Offshore Biological Radar

DEVELOPING A BUOY-BASED RADAR SYSTEM TO DETECT FLYING ANIMALS OVER OPEN WATER

BACKGROUND

In the United States, offshore wind energy is being developed, planned, or considered along the Atlantic and Pacific coasts, in the Great Lakes, and in the Gulf of Mexico. Offshore wind facilities may pose collision hazards for birds and bats or stimulate behavioral changes, such as avoidance or attraction in response to turbines. Detecting and monitoring flying animals in the vicinity of prospective wind farms is necessary to help scientists and regulators evaluate potential effects on bird and bat populations and to inform siting decisions or other mitigation measures.

Traditionally, baseline data on bird populations are collected during vessel or aerial surveys, but more information about flight behavior and abundance at wind development sites can be gained by deploying continuously-operating remote sensors for longer time periods than are achievable using remote surveys. However, deploying these sensors in open water is challenging, because most existing monitoring technologies require deployment from a stable platform. Data collection is further complicated because equipment must be weatherized to survive in an offshore environment and operate without interruption, but with limited availability of electrical power and opportunities for maintenance.

As a result of these technological challenges, the distribution and behavior of birds and bats over open water is poorly understood.

Developing new monitoring technology that can be deployed from a buoy would address these challenges and provide developers, regulators, and researchers with a flexible platform for collecting data on vertebrate abundance and behavior at many offshore locations without incurring the prohibitive costs of a jack-up barge or multi-season vessel surveys.

With funding from the Department of Energy's (DOE) Wind Energy Technologies Office, Pacific Northwest National Laboratory (PNNL), and the United States Geological Survey (USGS) are partnering to develop a radar system capable of measuring bird and bat abundances and behaviors at offshore locations.

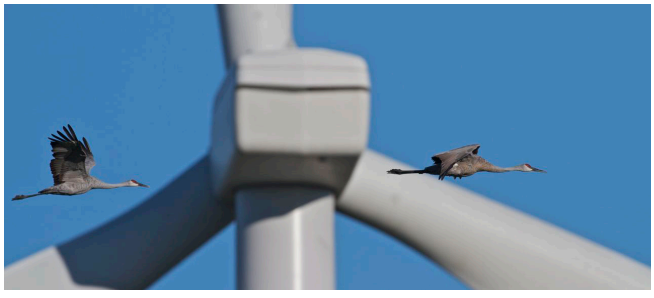
Radar antenna adjacent to a wind turbine (Photo by United States Geological Survey)

RESEARCH AND DEVELOPMENT

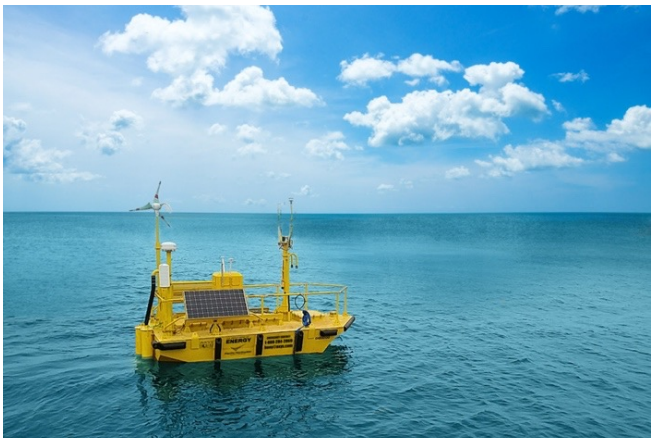
Radars developed for biological applications have long been used for the detection and monitoring of birds and bats in terrestrial settings and offer a promising solution for similar applications in offshore environments. Radar offers long-range remote monitoring capabilities beyond that of many optical or acoustic sensing solutions and can collect survey data over a distance of several kilometers from a single sampling location. With the appropriate sampling strategy and analytical approach, radar can record the flight height, speed, direction, geographical location, and general type of flying animals within its detection range (for example, between categories of large vertebrates, small vertebrates [birds or bats], and invertebrates).

Realizing the advantages of biological radar from floating platforms, particularly buoys, to collect pre-construction data for offshore wind development requires overcoming a number of technical challenges, including:

- Identifying and mitigating noise in the radar data due to sea surface motion and sea spray, also known as sea clutter
- Discriminating among different types of flying animals, particularly between insects and vertebrates like bird and bats
- Compensating for platform motion
- Ensuring adequate power availability through careful component selection and power management
- Weatherizing equipment and improving operational reliability
- Enabling reliable communications between the buoy and onshore personnel



Cranes flying near wind turbine. (Photo by J. Bartholmai)



Department of Energy lidar buoy deployed off the coast of California (Photo by: AXYS Technologies, Inc.)

PNNL and USGS are working together to address these challenges and develop, validate, and deploy a radar system capable of detecting and monitoring flying animals over open water. The team has partnered with the **University of Oklahoma Advanced Radar Research Center**, who is providing technical support by modeling the radar signal and developing software to mitigate sea clutter. Ultimately, the developed radar system will be integrated with one of **DOE's lidar buoys** for testing and deployment. The technology will be compared to other bird and bat monitoring technologies, including **thermal cameras**, acoustic monitors, weather radar (NEXRAD), and human observers.

Ultimately, the team aims to develop a radar and buoy system capable of monitoring bird and bat activity at offshore wind sites and validate its performance with an initial deployment of the buoy in open water.

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