Wind farms: A danger to ultra-light aircraft?

Eurekalert!

For a motorized hangglider or a one-seater weighing 300 kilograms: the business of flying by ultra-light aircraft is booming. That is also why numerous airfields are applying for the license to host these lightweight gliders. Most of these airfields are located on flat land, which is also the preferred terrain for wind power plant. However, these facilities could turn out to be a risk factor for aviators, especially when it comes to takeoff and landing: On the one hand, the power plants "pilfer" the winds from the planes, because wind speeds aft of such facilities are considerably lower. If the aircraft fly in the region behind the rotor, then they will suddenly find themselves contending with an entirely new aerodynamic situation. On the other hand, rotors produce turbulence in the air that could equally interfere with the aircraft.

Simulation calculates turbulence

The extent to which wind turbines impact ultra-light aircraft is an especially pertinent question now at the Linnich-Boslar ULV Airfield, where a major wind farm is slated for construction in close proximity. The operator, BMR Windenergie, wants to be sure – prior to construction – that no risk imperils the aviators. On behalf of this company, researchers at the Fraunhofer Institute for Wind Energy and Energy System Technology IWES in Oldenburg developed a simulation that enables them to calculate what turbulence these facilities generate, how they alter wind speed and what influence these factors have on airplanes. "We conducted these simulations under a variety of scenarios," says Dr. Bernhard Stoevesandt, head of department at IWES. "We simulated various wind directions, two different wind speeds and five different flight trajectories in which the plane is under the rotor's sphere of influence for various lengths of time."

Complex grid model

For the simulations, the researchers initially created a computer model of the ground and a wind profile of the surrounding area where the wind farm is to be built. A grid was placed over the model. The computer calculates how the power plants alter wind conditions and turbulence at various points on the grid. "The true skill is in the creation of the grid: Because the points on the grid where the computer makes the individual calculations must lie at exactly the right places," explains Stoevesandt. The complexity of the simulation is enormous – the software must calculate the prevailing currents within several million grid cells that mutually influence each other. Other challenges consist in properly depicting the trail – that is, the turbulence and the change in wind speed behind the rotor – and determining how it affects the airplane. "To validate the simulations, the trail from actual wind energy plants was measured at various individual points behind the rotor, and the measurements compared with the simulations," affirms Stoevesandt. "Each of the data matched well."

Altogether, the scientists examined the effects of wind farms within an approximately 1500 meter perimeter and an altitude of up to 500 meters. By comparison, the hub of the rotor is 123 meters in height. The finding: At the Linnich-Boslar landing field, the turbulence generated by the wind turbines is lower than the ordinary turbulence of the surrounding environment. Still, this finding can only be applied to other airports to a limited extent, because the surrounding terrain has a tremendous impact on the trail; unlike flat terrain, the trail is different where the landscape is forested or hilly. "The simulations would have to be commensurately adjusted for those kinds of airfields," says Stoevesandt.

Source: http://www.eurekalert.org/pub_releases/2012-08/f-wfa081312.php [1]

Source URL (retrieved on *09/01/2014 - 3:30am*):
http://www.ecnmag.com/news/2012/08/wind-farms-danger-ultra-light-aircraft

Links:
[1] http://www.eurekalert.org/pub_releases/2012-08/f-wfa081312.php