



THE UNDER SECRETARY OF DEFENSE

3010 DEFENSE PENTAGON  
WASHINGTON, DC 20301-3010

ACQUISITION  
TECHNOLOGY,  
AND LOGISTICS

APR 22 2016

The Honorable William M. "Mac" Thornberry  
Chairman  
Committee on Armed Services Committee  
U.S. House of Representatives  
Washington, DC 20515

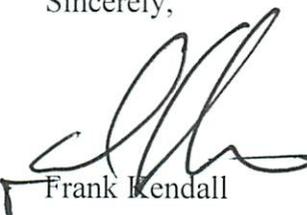
Dear Mr. Chairman:

As requested by House Report 114-102, pages 353-354, accompanying H.R. 1735, the National Defense Authorization Act for Fiscal Year 2016, enclosed is the Report to Congress on the Impact of Wind Energy Developments on Military Installations.

The Department of Defense assesses risks posed by wind energy developments in proximity to military installations, ranges, or training routes. The enclosed report provides information on the technical analyses, parameters for acceptable risk, past mitigation agreements with wind and other energy developers, and feedback from local military installation commanders on the impact of mitigation measures.

With continued congressional support, DoD and its partners will maintain military readiness, promote compatible land uses around DoD facilities, and protect the resources entrusted to our care. I look forward to continuing our relationship and working with you to ensure the Department's test and training ranges are sustained for years to come. An identical letter has been sent to the other congressional defense committees.

Sincerely,



Frank Kendall

Enclosure:  
As stated

cc:  
The Honorable Adam Smith  
Ranking Member



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WASHINGTON, DC 20301-3010

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TECHNOLOGY,  
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APR 22 2016

The Honorable Harold Rogers  
Chairman  
Committee on Appropriations  
U.S. House of Representatives  
Washington, DC 20515

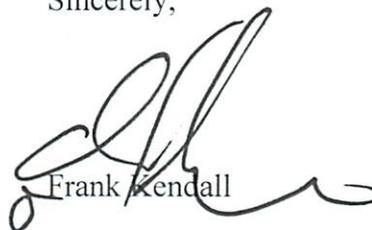
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Frank Kendall

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cc:  
The Honorable Nita M. Lowey  
Ranking Member



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The Honorable John McCain  
Chairman  
Committee on Armed Services  
United States Senate  
Washington, DC 20510

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As stated

cc:  
The Honorable Jack Reed  
Ranking Member



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ACQUISITION  
TECHNOLOGY,  
AND LOGISTICS

APR 22 2016

The Honorable Thad Cochran  
Chairman  
Committee on Appropriations  
United States Senate  
Washington, DC 20510

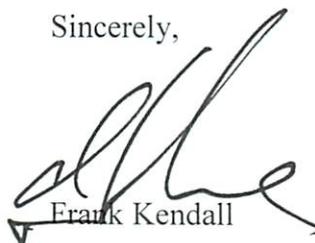
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Frank Kendall

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As stated

cc:  
The Honorable Barbara A. Mikulski  
Vice Chairwoman

**REPORT ON THE IMPACT OF WIND ENERGY DEVELOPMENTS  
ON  
MILITARY INSTALLATIONS**

Pursuant to House Report 114-102, pages 353–354, accompanying H.R. 1735, the  
National Defense Authorization Act for Fiscal Year 2016



Office of the Under Secretary of Defense  
for Acquisition, Technology, and Logistics

APRIL 2016

The estimated cost of this report or study for the Department of Defense is approximately \$59,000 for Fiscal Year 2016. This includes \$12,000 in expenses and \$47,000 in DoD labor.

Cost estimate generated on March 7, 2016.  
RefID: B-C75859F

# **Report on the Impact of Wind Energy Developments on Military Installations**

## **Requirement for this Report**

In accordance with House Report 114-102, pages 353–354, accompanying H.R. 1735, the National Defense Authorization Act for Fiscal Year 2016, DoD provides this report on the assessment of the science, standards, assumptions, and criteria by which the Department assesses the risks to military missions posed by wind energy developments in proximity to military installations or training ranges. The report also includes the parameters and distances from military training routes and ranges that are considered an acceptable risk; a review of the success of mitigation measures included in past agreements with wind energy developments, including the cost of mitigation measures; and an analysis of feedback from local military installation commanders of the impact or effectiveness of mitigation measures.

## **Science, Standards, Assumptions, and Criteria by which the Department Assesses Risk**

In the context of the mission compatibility evaluation (MCE) process, DoD utilizes computerized geospatial tools and other analytical aids, in addition to human analysis, to identify and assess the risks posed by energy developments to military training, testing, and operational missions. The science behind the many different effects wind turbines potentially inflict on radar systems and military operations is understood and has been documented. Wind turbines can degrade radar performance by decreasing probability of detection, resulting in lost or unseen targets as well as scatter radar returns in a manner that creates false targets. Wind turbines can also cause electromagnetic, seismic, and physical interference. For example, DoD delivered to Congress a report in 2006 on “The Effect of Windmill Farms on Military Readiness,”<sup>1</sup> which focused on effects to air defense and missile warning radars and the potential impact on military readiness. The report described the general principles of radar systems and the detrimental impact that wind turbines can potentially have on their operation. As another example, maintenance of ranges in a pristine state for sensor testing are also analyzed for possible impacts, as are safety issues related to both personnel and operations.

There are ongoing efforts to improve mission impact models and mitigation methods as part of DoD’s risk assessment program. For example, DoD is working to improve models to predict the impact on air traffic control and long range radars from wind projects and electromagnetic interference caused by transmission lines. The Department is working to reduce risks from wind energy developments through fielding additional radars to fill gaps in coverage, improving software in existing radars, and fusing data from multiple sources.

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<sup>1</sup> Report to the Congressional Defense Committees on The Effect of Windmills Farms on Military Readiness (2006): <http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA455993>

The MCE process follows current and generally accepted scientific and engineering principles pertinent to DoD mission requirements. The assumptions are shaped by the tools, aids, and methodologies of analysis crafted using science provided under the provisions of the Interagency Field Test and Evaluation Program. This program is jointly executed by DoD, the Department of Energy, the Department of Homeland Security, and the Federal Aviation Administration (FAA), with collaboration and assistance from the National Oceanic and Atmospheric Administration. The Massachusetts Institute of Technology/Lincoln Laboratory (MIT/LL) and the Sandia National Laboratories support the program.<sup>2</sup>

Further, DoD has engaged the MIT/LL to perform specialized scientific and engineering studies to identify potential mitigation solutions to wind turbine developments. These specialized studies included the wind turbine development impacts on specialized military radars at the Fossil Long Range Radar site in central Oregon; the Relocatable Over-the-Horizon Radars operating from the Naval Support Activity Chesapeake, Virginia, King County, Texas, and Puerto Rico; and specialized radars at the Naval Air Station Patuxent River, Maryland. Further, MIT/LL and the Idaho National Laboratory supported specialized scientific and engineering studies to identify potential electromagnetic interference of proposed bulk power transmission lines near the White Sands Missile Range in New Mexico. Several of the studies that underpin the Department's science, standards, and assumptions are posted on MIT/LL's web site.<sup>3</sup>

On February 10, 2016, DoD, along with its wind turbine wind interference mitigation partners, released a new strategy to identify mitigation solutions to the radar interference issue.<sup>4</sup> The strategy identified three research and development focus areas:

- Improve Government and Industry Capacity to Evaluate the Impact of Wind Turbines on Sensitive Radar Systems,
- Develop and Facilitate the Deployment of Mitigation Solutions to Increase the Resilience of Existing Radar Systems to Wind Turbines, and
- Encourage the Development of Next-Generation Radar Systems That Are Resistant to Wind Turbine Radar Interference.

The criteria utilized to determine unacceptable risk to the national security of the United States are provided in 32 CFR Part 211:

- Endanger safety in air commerce, related to the activities of DoD; or

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<sup>2</sup> The IFT&E program conducted in 2012 and 2013 and scientifically evaluated the wind turbine-radar interference issues with the Nation's family of ground-based air surveillance radars. See: [http://energy.gov/sites/prod/files/2014/10/f18/IFTE%20Industry%20Report\\_FINAL.pdf](http://energy.gov/sites/prod/files/2014/10/f18/IFTE%20Industry%20Report_FINAL.pdf)

<sup>3</sup> For example, MIT/LL's preliminary study on the ROTH system is at [http://www.acq.osd.mil/dodsc/library/HF\\_turbine\\_quicklook\\_final\\_19\\_sept\\_13\\_final.pdf](http://www.acq.osd.mil/dodsc/library/HF_turbine_quicklook_final_19_sept_13_final.pdf). Further, DoD requested MITRE's JASON's group to study the wind turbine radar interference problem, and their study is posted at [http://www.acq.osd.mil/dodsc/library/JASONS%20Wind%20Farms%20Radar%20Study%20\(final\).pdf](http://www.acq.osd.mil/dodsc/library/JASONS%20Wind%20Farms%20Radar%20Study%20(final).pdf)

<sup>4</sup> Federal Interagency Wind Turbine Radar Interference Mitigation Strategy, see: <http://energy.gov/eere/wind/downloads/federal-interagency-wind-turbine-radar-interference-mitigation-strategy>

- Interfere with the efficient use and preservation of the navigable airspace and of airport traffic capacity at public-use airports, related to the activities of DoD; or
- Significantly impair or degrade the capability of DoD to conduct training, research, development, testing, and evaluation, and operations or to maintain military readiness.

At the request of Congress in 2013, DoD provided a detailed report on the unacceptable risk from commercial energy projects.<sup>5</sup>

### **Parameters and Distances Considered in the Mission Compatibility Evaluation Process**

The Department begins identification of military mission risks from a wind turbine project when it is informed of a wind energy proposal by a developer, other Federal agency, state, or Indian tribal government or local jurisdiction.<sup>6</sup> Pursuant to Federal law, developers are required to seek the FAA’s assessment of the extent of the adverse impact on the safe and efficient use of the navigable airspace at least 45 days prior to the start of project construction.<sup>7</sup> The types of wind turbines discussed in this report are subject to FAA obstruction evaluation process.<sup>8</sup>

FAA notifies the Military Departments (MILDEPs) and the DoD Siting Clearinghouse (Clearinghouse) of the developer’s proposed projects. The numbers of projects reviewed by the MILDEPS and the Clearinghouse over the past four years are identified in Table 1.

**Table 1: Energy Projects Reviewed by DoD**

Calendar Year (CY)	Total Number of Energy Projects	Total Number of Wind Turbine Projects
2015	3325	711
2014	2594	521
2013	2075	463
2012	1769	314

In order to assess this increasing workload, DoD performs human analysis in addition to an electronic database tool of general parameters and proximity to airfields, military training routes, airspace, and radar systems to identify projects with potential risk to military operations and readiness. These parameters and distances (highlighted in Table 2) allow the user to identify projects filed with the FAA that may present a conflict with the military mission. Most projects that fall outside of the parameters and distances require no further action by DoD. The Military Departments have also identified specific geographic areas with complex DoD missions that fall

<sup>5</sup> Report to Congress on Unacceptable Risk to National Security from Commercial Energy Projects, see: <http://www.acq.osd.mil/dodsc/library/RTC%20UR%20Final.pdf>

<sup>6</sup> Public Law 111-383, Section 358, as amended; 32 CFR Part 211.

<sup>7</sup> 49 U.S.C. 44718 Structuring Interfering with Air Commerce.

<sup>8</sup> Pursuant to Section 211.7 of 32 CFR, developers and other parties may request “informal” reviews of proposed projects with the DoD.

outside of these parameters. When there is a proposed project in these areas, the Clearinghouse conducts a general analysis to ensure further scrutiny of the project is not required before giving DoD's response to the FAA.

**Table 2: FAA Parameters and Distances from Military Airspace for Wind Turbine Projects Review**

Parameter	Distance
Distances laterally and vertically within defined Class A through Class C airspace associated with airfield or helipad on a military installation	0 ft
Distance under floor of a Military Training Route, Special Use Airspace, or Restricted Airspace	200 ft
Distance beyond the edge of a Restricted Area associated with testing airborne military radars	10 miles
Distance from a ground based Long Range Air Surveillance Radar	Line of Site ~ 25 miles

After initial screening and analysis, the remaining projects receive individual review by the affected Service(s). The detailed review considers the specific missions performed in the area and how the project would affect future operations. As every mission has unique requirements, there is no single standoff distance or parameter that applies to the varied ranges, airspace, or installations. The analysis considers the level of impact, availability, and proximity of similar operating space, cumulative impacts from other development, frequency of operations, and any potential mitigation options.

### A Review of Successful Mitigation Measures and Their Costs

When DoD determines that a potential wind turbine project may present an adverse impact on military operations and readiness, DoD will offer to enter into discussions with the developer to mitigate the potential impact. These discussions, both formal and informal, between project developers, local governments, and DoD representatives have been a very effective means to mitigate potential impacts with minimal resources. Often, a brief discussion with the applicant resolves DoD's concerns.

Since 2012, DoD has entered into 39 formal mitigation discussions. In 11 of those cases, DoD entered into extensive discussions with the applicants that resulted in a signed Memorandum of Agreement (MOA) to mitigate adverse impacts on military readiness and operations.<sup>9</sup> In one case, the developer chose to withdraw from mitigation discussions, yielding no MOA, and indefinitely suspended the project after DoD formally objected to the project.<sup>10</sup>

<sup>9</sup> Mitigation agreements may be accessed on the library page of the Clearinghouse website, under Memorandum of Agreements; see: <http://www.acq.osd.mil/dodsc/about/library.html>

<sup>10</sup> In December 2014, the Deputy Secretary of Defense informed the Secretary of Transportation of the objection, and then informed the four defense congressional committees; see: <http://www.acq.osd.mil/dodsc/library/USA006599-14%20TAB%20B%20-%20Great%20Bay%20Wind%20Final.pdf>

Additionally, by statute, DoD may accept a voluntary contribution of funds from a developer to defray the cost of implementing any provisions of the MOA.<sup>11</sup>

Table 3 outlines measures incorporated into formal DoD mitigation agreements. As noted in Table 3, several methods are employed by DoD to mitigate the impact of wind turbines on military mission:

- Alteration of wind turbine siting to reduce or eliminate impacts;
- Modification of government radars in order to mitigate risk, either through their optimization or through additional radars;
- The curtailment of wind turbine operations for specified time periods (such as during military testing).

The most effective solution is to alter the siting of proposed turbines. For example, the developer of the one project agreed not to construct 46 turbines (out of 150 planned) until such time that the remaining project is operational and the potential impact of the project can be assessed by a third-party radar expert. Other cases have been resolved by moving turbine locations without reducing their total number; this may not require an official mitigation agreement as the proponent may simply alter the project, thus resulting in a favorable DoD recommendation and FAA determination.

In cases where the turbines degrade radar performance, a radar modification can often be implemented to mitigate the impacts. In these cases, DoD often employs developer funds, contributed under statutory authority for voluntary contributions, in order to mitigate the effects of the turbines. To date, DoD has signed agreements for a total of approximately \$11.4 million in voluntary contributions to develop and implement system upgrades or solutions that are both feasible and affordable.<sup>12</sup> The funds that are voluntarily contributed by developers do not reflect the total cost to DoD for the mitigation measures, but they help to offset up front expenditures for physical assets that are part of the mitigation. These funds do not cover the money DoD has spent on studies and model development used to support our discussions with developers. As an example, the Javelina<sup>13</sup> agreement provided voluntary funding that will be used to procure a supplemental (infill) radar as well as pay for related infrastructure and operational costs.

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<sup>11</sup> Section 358(g) of PL 111-383 states: “Authority to Accept Contributions of Funds.—The Secretary of Defense is authorized to accept a voluntary contribution of funds from an applicant for a project filed with the Secretary of Transportation pursuant to section 44718 of title 49, United States Code. Amounts so accepted shall be available for the purpose of offsetting the cost of measures undertaken by the Secretary of Defense to mitigate adverse impacts of such project on military operations and readiness.”

<sup>12</sup> To date, approximately \$3.1M has been received. Remaining funds are pending the developer’s plans for proceeding forward with the project.

<sup>13</sup> See Table 3.

**Table 3: Mitigation Measures Identified by Wind Turbine Project<sup>14</sup>**

Mitigation Measure	Project	State	Year(s)	Voluntary Contributions
Alter Siting of turbines	Pantego	NC	2014	n/a
Alter Siting of turbines	Brush Canyon	OR	2014	n/a
Alter Siting of turbines/Coordinate Test Events	Atlantic Wind	NC	2014	n/a
Alter Siting of turbines/Modify Radar to mitigate risk	Mariah 3	NM	2014	\$3,000,000
Alter Siting of turbines/Modify Radar to mitigate risk	Scandia	NM	2014 & 2015	\$3,000,000
Modify Radar to mitigate risk/Curtailment, if necessary	Riviera I	TX	2012	\$500,000
Modify Radar to mitigate risk/Curtailment, if necessary	Patriot (formally known as Petronila)	TX	2012 & 2014 change	\$750,000
Modify Radar to mitigate risk	Baffin <sup>a</sup>	TX	2014	\$80,000
Modify Radar to mitigate risk	Chapman Ranch	TX	2015	\$200,000
Add additional radar/s	Javelina	TX	2015	\$2,850,000
Curtailment	Searchlight	NV	2015	n/a

<sup>a</sup> This is the only project subject to a mitigation agreement that has entered the construction phase.

Other agreements, when executed, will improve radar performance through such methods as software optimizations. Based on previous testing, these programs have a high probability of enhancing detection; however, the actual results will not be known until both the projects and mitigations are installed.

Curtailment of wind turbines is has also been identified as an option to protect certain missions. For example, the Searchlight<sup>15</sup> agreement is structured to suspend wind turbine operations when DoD conducts flight tests. The agreement provides for a number of hours the turbines must be non-operational on an annual basis as well as a provision that allows unused annual non-operational hours to be carried forward into future years, subject to a maximum total (carryover) of curtailment hours.

Though significant progress has been made to mitigate mission impacts to air traffic control radars and training missions, some DoD missions are no longer realistic if the unique systems are altered to overcome wind turbine interference. This can cause significant alteration of military operations or degrade capability development.

Finally, while DoD enters into agreements to mitigate the impact on operations and readiness, these agreements do not necessarily remove all impacts to DoD mission. The threshold for DoD objection to a proposal is that it would present an “unacceptable risk to

<sup>14</sup> Table represents mitigation agreements signed as of December 1, 2015.

<sup>15</sup> See Table 3.

national security,” taking into consideration any feasible and affordable mitigation offered by the energy developer. This is a high standard, and the Department often implements procedural changes to overcome degradation that may not eliminate all impacts. For example, in the Pantego<sup>16</sup> agreement, military training must consider the operational impacts to flight training with a wind turbine project planned for the outer mile of a low-level military training route. This risk has been assessed by the Seymour-Johnson Air Force Base Wing Commander as acceptable and does not unacceptably impact the base’s training mission, but it does decrease the operating space. The land left undeveloped by the agreement becomes more critical as it is still subject to development should another company make a proposal.

### **Analysis from Local Military Installation Commanders of Mitigation Measure Effectiveness**

In order to measure the success of mitigation agreements reached with energy developers, DoD sent a questionnaire to the commanders of installations covered by the above-referenced agreements. DoD requested that each commander assess whether the mitigations were performing as expected. Nine of the subject agreements cover projects that have yet to begin construction. In those cases, the commanders were asked for their current assessment of the mitigation provisions in the applicable agreements. All installation commanders were asked whether or not any other factors, such as mission change, new study results, or additional energy development, have changed their assessment of the agreement and the likelihood of impacts.

The responses indicate that installation commanders remain confident that agreements provide sufficient protections from the individual projects covered by the agreements. When asked to rate confidence of the mitigation actions to perform as predicted on a scale of 1 (not at all confident) to 5 (completely confident), respondents gave an average of 3.8.<sup>17</sup>

While this result shows a reasonable level of confidence in individual agreements, many commanders expressed concern related to how additional wind energy projects in the vicinity of the military installation might increase cumulative impacts to military readiness and operations. That is, the current 11 agreements appear to be adequate in terms of managing impact on operations and readiness; however, if more projects are constructed near installations and these projects necessitate mitigation agreements, the cumulative impact of multiple agreements on operations and readiness is unknown. For example, an installation may find it reasonable to contend with one project with one mitigation agreement, however, if more projects with mitigation agreements are constructed near the same installation, the outcomes in terms of logistics, operations, and readiness cannot be determined at this time.

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<sup>16</sup> See Table 3.

<sup>17</sup> The range of response was 3 to 5.