

# Classification of Wind Farm Turbulence and Its Effects on General Aviation Aircraft and Airports

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## Introduction

Wind turbines located on sites known as wind farms have become popular in the United States and elsewhere because they may be able to reduce, if not replace, the use of fossil fuels for energy production. The development of wind farms has been particularly rapid in recent years along the so-called “wind corridors” in such areas as Kansas, Nebraska, Iowa, and South Dakota, thanks to their relatively flat terrain and locations downwind from the Rocky Mountains range. Since February 2013, when there were about 15 existing wind farms and more than 50 wind projects proposed in the state of Kansas, additional proposals have been generated through mid-year 2015. Each proposal typically has several dozen turbines associated with it at the project site. When the proposed sites are in proximity to airports, there is an important question to answer about the impact of turbulence generated by the turbines’ rotating blades: is the impact particularly high on General Aviation (GA) aircraft due to their lightweight airframes and their operations typically being at lower altitudes? It is for these reasons that concern exists among general aviation pilots, aerial agricultural applicators, and air ambulance operators, along with airport managers and aviation associations, that the wake turbulence from the spinning blades of wind turbines may create a hazard to aviation/airport safety.

## Project Description

A literature review has revealed that very little research has been conducted to address the concern. In a previous project with the Kansas Department of Transportation (KDOT) completed in 2013 (Mulinazzi & Zheng, 2014), it has been found that the spinning blades from wind turbines can create turbulence, in the form of rotational vortices. It is already known that such vortices can sustain strength and distance for several miles before fully dissipating. Given the results of this previous study, which also formulated a “*hazard index*,” consideration

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should be given during the planning stage of wind farms for the relationship between their locations and any nearby airport, or area of high aircraft use. These considerations also include aerial agricultural applicators and air ambulance providers. It should be noted that the “*hazard index*” is not an industry standard. Rather, it is a term developed by the current authors as a measure to quantify the relative level of hazard.

## Project Results

In this project, studies were performed to draw the proper correlation between the “*hazard index*,” developed in a previous study (Mulinazzi & Zheng, 2014), and the safe operation of aircraft at low airspeeds and at low flight altitudes when operating near wind turbine sites or at general aviation airports that are in proximity to wind farms. It is expected that the correlation would help in the planning of future wind farms and siting turbines to prevent detrimental effects for GA operations. Theoretical and applied investigations in this project are used to determine applicability of the “*hazard index*” to a commonly-used GA aircraft and proximity of wind turbines to specific airports. With one type of aircraft as an example, the results can be extended to other GA types of aircraft accordingly.

## Project Information

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