Results Summary

Technology Innovation Program Test of DTBird
September 17, 2018

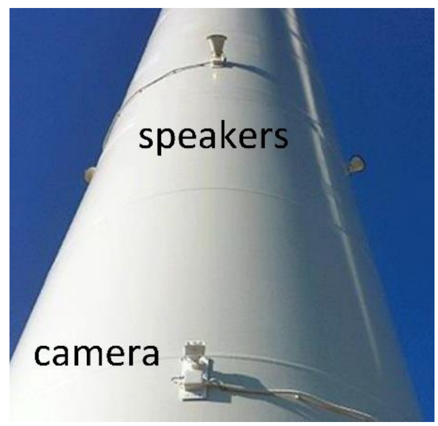
AWWI's Technology Innovation program contracted with H. T. Harvey & Associates to conduct an independent evaluation of the DTBird detection/deterrence system. This pilot test used eagle-like unmanned aerial vehicles (aka, drones) and *in situ* large raptors to evaluate DTBird's ability to detect and deter large raptors, particularly golden eagles, and reduce the risk of collisions of these birds with wind turbines.

View the full report at www.awwi.org/resources/dtbird-technical-report/.

ABOUT THE TECHNOLOGY

DTBird is designed to detect birds and deter them from flying into the rotor-swept zone of an operational wind turbine. The system is mounted on the turbine tower and includes two main components:

1. A camera/video-based *detection module* designed to detect and track moving birds and estimate the distance to them based on the known size of the target bird species and how many pixels a bird of that size should occupy at different distances from the camera.
2. A *deterrence module* (i.e., speaker set) that emits two audible signals: first, a warning sound when the system estimates that a detected flying object has crossed a calibrated distance threshold, then a stronger dissuasion sound if the system estimates that the tracked object crosses a second, closer distance threshold.



KEY TAKEAWAYS

- In this test, DTBird **successfully detected 63% of drones** being used as surrogates for eagles. The system's ability to detect drones appeared to be reduced by sun glare and other variables.
- The **deterrence rate for golden eagles in response to the warning/dissuasion signals was at least 52%**, and as high as 83% with the inclusion of "potential successes." In many cases, responses from raptors were unclear.
- The system produced a **large number of false-positive detections** (i.e., not large birds). Also, detections occurred at closer and farther distances than expected. Both outcomes resulted in **unnecessary deterrent signaling**, which could adversely affect non-target wildlife and disturb facility neighbors and staff.

NEXT STEPS

AWWI is conducting additional testing in 2018-2021 on DTBird with funding from the U.S. Department of Energy after upgrades are made to the system. Additional tests will focus on assessing the following factors at multiple sites over a longer time period:

- Evaluating deterrence through controlled experiments looking at responses of *in situ* raptors
- Further evaluation of factors affecting false-positive detection rates
- Modeling the probability of detection and deterrent-triggering at expected distances

STUDY DESIGN

DTBird's performance was measured at seven nonoperational turbines over a 9-month period in 2016-2017. Four video cameras and four speakers were mounted to the turbine towers

To evaluate the probability of detection, researchers conducted flight trials using two eagle-like drones as surrogates for eagles. Each drone carried onboard electronics that provided high resolution GPS tracking data.

To evaluate the probability of deterrence, researchers analyzed DTBird video footage of *in situ* birds and evaluated the behavioral responses of birds identified as raptors to the warning and dissuasion signals. Deterrence was considered successful if a bird's flight path diverged more than 15° and away from the rotor-swept zone within 5 seconds of a warning or dissuasion signal.

Statistical models were developed to evaluate how several variables, including flight characteristics and environmental conditions, influenced the distance at which DTBird detection and deterrent systems were triggered.

Researchers estimated the probability of collision-risk reduction for golden eagles by multiplying the probability of detecting an eagle-like drone by the estimated probability of deterrence based on video records of eagle behavior.

STUDY RESULTS

Researchers found a 63% average probability of DTBird detecting a drone. A total of 12,805 individual detection events were recorded. Researchers attempted to identify 5,079 of the detected objects. Of these, 30% were false positives (e.g., not large birds). Eighty percent of these false detections triggered one or both deterrent signals.

The successful deterrence rate for golden eagles was 52%. When *potential* successful deterrence events were added, the deterrence rate for golden eagles increased to 83% (*potential success* is defined as a reaction that researchers were not confident was solely a response to the signal). The deterrence rate was at least 30–40% for other raptors.

Based on this study, the likely range of DTBird in deterring golden eagles from entering the collision risk zone of individual turbines is 33–53%.

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