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Southwest Regional Office
Obstruction Evaluation Group
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Fort Worth, TX 76137

Aeronautical Study No.
2012-WTE-322-OE
Prior Study No.
2009-WTE-332-OE

Issued Date: 08/15/2012

Mr. Craig Olmsted
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Suite 320
Boston, MA 02116

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine 4A-HSS
Location:	Cotuit, MA
Latitude:	41-30-55.77N NAD 83
Longitude:	70-23-48.35W
Heights:	0 feet site elevation (SE)
	440 feet above ground level (AGL)
	440 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 , Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

- ☒ At least 10 days prior to start of construction (7460-2, Part I)
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

Any height exceeding 440 feet above ground level (440 feet above mean sea level), will result in a substantial adverse effect and would warrant a Determination of Hazard to Air Navigation.

This determination expires on 02/15/2014 unless:

- the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. This determination is based, in part, on the foregoing description which includes specific coordinates and heights . Any changes in coordinates will void this determination. Any future construction or alteration requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (816) 329-2525. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2012-WTE-322-OE.

Signature Control No: 157246996-171245157

(DNE -WT)

Sheri Edgett-Baron

Manager, Obstruction Evaluation Group

Attachment(s)

Map(s)

The proposed construction consists of 130 wind turbines that would be located in Nantucket Sound, Massachusetts, within the area bounded by the following latitude/longitude coordinates:

North Boundary Line 41-32-36.55N
East Boundary Line 70-14-24.92W
South Boundary Line 41-27-37.39N
West Boundary Line 70-23-48.35W

Pursuant to FAA policy and procedure, the FAA applies a three-phase approach in determining whether a structure will have a substantial adverse effect on air navigation operations or facilities. FAA Order 7400.2J, Procedures for Handling Airspace Matters, Chapter 6 sets forth agency policy for conducting aeronautical studies and evaluating aeronautical effect. As a threshold inquiry, the FAA must first determine whether a proposed structure: (1) exceeds the obstruction standards of Title 14 of the Code of Federal Regulations (14 CFR) part 77; and/or (2) would have a physical or electromagnetic radiation effect on the operation of air navigation facilities. If the FAA determines that a structure meets one or both of the above criteria, the agency must then proceed to the second phase of the evaluation by conducting further analysis to determine whether the structure poses an adverse effect. Third, and finally, if the FAA determines that a structure will have an adverse effect; it must conduct further study to determine whether that effect is substantial. A structure that is found to have a substantial adverse effect would be a hazard to air navigation.

Based on the factual record before it and FAA regulations and guidance, the FAA has determined that the proposed construction of the 130 wind turbines, individually and as a group, does not exceed the obstruction standards in part 77, nor have physical or electromagnetic radiation effect on the operation of air navigation facilities. Therefore, the FAA concludes that the project, if constructed as proposed, poses no hazard to air navigation.

Each wind turbine has been studied separately under Aeronautical Study Numbers (ASN) 2012-WTE-322 through 451 OE. FAA analysis has determined that the proposed turbines do not exceed any obstruction standard in 14 CFR §77.17, Subpart C. The FAA also analyzed whether the proposed turbines would have a physical or electromagnetic radiation effect on the operation of air navigation facilities. This analysis, as summarized below, shows that there would be no physical or electromagnetic radiation effect on affected facilities. Based on the foregoing, under paragraph 6-3-3, there is no need to analyze whether the proposed wind turbines would have an adverse effect, because the proposed wind turbines do not exceed obstruction standards and do not have a physical or electromagnetic radiation effect on the operation of air navigation facilities. In accordance with paragraph 7-1-3, a "Does Not Exceed (DNE)" determination is appropriate for all of the proposed wind turbines.

While these proposed wind turbines do not require additional study under existing FAA regulations and policy, the FAA did gather data on visual flight rule (VFR) traffic in the

area of the proposed wind farm. The FAA gathered this additional data specifically to respond to the court's concern raised in Town of Barnstable, Mass. v. FAA, 659 F.3d 28 (D.C. Cir. 2011). The proposed wind turbines were circularized for public comment on February 10, 2012, to all known aviation interests and to non-aeronautical interests that may be affected by the proposed turbines.¹ In order to facilitate the public comment process, all 130 of the proposed structures were included in the public notice issued under ASN 2012-WTE-322-OE. However, each structure receives a separate determination. The comment period closed on March 17, 2012. Comments received from the circularization process were considered in completing each of the determinations for the studies listed above.

Evaluation of effect on air navigation and communication facilities.

In making this determination, the FAA relied on several reports, including: Technical Operations Division Response (2012-WTE-322-451-OE), Surveillance Engineering Study (Feb. 23, 2010), Guidelines for Evaluating Wind Turbine Impacts to Radars (Dec., 2010), and Impact Study of 130 Offshore Wind Turbines in Nantucket Sound (March 03, 2009). There are three FAA radar sites providing aircraft detection for air traffic control within the Nantucket Sound area. These radar facilities are: (1) North Truro Cape (QEA), an Air Route Surveillance Radar (ARSR-4) digital/long range search radar with digital secondary radar; (2) Nantucket (ACK), an ASR-9 (digital/terminal search radar) with digital secondary radar; and (3) Falmouth, Cape Cod Coast Guard Air Station (FMH), an ASR-8 (analog/terminal search radar) with analog secondary radar.

The FAA analyzed potential impacts to the above radar facilities. Studies indicate that there would be no noticeable effect on beacon (i.e. transponder or secondary) radar service because the proposed turbines are not likely to affect the detection of aircraft with an operational transponder. The three radar sites are beyond 2.4 nautical miles from the proposed wind turbines, and thus the FAA does not anticipate that the wind turbines would cause any beam distortion.²

The wind turbines would not affect the search radar service (primary)³ of QEA. The QEA ARSR-4 is utilized by the FAA, DOD and DHS for long range coverage. This radar is used for national defense early warning, drug smuggling interdiction, and air traffic control. The QEA ARSR-4 is located 31.66 nautical miles from the nearest wind turbine proposal, and the maximum vertical elevation angle for any of the proposed wind turbines is 0.08 degrees, which is minimal. This distance, combined with the elevation

¹ See FAA Order 7400.2J, paragraph 6-3-17 a.1.

² In 2008, the FAA conducted a special flight inspection over a wind farm in Great Falls, Montana. The focus of this inspection was to determine the potential of secondary radar false targets from wind turbine impacts from turbines that are approximately 2.4 nautical miles from the ASR/beacon site. The flight inspection included several flyovers of the turbines, behind the turbines, and around the turbine hub height. The results of this study reveal there were no impacts to beacon performance from wind turbines that are 2.4 nautical miles and beyond from the ASR/beacon site. See Guidelines for Evaluating Wind Turbine Impacts to Radars (Dec., 2010).

³ Primary radar provides "target only" information; meaning that it only displays an unidentified target with no information concerning its altitude or speed, or even if it is an aircraft.

angle, results in no effect to the low altitude coverage of the QEA ARSR-4 search radar. In addition to the FAA's evaluation, the DOD and DHS evaluated the QEA ARSR-4 for potential impacts from the wind farm proposal and no impacts were identified.

The wind turbines would affect the search radar service of ACK and FMH, but the FAA Operations Engineering Support Group determined that this level of impact to the primary radar does not constitute a physical or electromagnetic effect on the operation of air these navigation facilities. The probability of detection (PD) for the ACK ASR-9 may decrease as a result of wind turbine clutter⁴ but it is not expected to drop below acceptable values.⁵ All ASR-9 sites have been upgraded with a processor augmentation card (9PAC-II), including the ASR-9 at Nantucket. This upgrade included a dynamic geo-sensor, which significantly reduces clutter.

An evaluation of the wind turbine proposal on the FMH ASR-8 does not present line-of sight shielding issues because the turbines would be a minimum of nine nautical miles from the radar site and the individual wind turbines would be separated by a distance of 0.25 nautical miles. Only targets below 800 feet and within 3 nautical miles of the wind farm may potentially be affected by shadowing. However, the spacing between the proposed wind turbines, combined with the individual width of the turbines would result only in a brief and intermittent loss of the primary radar return. Additionally, there will be no loss of aircraft detection as there is no noticeable effect to the beacon (secondary) radar.

On January 12, 2012, the FAA upgraded the FMH ASR-8 radar and beacon by digitizing the output with a TDX-2000 modification.⁶ This installation was to address existing issues associated with coasting, dropped targets and ring around. In conducting this aeronautical study, the FAA concludes that not only does the installation of the TDX-2000 address the above identified radar issues; it also would reduce unwanted returns from the wind turbines.⁷

Evaluation of effect on VFR operations.

FAA Order 7400.2J, paragraph 6-3-8, provides the criteria to assess a proposed structure's effect on VFR operations. Subparagraph (c) of that section provides that the area considered for en route VFR flight begins and ends outside the airport traffic pattern airspace area or Class B, C, and D airspace areas. As the location of all wind turbines in

⁴ See Impact Study of 130 Offshore Wind Turbines in Nantucket Sound, March 03, 2009.

⁵ A Probability of Detection (PD) of .9 (90%) or better is desirable. For most search radars, a PD of .8 (80%) or better is considered satisfactory. Id.

⁶ The FAA Determinations of No Hazard issued to Cape Wind on May 17, 2010, were conditioned on Cape Wind reimbursing the FAA for the costs and installation of the TDX-2000 modification to the FMH ASR-8 radar. In the event that the TDX-2000 modification did not fully mitigate the radar interference or clutter, Cape Wind would provide financial assurance for the acquisition, siting and installation of an ASR-11 system. Subsequent to the issuance of these determinations, the FAA concluded that current issues with the ASR-8 radar (coasting, dropped targets and ring around) due to reflections from the aircraft hangars at FMH could be addressed by the TDX-2000 modification. Consequently and on its own accord, the FAA installed the TDX-2000 modification to the FMH ASR-8.

⁷ See Surveillance Engineering Study (Feb. 23, 2010).

this project would lie outside all traffic pattern airspace and outside Class B, C, and D airspace, the airspace over the wind farm is appropriately considered to be in the area of en route operations. While recognizing that some aircraft operating under VFR may have to alter their altitude or route of flight, paragraph 6-3-8(c)(1) states that a structure would have an adverse effect upon VFR en route air navigation only if its height is greater than 500 ft. above the surface at its site and within two statute miles of any regularly used VFR route. The Cape Wind project is within two statute miles of a regularly used VFR route.⁸ However, the requested height for these structures is not greater than 500 ft. above the surface at their site. Therefore, even if the proposed wind turbines exceeded an obstruction standard in 14 CFR § 77.17, they would not adversely affect VFR operations.

Further analysis conducted in accordance with paragraph 6-3-8 concluded that the proposed wind farm would not have an adverse effect on any existing or proposed arrival or departure VFR operations or procedures. The turbines would not conflict with airspace required to conduct normal VFR traffic pattern operations at Falmouth Cape Cod Coast Guard Air Station (FMH), Barnstable Municipal Airport-Boardman/Polando Field (HYA), Nantucket Memorial Airport (ACK), Martha's Vineyard (MVY), or any other known public use or military airports.

The FAA acknowledges that if the wind turbines first exceeded an obstruction standard and would be greater than 500 feet AGL, then the wind turbines would be presumed to have an adverse effect on VFR operations because they are within two statute miles of a VFR route.⁹ But that is not the case here. A determination of adverse effect is based on long-standing FAA policy governing aeronautical studies of proposed structures and their potential to impact VFR operations. In accordance with that policy, even if the proposed wind turbines exceeded an obstruction standard in 14 CFR § 77.17, the proposed wind farm would not have an adverse impact to VFR operations, because none of the wind turbines exceed 500 feet AGL.

Mitre Report, VFR Traffic Analysis for the Proposed Horseshoe Shoal Wind Farm

As stated previously, in studying the VFR effect for the airspace over the proposed wind turbines, FAA policy provides that the proposed structure must exceed 500 feet AGL and be within two statute miles of a VFR route. Based on the specific facts presented, no VFR analysis is required in this case. Nonetheless, to address concerns raised by the court in Town of Barnstable, the FAA requested Mitre to conduct a study of VFR operations over the wind farm polygon. Analysis was limited to VFR traffic with an operational transponder over the proposed wind farm polygon.¹⁰ Traffic counts were

⁸ See discussion of Mitre Report and Public Comments later in this document.

⁹ The FAA would then complete additional study to determine whether the proposed wind turbines would have a substantial adverse effect on a significant volume of aeronautical operations. See FAA Order 7400.2J, paragraph 6-3-5.

¹⁰ VFR aircraft without an operating transponder cannot be tracked by the FAA. The purpose of seeking public comment was to receive information concerning these types of operations, as the FAA has no other means to gather the information. The public comments, including those related to VFR effect, are addressed later in this document.

reported for transponder equipped aircraft reporting 900 feet and below, and transponder equipped aircraft that reported 1,000 feet.¹¹ Mode C data was utilized from the Falmouth radar system and Boston Consolidated Terminal Radar Approach Control (TRACON), as these facilities sufficiently captured VFR traffic within the wind farm polygon.

Data analysis concludes that for the entire nine months of January through September, 2011, there were 427 aircraft operating VFR at altitudes of 949 feet and below in the wind farm polygon area. For the same nine month period, there were 356 aircraft operating VFR from 950 feet to 1,049 feet in the wind farm polygon area. It is noted that for a wind turbine height of 440 feet, aircraft would have to fly at 940 feet to maintain a 500 foot clearance in accordance with 14 CFR § 91.119. Therefore, VFR aircraft reported at 1,000 feet are not affected by the proposed wind turbines.

There were many days in each of the nine months (January through September) that had zero aircraft operations in the area of the proposed wind farm. Data analysis concludes that 52% of VFR aircraft operations at altitudes of 949 feet and below were located in the extreme southeast corner of the wind farm polygon area. The FAA requested MITRE to perform an additional analysis based on a smaller wind farm polygon with the four wind turbines in the extreme southeast corner removed. This analysis reduced the number of VFR aircraft operations by more than half. Peak month counts were in July and August. For VFR aircraft operations at altitudes of 949 feet and below, approximately 38% of total operations for the original polygon and 37% of total operations in the area not included in the modified polygon occurred during this two month period.

Public comments

As part of the process of evaluating the impact of the wind farm on the navigable airspace, the FAA solicited comment during the circularization process. During the comment period, the FAA received 14 comments. Nine commenters objected to the project and five commenters supported the project. The supporting commenters stated that the turbines would not have a significant adverse effect on VFR flight in the area. The commenters objecting to the wind turbines were concerned with radar impact and the effect on VFR operations. The comments are summarized below.

Comment: Some pilots, including one official with a regional air taxi company, state that they are experienced in flying the Nantucket Sound area and do not find that the project would have a significant impact on flight operations. One commenter also stated that any adjustments to flight paths or altitudes would be minor and brief. Two commenters questioned why aircraft would fly at a 500 foot cruising altitude when considering the current level of marine traffic in the area (including regular passenger ferries of a 75 ft. height). Another commenter stated that flying at 500 feet presented limited options in case of an emergency, such as engine failure.

¹¹ See Mitre Report, VFR Traffic Analysis for the Proposed Horseshoe Shoal Wind Farm, dated July 19, 2012. Mode C transponder returns are rounded to 100 foot increments. Therefore, transponder equipped aircraft reporting an altitude of 1,000 feet can be at altitudes of 950 feet to 1,049 feet.

Response: The FAA agrees that adjustments may be minor and brief, and that aircraft make these adjustments today. Section 91.119 Minimum safe altitudes, provides that no person may operate an aircraft at an altitude of 500 feet AGL except over open water or sparsely populated areas. This section also provides that aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure, which would include any marine traffic in Nantucket Sound.

Comment: There are 400,000 operations in the area. One commenter specifically contended that there were approximately 548 flights/day below 1,000 feet AGL/AMSL. (No supporting data was submitted.)

Response: This claim is not supported by facility records. The FAA's Cape TRACON records indicate that for 2011, there were a total of 192,580 aircraft operations (including both VFR and IFR) occurring in the airspace it manages, which consists of approximately 46 nautical miles east/west by 52 nautical miles north/south. The wind farm polygon comprises an area of 25 square miles within the airspace managed by the Cape TRACON. The data also indicate that approximately 35 percent of this yearly total of VFR and IFR traffic transited the mainland to the islands across Nantucket Sound.

Comment: There would be a compression of flight as aircraft moved from the lower altitude strata (500 to 1000 ft. AGL/ AMSL) to a higher altitude to avoid the turbines. This project would force more VFR aircraft into IFR corridors.

Response: The FAA does not agree that VFR aircraft would be forced into IFR corridors. In the airspace over Nantucket sound, the air traffic controllers utilize 2,000 feet and higher for IFR aircraft, and the minimum vectoring altitude is 1,500 feet. Common separation between VFR and IFR aircraft is 500 feet. The proposed height of the wind turbines is 440 feet. For VFR aircraft to comply with 14 CFR § 91.119, these aircraft could operate at 940 feet AMSL. This provides adequate airspace for VFR aircraft and IFR aircraft operating in this area

Comment: This project would affect VFR Flight Following Services by air traffic control.

Response: It is the pilot's responsibility to see and avoid other aircraft and structures when conducting VFR flight. A mixture of IFR and VFR operations is not unique to Nantucket Sound and is common in areas with major commercial airports and numerous adjacent general aviation airports, or in areas confined by terrain. Adherence to § 91.119 provides basic separation between IFR/VFR and VFR/VFR operations, regardless of whether the pilot is familiar with local customs, because all pilots are operating under the same requirements. VFR Flight Following is an additional service provided by ATC on a workload permitting basis and is not always available in all regions, at all times, or under all conditions. One of the commenters indicated that this service was not always available even now in the Nantucket Sound area due to controller workload.

Comment: Aircraft would have to circumnavigate (change altitude or route) especially during the frequent periods of marginal VFR weather.

Response: FAA Order 7400.2J, Paragraph 6-3-8, provides that “not every structure penetrating navigable airspace is considered to be a hazard to air navigation. Some may be marked and/or lighted so pilots can visually observe and avoid the structures.” The proposed structures would be appropriately marked and/or lighted to make them conspicuous to airmen should circumnavigation be necessary. This is not unusual and does not; of itself create a safety risk. The FAA acknowledges that some operations may have to circumnavigate around the wind farms. It is noted that several commenters indicate that aircraft currently make course and altitude adjustments in this area to avoid passenger ferries and other marine traffic.

Comment: This project would hamper search and rescue operations, and could increase the complexity and/or reduce pilot options available during an emergency.

Response: Under part 77, the FAA does not consider impacts to emergency operations in an aeronautical study because they would not occur on an ongoing and regular basis and, therefore, do not reach the level that could be considered significant. Furthermore, Nantucket Sound is not unique in that major metropolitan areas have a vast expanse of existing structures (buildings, power lines, antenna towers, roads with overpasses and heavy traffic), more complex than a wind farm, for which a pilot with an in-flight emergency or emergency responder operations would have to avoid.

Comment: The project would impact FAA radar by causing primary target drops and clutter, and that the “masking” of primary radar returns could raise potential threat to national security.

Response: The analysis of the proposed wind farm on the relevant radar systems is addressed previously in this document. During the aeronautical study, the Departments of Defense and Homeland Security evaluated the proposal and found no impacts to national security.

Conclusion

As stated previously, in order for a proposed structure to be determined to have an adverse effect on VFR operations, the structure must first exceed an obstruction standard in 14 CFR part 77.17 and/or have an electromagnetic radiation effect on the operation of air navigation facilities. The proposed wind turbines do not exceed obstruction standards and do not have a physical or electromagnetic radiation effect on the operation of air navigation facilities. In accordance with paragraph 7-1-3, a “Does Not Exceed (DNE)” determination is appropriate for all proposed wind turbines. Such a determination means that there would be no hazard to air navigation. The FAA found it appropriate to study VFR operations in the vicinity of the proposed wind farm, notwithstanding the fact that these structures are less than the obstruction criteria, in order to provide additional facts in view of the holding in Town of Barnstable, Mass v. FAA. The inclusion of this

Additional information for ASN 2012-WTE-322-OE

information in the administrative record does not change the fact that neither of the criteria necessary for determination of an adverse effect has been met. Therefore, it is determined that the proposed construction would not have a substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on any air navigation facility and would not be a hazard to air navigation provided the conditions set forth within this determination are met.

Additional Conditions

1) In addition to the 10 day prior notice specified earlier in this determination, the proponent for this project shall also notify this office at least 90 days prior to the start of construction to ensure aeronautical charts are updated to reflect this area as now being under construction. It is imperative that the proponent ensures that this information has been received and acted upon. This requires the proponent to speak directly with the current FAA Obstruction Evaluation Group (OEG) specialist responsible for the Cape Wind project or his/her supervisor. This information can be obtained from our website at <https://oeaaa.faa.gov>

DO NOT LEAVE A VOICE OR ELECTRONIC MESSAGE. PERSONAL CONTACT IS REQUIRED.

2) The proponent shall establish financial assurance by escrow or other financial instrument in the amount of \$15,000,000 for a period of 24 months after the 7460-2 Part II is filed (based on substantiated, solid supporting evidence of an ASR-11 requirement) for the acquisition, siting, and installation of an ASR-11 system in the event that the TDX-2000 modification to the FMH ASR-8 does not fully mitigate the radar interference/clutter issue.

3) The proponent shall work directly with the FAA during the construction period to ensure adequate temporary obstruction marking and lighting is in place to protect aviation until such time as all wind turbines are built and the final obstruction marking and lighting scheme is completed and operational.

4) Obstruction lighting systems on all wind turbines for which obstruction lighting is recommended shall be synchronized (specifically the red lights) to flash at the same time.

NOTE: THE SEPARATE DETERMINATIONS FOR ALL CASES ASSOCIATED WITH THE CAPE WIND PROJECT MAY BE IMMEDIATELY OBTAINED, AS THEY ARE COMPLETED, FROM OUR WEBSITE AT: <https://oeaaa.faa.gov>

SEARCH USING THE INDIVIDUAL AERONAUTICAL STUDY NUMBER (2012-WTE-322 through 451-OE).



