U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Evaluating the Effectiveness of a Detection and Deterrent System in Reducing Golden Eagle Fatalities at Operational Wind Facilities

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American Wind Wildlife Institute

FY17-FY18 Wind Office Project Organization

"Enabling Wind Energy Options Nationwide"

Technology Development	Market Acceleration & Deployment
Atmosphere to Electrons	Stakeholder Engagement, Workforce Development, and Human Use Considerations
Offshore Wind	Environmental Research
Distributed Wind	Grid Integration
Testing Infrastructure	Regulatory and Siting
Standards Support and International Engagement	
Advanced Components, Reliability, and Manufacturing	

Analysis and Modeling (cross-cutting)

Project Overview

Evaluating the Effectiveness of a Detection and Deterrent System in Reducing Golden Eagle Fatalities at Operational Wind Facilities

Technology Summary: DTBird is a turbine-mounted system for automated bird (optical) detection and (acoustic) deterrence. Multiple cameras and speakers mounted on each turbine work in concert with on-site software to determine when an eagle crosses pre-determined distance thresholds, triggering sounds to either alert or dissuade the eagle from collision risk zone of a wind turbine.

Period of Performance: June 1, 2017 – May 2022

Technology Impact: DTBird's use of visual cameras and image analysis combined with an activity activated deterrence system offers potential solutions to many of the challenges found with other methods for reducing eagle collision risk. If proven effective, DTBird could be installed in place of informed curtailment programs at wind facilities seeking to reduce eagle collisions, thereby reducing eagle collision risk and costs to project operators.

Project Goals: Evaluate the effectiveness of the DTBird system in minimizing the risk of golden eagles colliding with wind turbines

Partners:

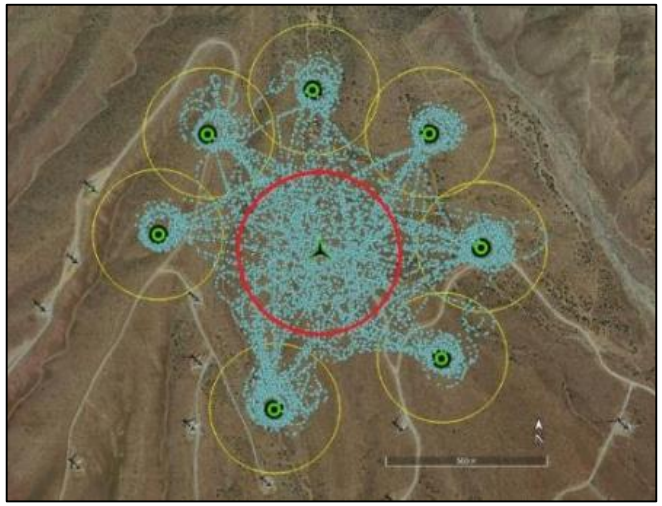
- American Wind Wildlife Institute (**AWWI**), HT Harvey & Associates (**HTH**), Liquen Consultoria Ambiental, Avangrid Renewables LLC, PacifiCorp

Technical Merit and Relevance

- Evaluate and improve a detection/deterrent system designed to reduce risk to eagles without increasing curtailment
- Multi-year, multi-site evaluation of DTBird's capabilities provide robust quantification of collision risk reduction for eagles
- 3rd party, peer-reviewed findings better inform the application of DTBird (as appropriate) in regulatory settings

Approach and Methodology

- Develop merit-reviewed study design
- Full-scale evaluations at two wind facilities (CA, WA) with two-year field study, informed by AWWI pilot test
- UAV flight trials to evaluate detection and deterrent-triggering capabilities against spatially and temporally explicit targets
- Further estimate the effectiveness of eagle risk reduction by evaluating *in situ* eagles' behavioral responses to DTBird deterrents



Approach and Methodology

- Two-year controlled experiment at WA site to evaluate deterrent-triggering rates by *in situ* raptors at muted vs unmuted DTBird-equipped turbines
- Analysis of false positives and false negatives detections at regionally distinct sites with multi-year datasets
- Analysis of flight, landscape, and weather characteristics on DTBird performance
- Comparative systems cost analysis

Accomplishments and Progress

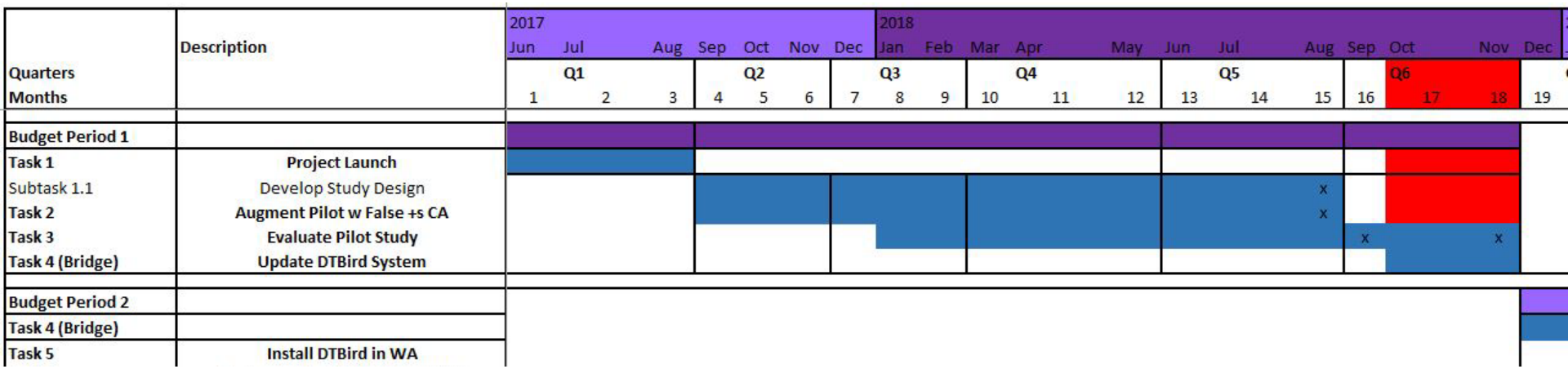
MILESTONES

- Study design submitted and Merit Reviewed- final revisions underway as of September 2018 ☑
- Quantitative Performance Targets Established ☑
- Provided recommendations for system updates to Liquen (DTBird vendor) ☑
- Evaluated false positives using data from pilot study ☑
- Identified alternative host site after initial site was deemed flawed in NEPA process

Accomplishments and Progress

- Updates to DTBird system underway
- Procurement contract with Liquen complete
- Preparing for analysis of 2018 data from CA site
- Preparing for UAV flight trials at WA site

Accomplishments and Progress



- **Slipped milestones and schedule**

  Merit-review of study design extended

  – In Original SOPO, study design scheduled for completion August 2017.
  – Draft study design was submitted January 2018.
  – In-person Merit Review took place on April 2018.
  – The final study design was submitted in July 2018, approved November 2018.
  – Delays due to extended Award Negotiations, relocation of project to new host site, and delays in coordination among peer reviewers

  Installation of DTBird at Washington site

  – 2-3 month delay in installation of DTBird due to logistics/procurement pushed back field work

Communication, Coordination, and Commercialization

- AWWI/HTH will submit completed manuscripts for publication in peer-reviewed journals
- AWWI/HTH will present results of study at national conference(s) such as NWCC Research Meeting
- As part of AWWI's Education & Outreach initiative, we will present peer-reviewed study results to relevant industry, conservation, and regulatory stakeholders through webinars, conference, and in-person presentations.
- Liquen will use study results to demonstrate performance to potential customers and further improve DTBird's performance
- Inform the appropriate use of DTBird to satisfy requirements of Eagle Conservation Plans

Upcoming Project Activities

- **Go/No Go Decision Point- October/November 2018**

  Successful development of merit-reviewed study plan and initial quantification of false positives and negatives based on pilot study? Received "Go" November 2018.

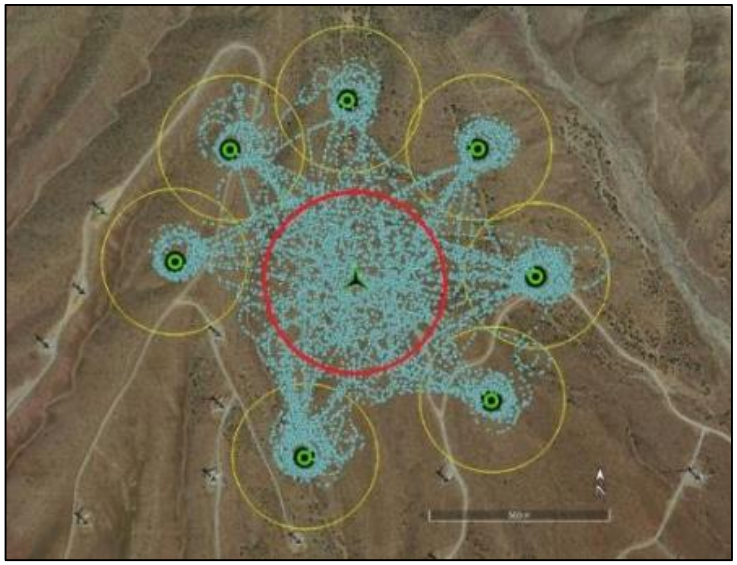
- ☑ – Successful development of merit-reviewed study design
- ☑ – Determine whether updates to DTBird system can be made prior to field study
- ☑ – Initial quantification of false positives, false negatives, and estimate of collision risk reduction
- ☑ – Adhere to schedule, budget, deliverables, quality of work
- ☑ – Evaluation of technical performance goals

Upcoming Project Activities

- The Project is on track to accomplish study objectives
- Schedule has been adjusted to accommodate technical setbacks and to allow for comprehensive data analysis for Go/No Go report and for final report
- Budget is on target:
  - DOE provided additional budget in Budget Period 1 to account for out-of-scope work
  - Cost of procurement and licensing of DTBird higher than budgeted
  - AWWI added cost share and trimmed budget in other areas to accommodate increased costs
  - Continued negotiations with Liquen to lower licensing fees
- Project is relevant regardless of marketplace changes as an evaluation of audio deterrents as a strategy for minimizing risk to eagles at wind energy facilities

Upcoming Project Activities

- Budget Period 2 – December 2018 – September 2020
  - Install DTBird at WA site
  - Analyze DTBird detection/deterrence Conduct UAV flight trials
  - Expand analysis of behavioral responses of *in situ* raptors to DTBird deterrent signals at CA site to leverage prior analysis in the pilot study
  - Analyze false positives and false negatives at WA site
  - triggering responses
  - Conduct first year of controlled experiment at WA site



Upcoming Project Activities

- Budget Period 3 – October 2020 – May 2022
  - Conduct 2nd year of controlled experiment and analyze results
  - Evaluate behavioral responses of *in situ* raptors to DTBird deterrent signals at WA site
  - Combined multi-site analysis
  - Systems Cost Analysis
  - Complete report, publish manuscript(s)