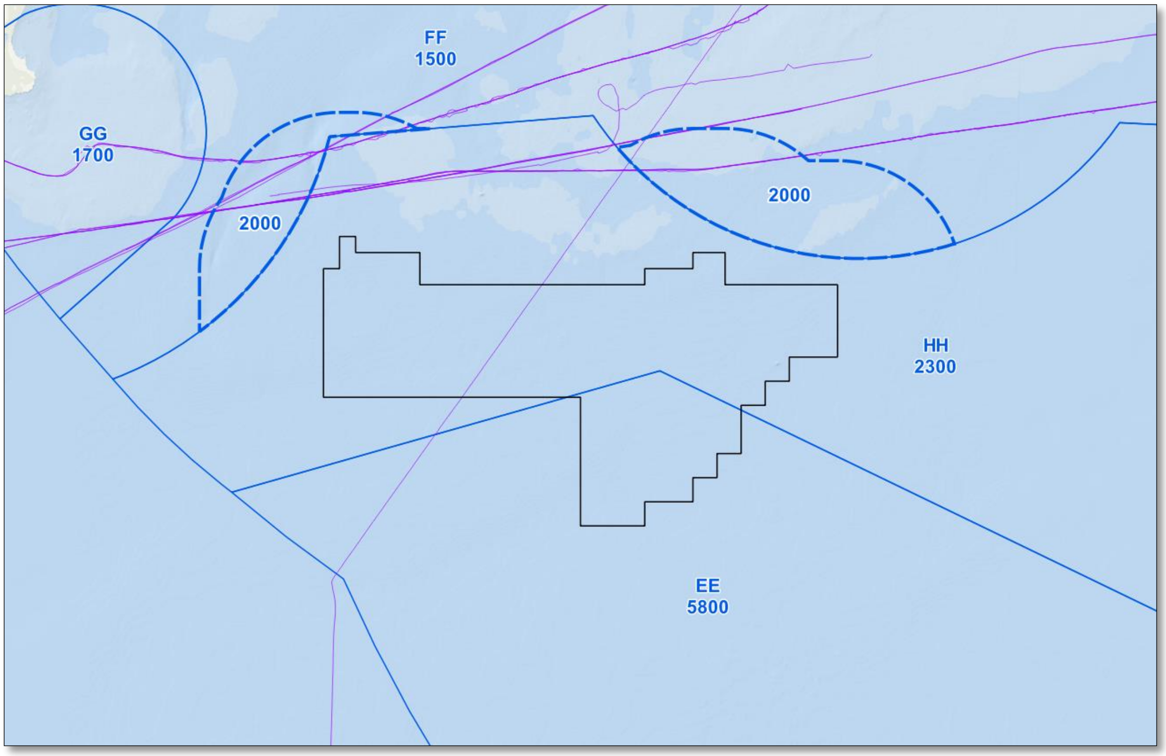

Figure 5: Historical flight tracks (purple) that operated within the FUSION 5 affected airspace (dashed blue outlines)

Providence (PVD) TRACON

In order to accommodate wind development up to 968 feet AMSL, the FAA must increase existing MVAs from 1,500 feet AMSL up to as high as 2,000 feet AMSL. This increase would affect both the FUSION 3 and FUSION 5 MVA charts.

FUSION 3 (PVD_MVA_FUS3_2019)

Sector C

The current MVA is 1,500 feet AMSL; the obstacle clearance surface is 549 feet AMSL. At 636 to 968 feet AMSL, proposed wind turbines in the northwestern and northeastern sections of the study area would exceed this surface and require an increase to the MVA from 1,500 to as high as 2,000 feet AMSL.

Flight track data indicates that only two flights (purple tracks, ***Figure 6***) operated within the affected airspace (dashed blue outlines, ***Figure 6***). This flight total represents an average of *0.04 flights per week* which is below the FAA's threshold for a significant volume of operations. Additionally, it is not likely that all of these flights were receiving radar vectoring services.

FUSION 5 (PVD_MVA_FUS5_2019)

Sector C

The current MVA is 1,500 feet AMSL; the obstacle clearance surface is 549 feet AMSL. At 636 to 968 feet AMSL, proposed wind turbines in the northwestern and northeastern sections of the study area (red areas, ***Figure 3***) would exceed this surface and require an increase to the MVA from 1,500 to as high as 2,000 feet AMSL.

Flight track data indicates that only six flights (purple tracks, ***Figure 7***) operated within the affected airspace (dashed blue outlines, ***Figure 7***). This flight total represents an average of *0.12 flights per week* which is below the FAA's threshold for a significant volume of operations. Additionally, it is not likely that all of these flights were receiving radar vectoring services.

As a result of these findings, it is possible that Providence (PVD) TRACON would not object to modifying Sector C in order to accommodate wind development up to 968 feet AMSL. This mitigation option is subject to FAA approval.

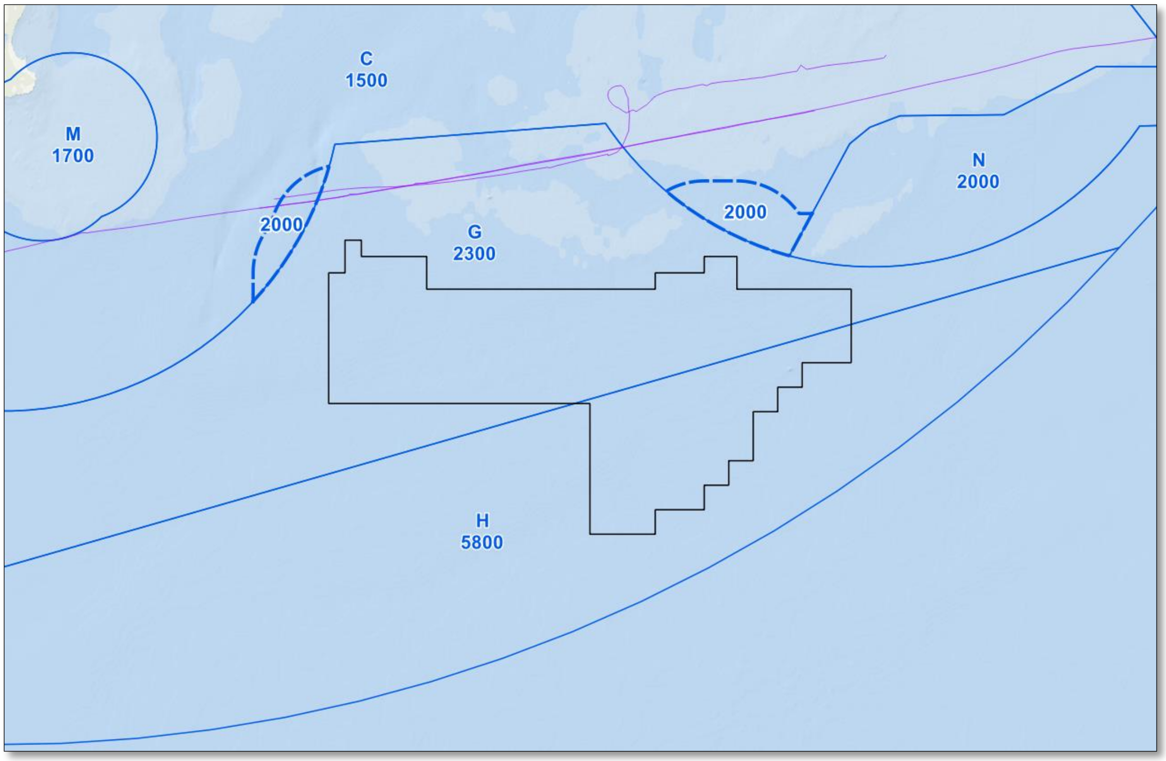

Figure 6: Historical flight tracks (purple) that operated within the FUSION 3 affected airspace (dashed blue outlines)

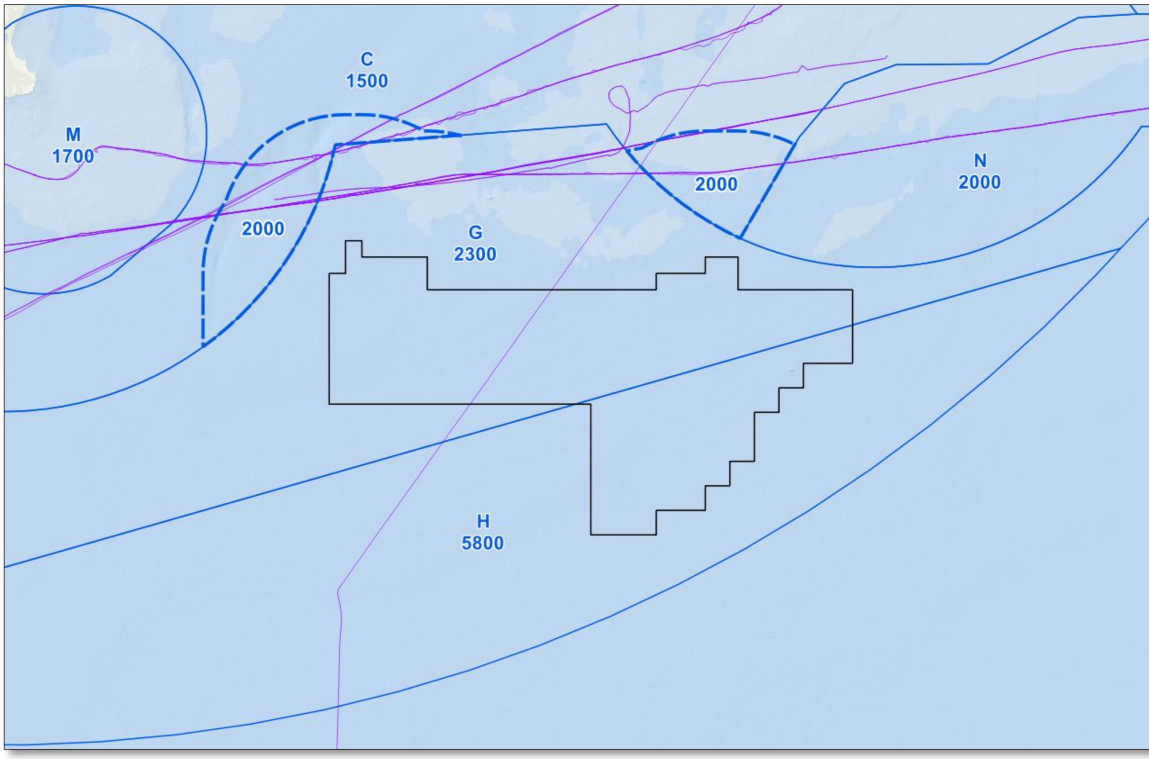

Figure 7: Historical flight tracks (purple) that operated within the FUSION 5 affected airspace (dashed blue outlines)

Conclusion

Capitol Airspace assessed historical FAA radar track data covering the period of one year to determine the number of operations that could be affected by increasing Boston Consolidated (A90) TRACON and Providence (PVD) TRACON MVAs. In order to accommodate wind development up to 968 feet AMSL, the MVAs must be increased from 1,500 to as high as 2,000 feet AMSL.

Historical radar track data indicates that proposed wind turbines should not affect a significant volume of Boston Consolidated (A90) TRACON radar vectoring operations (*0.02 flights per week* for FUSION 3 Chart, *0.12 flights per week* for FUSION 5 Chart) or Providence (PVD) TRACON radar vectoring operations (*0.02 flights per week* for FUSION 3 Chart, *0.12 flights per week* for FUSION 5 Chart). These numbers are below the FAA threshold for a significant volume of operations. As a result of these findings, it is possible that Boston Consolidated (A90) TRACON and Providence (PVD) TRACON would not object to modifying the affected MVA sectors in order to accommodate wind development up to 968 feet AMSL. These mitigation options are subject to FAA approval.

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

Sunrise Wind Farm Project

Stantec Consulting Services Inc

Aircraft Detection Lighting System (ADLS) Efficacy Analysis

October 09, 2020

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Summary

Capitol Airspace conducted an Aircraft Detection Lighting System (ADLS) efficacy analysis for the Sunrise Wind Farm Project (SRWF) (blue area, *Figure 1*) located on the Outer Continental Shelf off the coast of Rhode Island & Massachusetts. 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 volume 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 for flights passing through the light activation volume indicates that ADLS-controlled obstruction lights would have been activated for a total of 35 minutes and 14 seconds over a one-year period for 636-foot above mean sea level (AMSL) wind turbines. Light activation duration increases for 968-foot AMSL wind turbines to 1 hour 21 minutes and 29 seconds over a one-year period.[1] Considering the local sunrise and sunset times, an ADLS-controlled obstruction lighting system could result in over a 99% reduction in system activated duration as compared to a traditional always-on obstruction lighting system.

[1] *Since the time the analysis herein was conducted, Sunrise Wind has elected to reduce the number of turbines from 122 to up to 94 at 102 potential positions and has chosen a WTG model within the original study parameters. Furthermore, the total structure height of the OCS–DC was reduced from 361 ft (110.0 m) to up to 295 ft (90 m). These reductions are anticipated to result in the same or lower levels of impact than those presented in this report.*

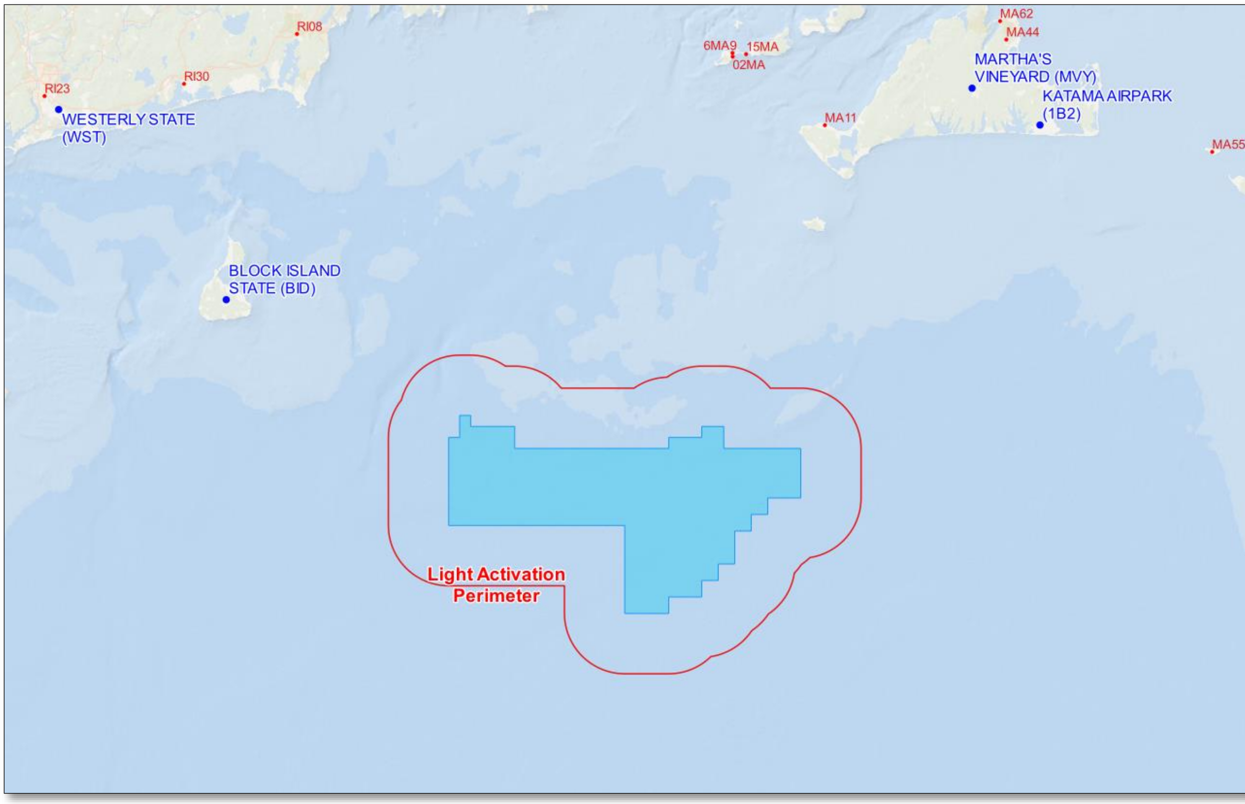

Figure 1: Public-use (blue) and private-use (red) airports in proximity to the SRWF wind project

Methodology

Capitol Airspace analyzed FAA National Offload Program (NOP) radar returns in proximity to the SRWF for the period between July 1, 2018 and June 30, 2019. FAA NOP data only includes secondary radar returns which are created if the identified aircraft is equipped with a transponder. Aircraft operations without an active transponder were not captured as part of this dataset. Within 70 nautical miles of the wind project, the NOP data contained 428,907,240 different radar returns from eight different air traffic control (ATC) facilities.[2] These radar returns were associated with 5,908,321 unique flight tracks.

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

1. **Define Three-Dimensional Light Activation Volume –** In accordance with FAA Advisory Circular 70/7460-1L, 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 SRWF. 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 (4,100 and 4,500 feet AMSL based on a maximum of 636 or a maximum of 968-foot AMSL wind turbines, respectively).
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.

[2] Source facilities included Boston Consolidated (A90) Terminal Radar Approach Control (TRACON), Albany (ALB) TRACON, Providence (G90) TRACON, New York (N90) TRACON, Yankee (Y90) TRACON, Boston (ZBW) Air Route Traffic Control Center (ARTCC), Washington (ZDC) ARTCC, and New York (ZNY) ARTCC.

Results

FAA NOP data indicates that as many as 601 flights had at least one radar return within the light activation volume (red outline, *Figure 2*). However, many of these flights occurred during daytime. Using local sunrise and sunset times, Capitol Airspace determined that as many as 94 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 94 flights was further evaluated to determine the amount of time they 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 35 minutes and 14 seconds for 636-foot AMSL wind turbines. Total obstruction light system activated duration increases slightly to 1 hour 21 minutes and 29 seconds for 968-foot AMSL wind turbines.

Considering that the SRWF ADLS light activation perimeter observes approximately 4,745 hours of nighttime each year, an ADLS-controlled obstruction lighting system could result in over a 99% reduction in system activated duration as compared to a traditional, always-on, obstruction lighting system (*Table 1*).

Month	Nighttime Observed (HHH:MM:SS)	Light System Activated Duration (HH:MM:SS)	
		636-foot AMSL WTG	968-foot AMSL WTG
January	484:09:04	00:00:48 (0.00%)	00:00:48 (0.00%)
February	408:08:22	00:00:00 (0.00%)	00:00:24 (0.00%)
March	410:55:21	00:00:00 (0.00%)	00:00:00 (0.00%)
April	356:12:44	00:00:00 (0.00%)	00:00:00 (0.00%)
May	331:37:33	00:00:00 (0.00%)	00:00:55 (0.00%)
June	302:56:40	00:03:18 (0.02%)	00:03:18 (0.02%)
July	322:20:26	00:01:36 (0.01%)	00:10:07 (0.05%)
August	354:16:29	00:12:35 (0.06%)	00:26:12 (0.12%)
September	382:30:05	00:03:27 (0.02%)	00:14:37 (0.06%)
October	437:47:26	00:10:14 (0.04%)	00:21:52 (0.08%)
November	459:51:01	00:03:16 (0.01%)	00:03:16 (0.01%)
December	494:36:09	00:00:00 (0.00%)	00:00:00 (0.00%)
Total	**4745:21:20**	**00:35:14 (0.01%)**	**01:21:29 (0.03%)**

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

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

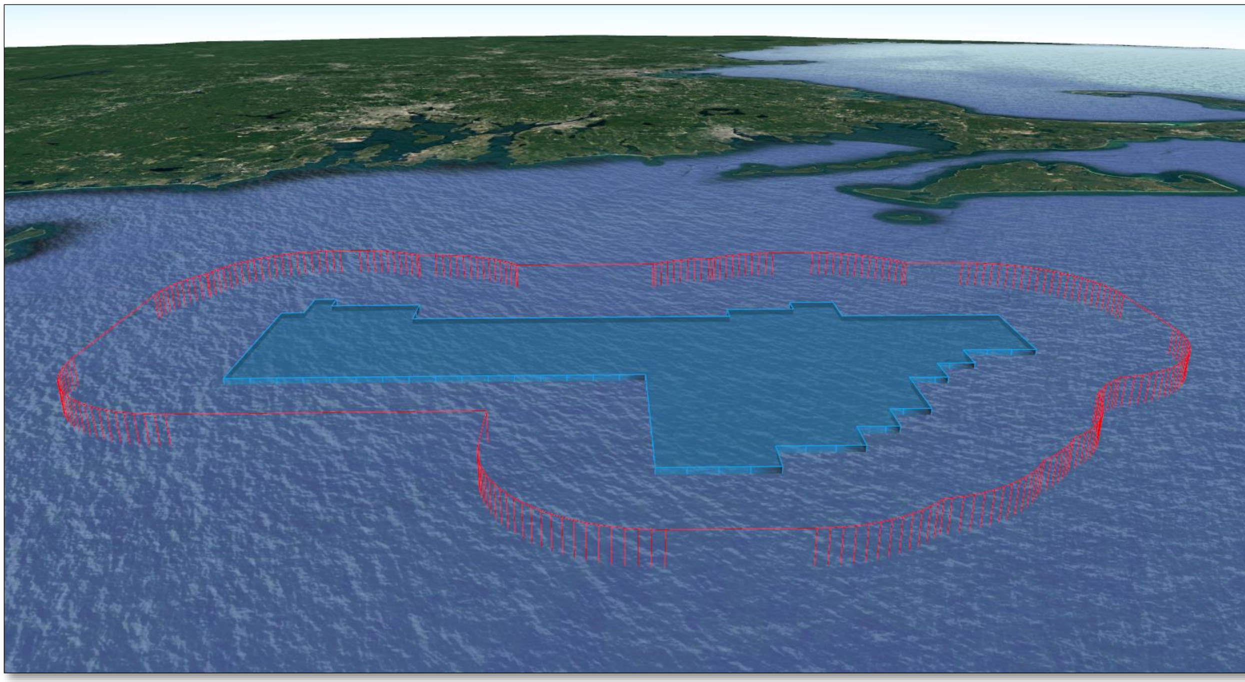

Figure 2: SRWF wind project (blue) and light activation volume (red outline)

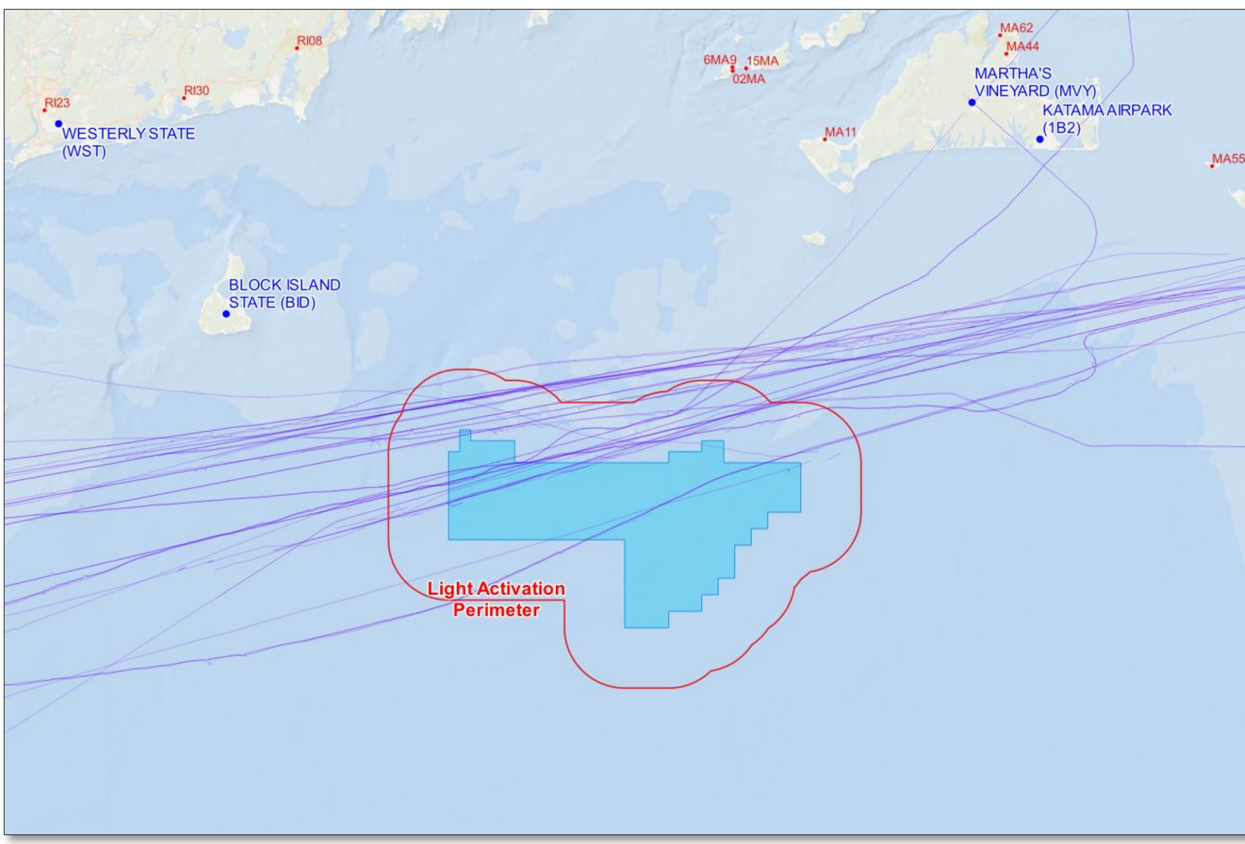

Figure 3: Flight tracks (purple) that would have activated ADLS obstruction lights (based on 968-foot AMSL wind turbines)