HOW TWO OF THE SOUTH'S MOST BELOVED EAGLES ARE MAKING TURBINES SAFER FOR ALL BIRDS

By Anna Claire Howard

Dennis Schroeder (NREL) / Southeastern Raptor Center at Auburn University

Spirit, a 20-year-old bald eagle, and Nova, a 17-year-old golden eagle also known as War Eagle VII, are famous in college football and the SEC for the pregame flights they make around Auburn University's Jordan-Hare Stadium on game days. Now, they're making strides in the wind energy industry.

The National Renewable Energy Laboratory (NREL), one of the

United States Department of Energy's 17 national laboratories, recently partnered with Laufer Wind LLC and Renewable Energy Systems Americas Inc. (RES) to gather data on avian flight patterns, which will help the companies develop technology for the industry to reduce bird collisions with turbines. The two eagles from Auburn University's Southeastern Raptor Center conducted 25 flights over the course of three days at the National Wind Technology Center (NWTC), a massive test center NREL operates just outside of

Marianne Hudson spins a lure as NREL's Jason Roadman and veterinarian Seth Oster release Nova from a lift during the study.

Boulder, Colorado. The ultimate goal of this research is to detect birds that are flying close to a wind turbine in enough time to stop the blades from spinning and to prevent a collision.

"While eagles are not endangered species, they are protected by law, and as our nation develops more sources of clean renewable power, we need to continue to protect our natural resources," said Tom Hiester, the

senior vice president of strategy for RES. "We offer the IdentiFlight visual detection system, which detects eagles at great distances so that we can shut down specific wind turbines that might be a risk to the bird. Precise and limited shutdowns protect both the eagles and the revenue from wind-generated electricity."

Last year, Laufer Wind held demonstrations at NREL to test a radar system that could detect and deter nearby aircraft by turning on navigation lights on wind turbines to forewarn pilots. However, early research was largely dependent on drones, and issues arose because their mechanical movements didn't sufficiently match the sporadic flight patterns of wild avian species.

This led Jason Roadman, a technical engineer and researcher for NREL, to pursue conducting similar research with a real bird, or in this case, raptor.

The first round of flight tests were conducted with the help of Houdini, a Peregrine falcon, and the Colorado Hawking Club to determine if this type of research was possible. After its success, RES joined NREL and Laufer Wind in a second round of testing and brought with it the IdentiFlight technology.

Unlike the radar technology, IdentiFlight is a visual camera-based detection system. In partnership with Boulder Imaging, experts in machine vision technology, RES developed a system of cameras that detects raptors at up to 1,000 meters, or 0.62 miles, from a wind turbine. At this distance, there is enough time to determine the identity of the eagle and for the wind turbine to come to a slow stop and protect the eagle from colliding with the rotating blades.

"We use stereoscopic cameras so that we can know the distance to the bird and its size, and if the bird is too close to a specific wind turbine, we can order only the turbine that poses a risk to the bird to be shut down," Hiester said. "In this way, IdentiFlight prevents a bird from striking a rotating turbine blade, and we limit the loss of wind-generated power."

Each IdentiFlight system consists of eight wide field-of-view cameras that continuously scan 360 degrees to detect eagle-sized objects moving in the environment. Algorithms determine if the moving objects are of interest, like if it's a bird, or if the object can be ignored, like if it's another rotating wind turbine blade, a tree, or an airplane. High-resolution stereoscopic cameras pointed at the bird can determine approximately 80 of its characteristics, including its size, color characteristics, and shapes to make a nearly instantaneous determination of location, flight trajectory, and whether or not the bird is an eagle.

"Obtaining permissions to construct new wind projects demands that the projects make maximum efforts to protect wildlife where impacts are likely," Hiester said. "With IdentiFlight, those impacts on eagles can be minimized and, perhaps, avoided altogether."

Throughout the duration of this project, Nova and Spirit were each equipped with a GPS logger to gather data before they flew among the NWTC's 14 turbines, and their flights were conducted at various angles in relation to the two detection systems, according to the DOE. By comparing the GPS data that was collected with the results from the two detection systems, developers will be able to better characterize the behavior of their detection algorithms and improve their analysis methods.

According to Marianne Hudson, the assistant director of raptor training and education at the Southeastern Raptor Center, the research required that the eagles fly from point A where an elevator lift hoisted them and the trainers up 100 feet in the air to point B where Hudson and Andrew Hopkins, another trainer from the Southeastern Raptor Center, were positioned with a reward in the form of food.

"Their flights in Colorado were similar to what is asked of them here at Auburn," Hudson said. "The location and terrain had changed, but what we asked the birds to do was fly to us over a distance for a reward, just as we do at home and on the football field."

Hudson said that while the eagles are trained to look for their trainers regardless of the location where they fly, they did have concerns about how they would behave in the snow — something rarely seen in Auburn, Alabama.

"We were worried that they may spook away from the feel of sinking into snow when they landed," Hudson said. "But we were able to take advantage of an unusual snowfall in north Alabama before we left for Colorado. We took the eagles to the snow and landed them in the snow cover, and they did not react at all. They seemed to know instinctively that snow is not something to be concerned about. We had no issues with landing them in snow, and I think it was us, the trainers, who struggled more with the snow and the cold. In addition to being Alabama birds, the eagles are designed for a Colorado habitat, so they were quite at home in the Colorado skies."

According to Roadman, the next step depends on the results of the data that was collected at the NWTC.

"While the number of bird strikes stemming from wind turbines is low, we in the industry hope to do everything we can to reduce them," Roadman said. "For those of us in this industry, I think we all agree if we're going to be a green industry, we need to be green the whole way, and that means protecting our wildlife." ⅄

For more information on this research, go to www.nrel.gov, www.vetmed.auburn.edu/raptor, or energy.gov. Further information on the avian detection technologies offered by Laufer Wind and RES can be found on the companies' respective websites.