

Appendix T – Aviation Risk Assessment





**Virginia Offshore Wind Technology Advancement Project (VOWTAP)
Outer Continental Shelf
Aviation Impact Analysis
October 2, 2013**

Summary

Capitol Airspace conducted an aviation impact analysis for the Virginia Offshore Wind Technology Advancement Project (VOWTAP). The project consists of two 576 foot tall wind turbines located approximately 24 nautical miles offshore of Virginia Beach, Virginia. The purpose for this study was to identify aviation impacts resulting from the construction of the proposed wind turbines and any mitigation options that could be implemented at the discretion of Dominion.

Within the United States as well as within 12 nautical miles offshore, the FAA is authorized under 14 CFR Part 77 to conduct aeronautical studies to ensure that proposed structures do not have an effect on the safety of air navigation and the efficient utilization of navigable airspace. Since VOWTAP is located more than 12 nautical miles offshore there will be no FAA aeronautical study; however, the analysis conducted by Capitol Airspace will assess for the same physical airspace impacts evaluated during FAA aeronautical study. Identified impacts can then be mitigated through the installation of obstruction marking and lighting, the issuance of notices to airmen (NOTAM), and other means.

The results of this study indicate that the two proposed wind turbines would impact Norfolk (ORF) ASR-9 minimum vectoring altitude sectors. However, the wind turbines would only impact the lower of the two minimum vectoring altitudes. This altitude is below the floor of controlled airspace and only used in emergency situations. FAA's Norfolk Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) and the Navy's Fleet Area Control & Surveillance Facility, Virginia Capes (FACSFAC VACAPES) have requested notification of the start of construction in order to make necessary charting revisions.

Additionally, since the wind turbines are greater than 499 feet tall it is recommended that they are lighted to increase conspicuity for low flying aircraft operating offshore in marginal weather conditions.

This study did not consider electromagnetic interference on communications, navigation or surveillance systems.

It should be noted that Capitol Airspace applies FAA defined rules and regulations applicable to obstacle evaluation, instrument procedures assessment and visual flight rules (VFR) operations to the best of its ability and with the intent to provide the most accurate representation of limiting airspace surfaces as possible. Capitol Airspace maintains datasets obtained from the FAA which are updated on a 56 day cycle. The results of this analysis/map are based on the most recent data available as of the date of this report. Limiting airspace surfaces depicted in this report are subject to change due to FAA rule changes and regular procedure amendments. Therefore, it is of the utmost importance to obtain FAA determinations of no hazard prior to making substantial financial investments in this project.



Methodology

Capitol Airspace studied the proposed wind turbines based upon location information provided by Tetra Tech. Using this information, Capitol Airspace generated graphical overlays to determine proximity to public and military airports, published instrument procedures, military operational areas, enroute airways, civil minimum vectoring altitude charts, and military training routes.

Capitol Airspace evaluated all published instrument approach and departure procedures, visual flight rules, civil minimum vectoring altitudes, and enroute operations. All formulas, headings, altitudes, bearings, and coordinates used during this study were derived from the following documents and data sources:

- FAA Order 8260.3B “United States Standard for Terminal Instrument Procedures”
- FAA Order 8260.58 “United States Standard for Performance Based Navigation (PBN) Instrument Procedure Design”
- United States Government Flight Information Publication, US Terminal Procedures
- National Airspace System Resource Aeronautical Data



Figure 1: Aviation facilities in proximity to BOEM Wind Energy Area (WEA)



Study Findings

Visual Flight Rules Operations

Aircraft operating under visual flight rules (VFR) are required to see and avoid terrain, obstacles, and other air traffic. In marginal weather conditions, obstacles may not be easily discernible and can be difficult to avoid. Within the United States, obstacles that exceed obstruction standards are normally required to have appropriate marking and lighting in order to increase their conspicuity. These requirements apply to all structures that exceed 499 feet AGL.

Since the proposed wind turbines are located offshore, it is unlikely they would have an impact on typical VFR operations such as airport traffic patterns and VFR routes. However, offshore aviation activities such as aerial fish spotting may occur in proximity to the proposed wind turbines.

In order to increase pilot awareness of the newly constructed wind turbines, Capitol Airspace recommends that Dominion request the FAA issue a Notice to Airmen (NOTAM) indicating the location and height of the two 576 foot tall wind turbines. Initiation of this process requires coordination with the FAA's Obstruction Evaluation Group to settle on the appropriate wording of the NOTAM. This should be accomplished a few weeks prior to the target NOTAM issuance date. When vertical construction of the wind turbines commences, a call by either the Obstruction Evaluation Group or Capitol Airspace Group to the appropriate Flight Service Station would activate this NOTAM for dissemination.

Additionally, consideration should be given to installing a red obstruction lighting system in accordance with the guidelines defined in FAA Advisory Circular 70/7460-1K "Obstruction Marking and Lighting". It should be noted that the FAA is in the process of revising this advisory circular with an anticipated publication date within the next six months. The FAA has indicated that they are considering mid-tower lighting (in addition to top lighting) for wind turbines exceeding 500 feet in height as part of the revision to the document. At this point, it is unknown if this new recommendation will be included in the anticipated document.

The two options recommended above will help mitigate any impact on visual flight rules operations in the vicinity of the proposed wind turbines.



Departure Procedures

In order to ensure that aircraft departing during marginal weather conditions do not fly into terrain or obstacles, the FAA has established departure procedures to provide obstacle clearance to pilots as they transition between the terminal and enroute environments. These procedures authorize diverse departures or contain specific routing and minimum climb gradients to ensure clearance from terrain and obstacles.

The two proposed wind turbines are located outside the boundaries of instrument departures and will not have an impact on these procedures.

Instrument Approach Procedures

Pilots operating during periods of reduced visibility and low cloud ceilings rely on terrestrial and satellite based navigational aids (navaids) in order to navigate from one point to another and to locate runways. The FAA has established published instrument approach procedures that provide horizontal guidance to on-board avionics that aid the pilot in locating the runway. Capitol Airspace assessed a total of 20 published instrument approach procedures at two airports in proximity to the proposed wind turbines.

The two wind turbines are located outside the boundaries of instrument approach procedures, and will not have an impact on these procedures.

Instrument procedures assessed:

Oceana NAS (Apollo Soucek Field) (NTU)

- RNAV (GPS) Approach to Runway 05L
- RNAV (GPS) Approach to Runway 05R
- RNAV (GPS) Approach to Runway 23L
- RNAV (GPS) Approach to Runway 23R
- TACAN Approach to Runway 05L
- TACAN Approach to Runway 05R
- TACAN Approach to Runway 23L/R
- TACAN Approach to Runway 32L/R

Norfolk International (ORF)

- ILS or Localizer Approach to Runway 05
- ILS or Localizer Approach to Runway 23
- RNAV (RNP) Y Approach to Runway 05
- RNAV (RNP) Y Approach to Runway 23
- RNAV (GPS) Approach to Runway 14
- RNAV (GPS) Approach to Runway 32
- RNAV (GPS) Z Approach to Runway 05
- RNAV (GPS) Z Approach to Runway 23
- VOR/DME Approach to Runway 05
- VOR/DME Approach to Runway 14
- VOR/DME Approach to Runway 32
- VOR Approach to Runway 23



Minimum Vectoring Altitudes

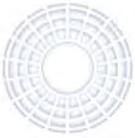
Minimum vectoring altitude (MVA) charts define sectors with the lowest altitudes at which air traffic controllers can issue radar vectors to an aircraft based on obstacle clearance. The FAA requires that sectors have a minimum of 1,000 feet of obstacle clearance in non-mountainous areas, and normally 2,000 feet in mountainous areas.

The proposed wind turbines are located inside the boundaries of multiple Norfolk (ORF) ASR-9 minimum vectoring altitude sectors (**Figure 2**). These sectors have two minimum vectoring altitudes established, one at 1,200 feet AMSL and the other at 1,700 feet AMSL. The 1,200 foot AMSL minimum vectoring altitude is based solely on obstacles and has a 249 foot AMSL obstacle clearance surface. The 1,700 foot AMSL minimum vectoring altitude is based on the floor of controlled airspace and has a 749 foot AMSL obstacle clearance surface.

At 576 feet AGL, the proposed wind turbines would necessitate a 1,600 foot AMSL minimum vectoring altitude, a 400 foot increase from the current 1,200 feet AMSL. However, this altitude is below the floor of controlled airspace (1,700 or 5,500 feet AMSL, as appropriate, **Figure 2**) and is used only in emergency situations. As a result, the impact will not likely affect a significant volume of operations. Norfolk Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) has requested notification of the start of wind turbine construction so that the appropriate charting changes can be made.



Figure 2: Norfolk (ORF) ASR-9 minimum vectoring altitude chart sectors (black) and 1,200/1,700 foot AMSL sector obstacle evaluation area (hashed green)



Enroute Airways

Capitol Airspace assessed potential height limitations due to the obstacle clearance requirements for enroute airways. These airways provide pilots a means of navigation when flying from airport to airport and are defined by radials between VHF omni-directional ranges (VORs). The FAA publishes minimum enroute altitudes for airways to ensure clearance from obstacles and terrain. The FAA requires that each airway have a minimum of 1,000 feet of obstacle clearance in non-mountainous areas, and normally 2,000 feet in mountainous areas.

The proposed wind turbines are located inside the boundaries of AR9 (Figure 3), an oceanic route with a 5,500 foot minimum enroute altitude (MEA). The associated obstacle clearance surface is 4,500 feet AMSL. Since the two proposed wind turbines are well below this obstacle clearance surface, they should not have an impact on enroute airways.

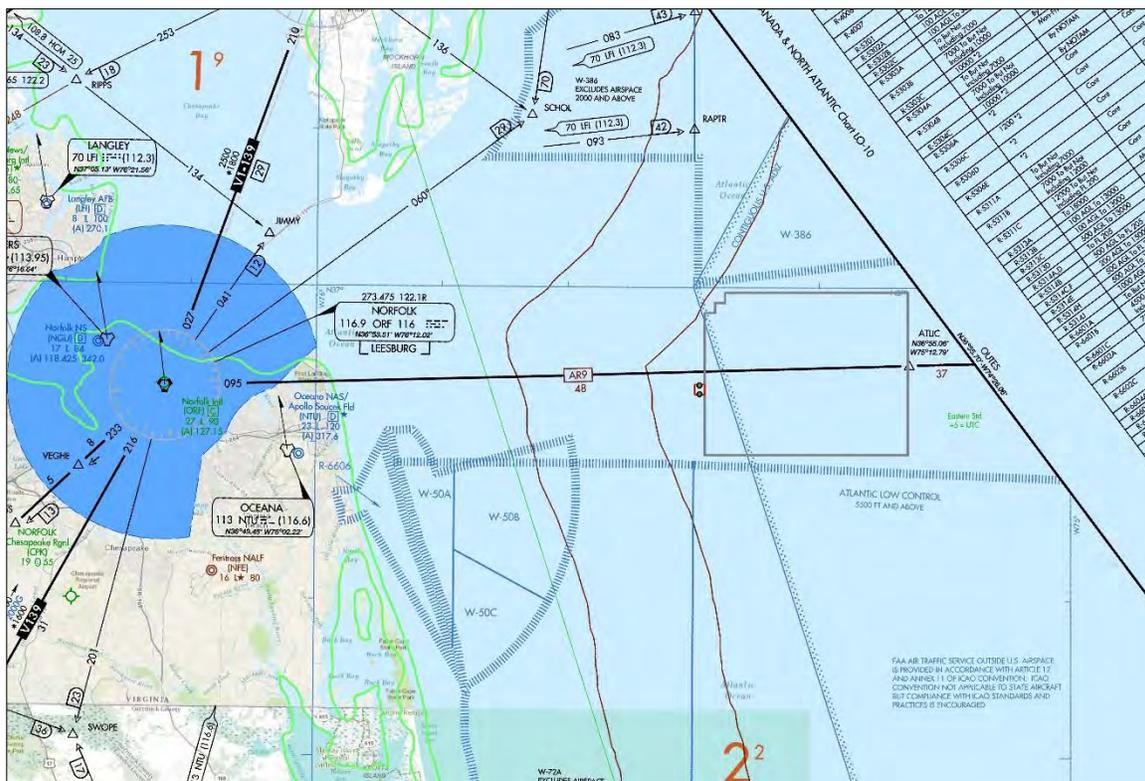


Figure 3: Low altitude enroute chart L-35 and VOWTAP BOEM Wind Energy Area



Long Range and NEXRAD Radar

While Capitol Airspace did not assess for electromagnetic interference on communications, navigation, or surveillance systems, the FAA/DOD preliminary screening tool was utilized to determine likely electromagnetic interference on long range and NEXRAD radars. According to the Long Range Radar tool, the two proposed wind turbines are located in an area designated as ‘Yellow.’ The screening tool defines this area as follows:

Yellow: Impact likely to Air Defense and Homeland Security radars. Aeronautical study required.

Since the project is located in a ‘Yellow’ area of the FAA/DOD preliminary screening tool, Capitol Airspace has initiated an informal review of the two proposed wind turbines with the DOD Clearinghouse. This informal review will indicate the anticipated impact, if any, on long range radars resulting from the two proposed offshore wind turbines.

Further, according to the NEXRAD tool, the two proposed wind turbines are located in an area designated as ‘Green: No Impact Zone’. The screening tool defines this area as follows:

Green: No Impact Zone: Impacts not likely. NOAA will not perform a detailed analysis, but would still like to know about the project.

It should be noted that the preliminary screening tool does not take into consideration turbine height nor does it consider the cumulative impact of existing or approved turbines in proximity to the area studied.

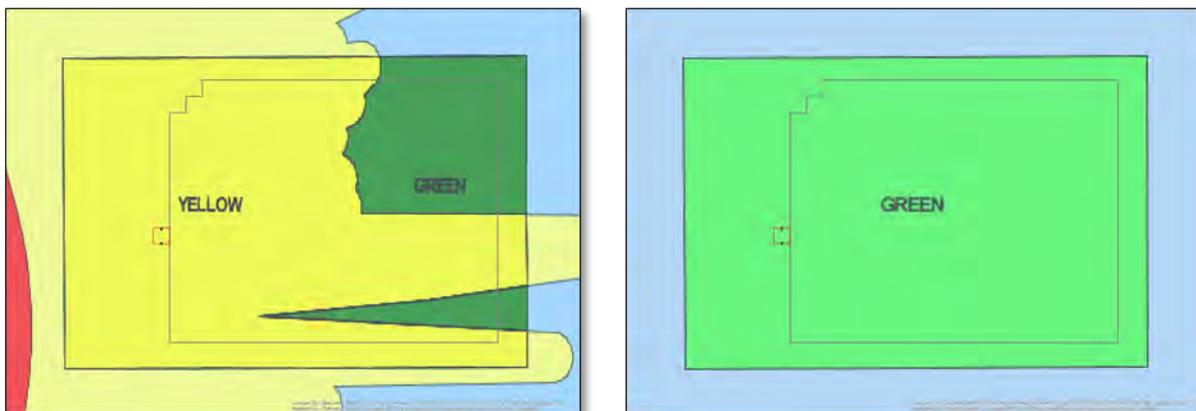


Figure 4: Long Range (left)/NEXRAD (right) radar preliminary screening tool results



Special-Use Airspace and Military Training Routes

Special-Use Airspace includes Prohibited, Restricted, Warning, and Military Operations Areas. Each of these areas has defined rules and access restrictions to ensure either separation or awareness of incompatible aviation operations. Military training routes are used for high speed low altitude training, including terrain following operations. Obstacles located within or below these segments of airspace can cause a compression of airspace, increase minimum altitudes, or pose a hazard to the special operations within the special-use airspace.

The two proposed wind turbines are located in proximity to Warning Areas 72A and 386. However, they are located outside these warning areas' lateral boundaries and should not have an impact on their operations.

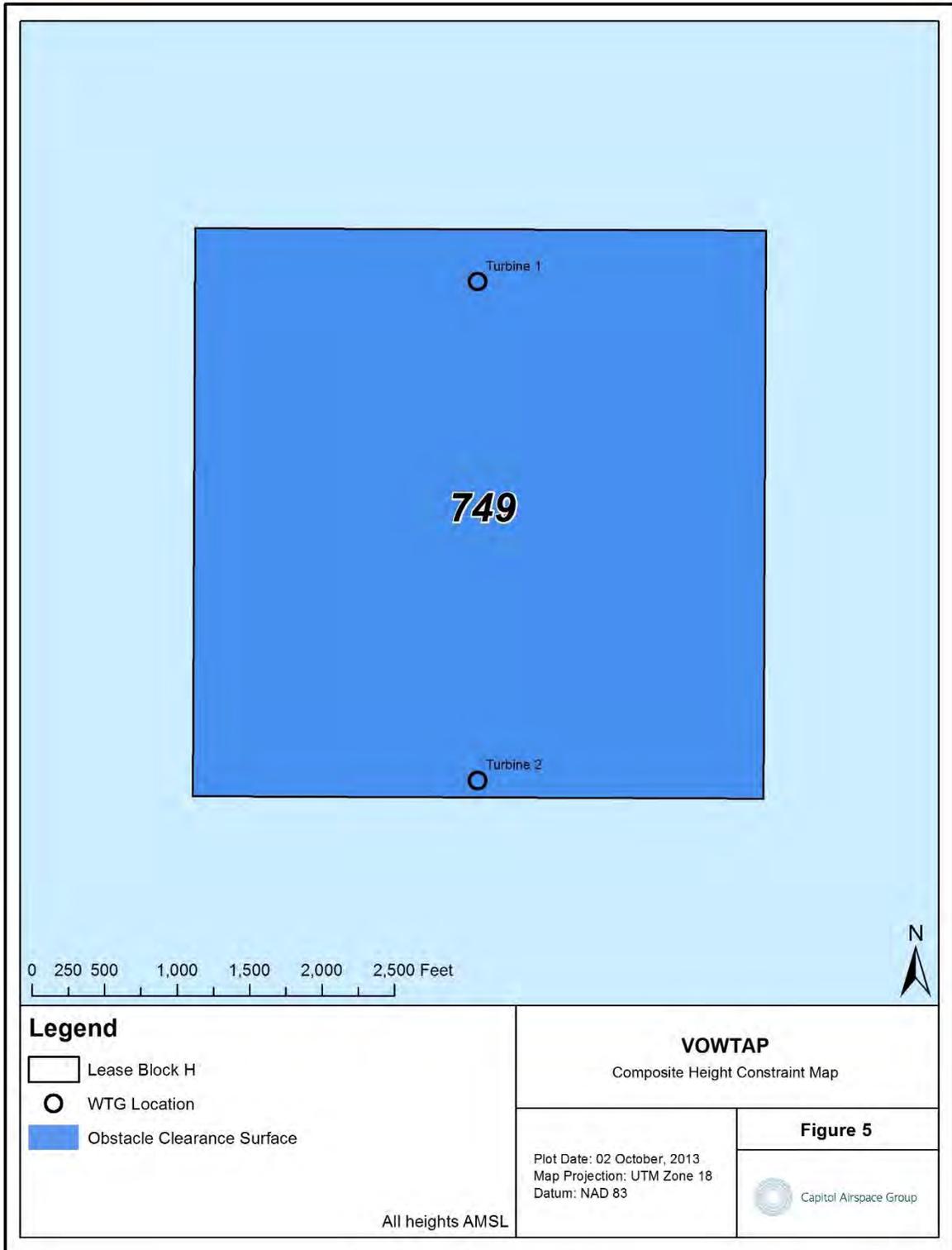
Conclusion

The results of this study indicate that the proposed wind turbines may impact offshore visual flight rules operations such as aerial fish spotting. At 576 feet tall it is recommended that Dominion light the wind turbines with an appropriate red obstruction lighting system as defined in FAA Advisory Circular 70/7460-1K "Obstruction Marking and Lighting". Additionally, requesting the FAA to issue a Notice to Airmen (NOTAM) will ensure that aircraft operating in the vicinity of the wind energy area are aware of the location and height of the proposed wind turbines once they are constructed.

The proposed wind turbines will impact minimum vectoring altitudes for sectors of the Norfolk (ORF) ASR-9 minimum vectoring altitude charts. However, the only impact will be on emergency minimum vectoring altitudes and should not affect a significant volume of operations. The proposed wind turbines will not impact the 1,700 foot AMSL minimum vectoring altitude established at the floor of controlled airspace. FAA's Norfolk Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) and the Navy's Fleet Area Control & Surveillance Facility, Virginia Capes (FACSFAC VACAPES) have requested notification of the start of construction in order to make necessary charting revisions.

It should be noted that the proposed wind turbines are located in an area designated as 'Yellow' on the FAA/DoD Long Range Radar preliminary screening tool. Further study may be necessary to determine if there is any impact on surveillance systems, and if that impact significantly derogates the ability of air traffic control to effectively manage offshore traffic.

If you have any questions regarding the findings in this study, please contact Benjamin Doyle or Tim Connolly at (703) 256-2485 or via email at ben.doyle@capitolairspace.com or tim.connolly@capitolairspace.com.



Attachment – Update on VOWTAP OE Study

December 5, 2013

Janelle Lavallee
160 Federal St
3rd Floor
Boston, MA 02110

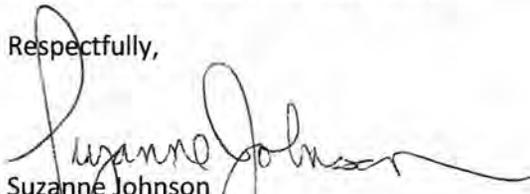
Reference: Update to the Virginia Offshore Wind Technology Advancement Project (VOWTAP) OE Study

Dear Ms. Lavallee:

This letter is in response to your request for an update to the DoD Siting Clearinghouse Informal review of the Virginia Offshore Wind Technology Advancement Project (VOWTAP). CAG has spoken with the DoD Siting Clearinghouse (DoD SCH) and they have indicated that there is no impact to Long Range Radar with the VOWTAP project. A formal response letter has not been sent by the DoD SCH because all parties have not responded to the informal review. The DoD SCH is waiting on responses from individual service leads. The Long Range Radar office has responded and indicates that there is no impact. Please accept this as an update to our report dated 2 Oct 2013.

If you have any questions or concerns about the DoD Siting Clearinghouse Informal Review of VOWTAP, please contact me at (703) 256-2485.

Respectfully,



Suzanne Johnson
DoD Projects Director
Capitol Airspace Group