NREL
Transforming ENERGY

# Evaluating Deterrent Stimuli for Increasing Species-specific Effectiveness of an Advanced Ultrasonic Deterrent

NWCC Webinar
17 March 2020

# Project Team

NRG Systems

Texas State University
The rising STAR of Texas

Bowman Consulting

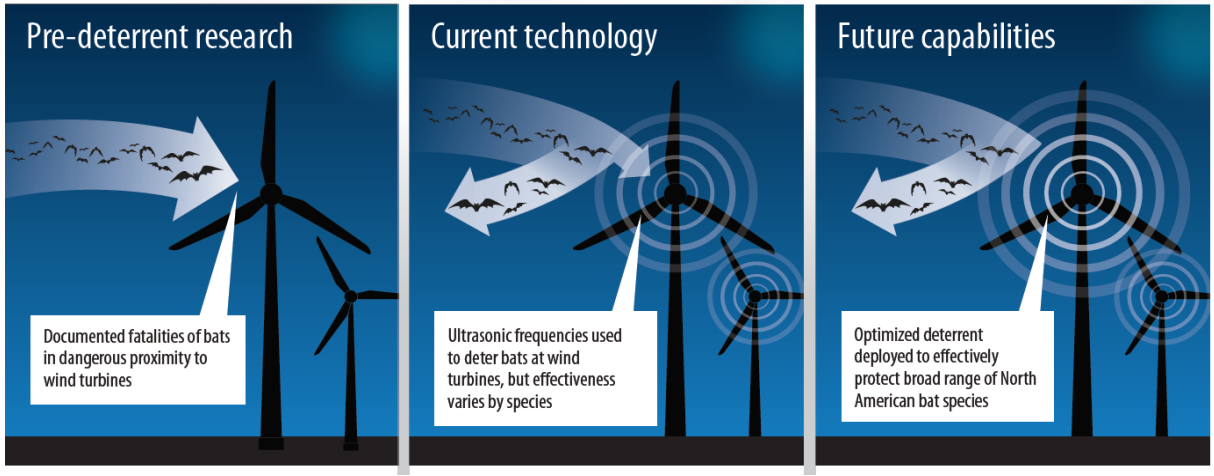
TCU

batcon.org
Bat Conservation International

NextEra Energy Resources

**Wildlife Imaging Systems**

# Project Goal



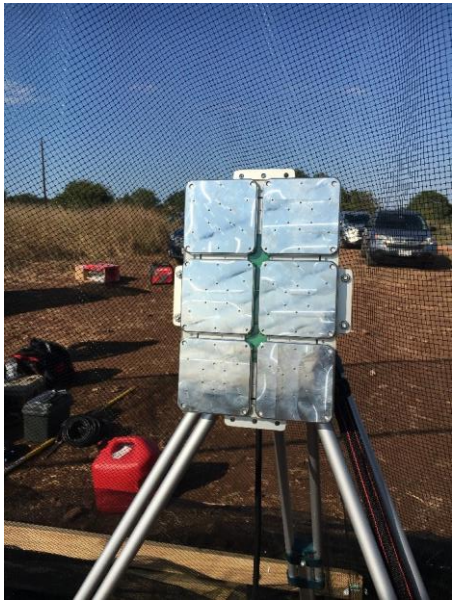

- Understand how bats are responding to ultrasonic acoustic deterrents (UADs) & improve the effectiveness of UADs for as many species as possible

Hoary bat (Photo by Cris Hein)

Silver-haired bat (Photo by Cris Hein)

# Project Objectives

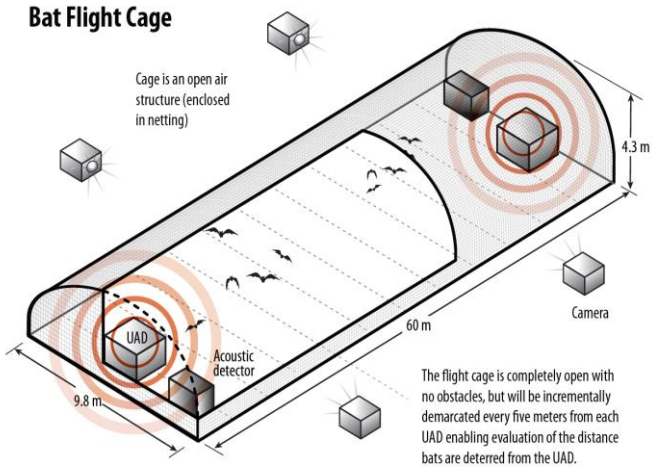
- Quantify the relationship between bats & sound pressure level (SPL) at different frequencies
  - ‘Low’ frequency (20–32 kHz)
  - ‘High’ frequency (38–50 kHz)
  - ‘All’ frequency (20–50 kHz)
- Observe potential seasonal differences in behaviors (i.e., spring vs. autumn)
- Determine whether bats change their echolocation characteristics in the presence of deterrent signals



NRG System’s deterrent (Photo by Brittany Stamp)

# Methodology

- ‘Open air’ flight cage
  - 60 m x 9.8 m x 4.3 m




Project team assembling the flight cage at Texas State University (Video by Rob Tyler)

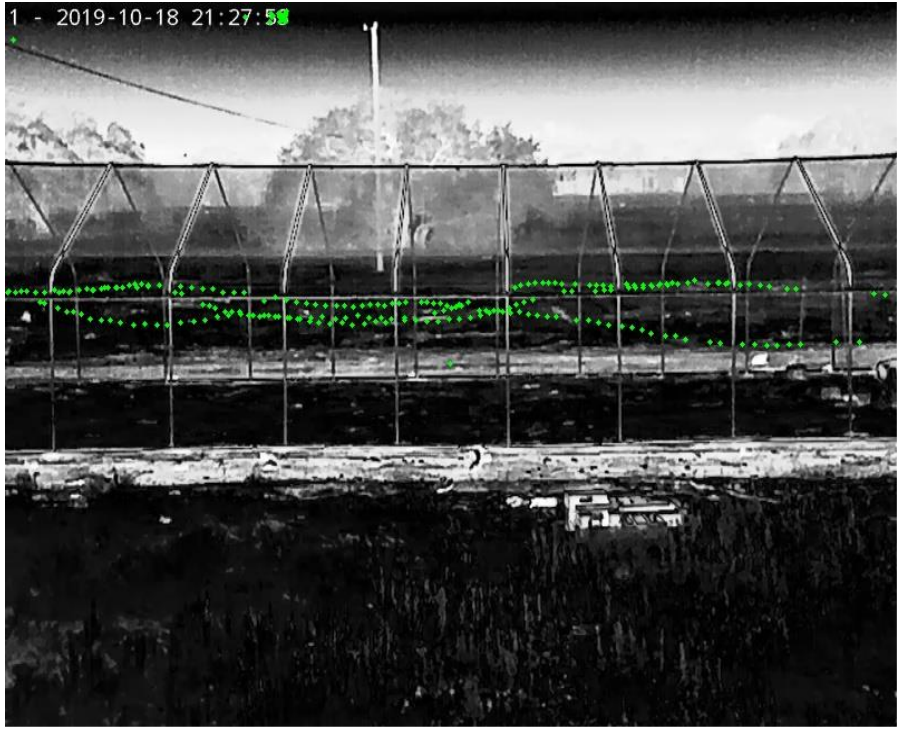
# Methodology

- Use thermal video cameras & acoustic detectors to record flight & echolocation behavior between control & treatment conditions
- Randomize treatments
- Randomize deterrent signal location

| Session | Time (minutes) |
|---|---|
| Control | 4 |
| Treatment 1 | 4 |
| Control | 4 |
| Treatment 2 | 4 |
| Control | 4 |
| Treatment 3 | 4 |
| Control | 4 |

# Preliminary Trials

- Initiated autumn 2019
- Conducted trials
  - 30 cave myotis (*Myotis velifer*)
  - 12 Brazilian free-tailed bats (*Tadarida brasiliensis*)
- Fine-tuning tracking software to output quantitative data
- Spring 2020
  - Tricolored, eastern red & evening bats




Bat flight track (Image by Brittany Stamp)

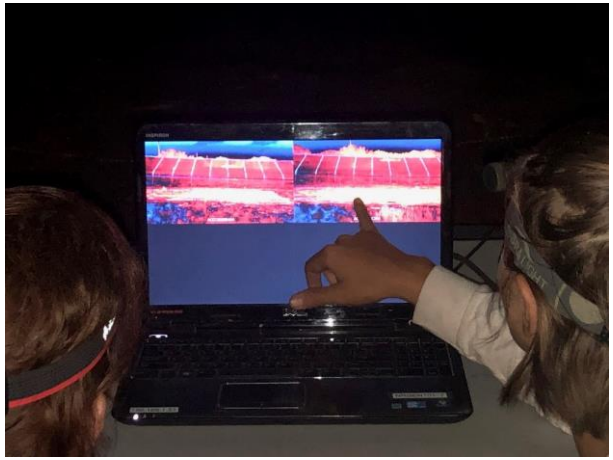
# Anticipated Outcomes

- Response among treatments
  - Do ‘high-frequency’ bats respond to ‘low-frequency’ deterrent signals?
- Shifts in echolocation
  - Do bats shift the frequency of their calls to get ‘outside’ the deterrent signal?
- Importance: May allow UADs to focus on ‘low-frequency’ signals

Fringed Myotis (Photo by Cris Hein)

# Anticipated Outcomes

- Relationship between SPL & distance
  - Importance: Provides a SPL to target that will deter bats the length of the blade
- Response between spring & autumn
  - Importance: Studies conducted in spring may not be applicable OR we can pool data across seasons
- **Big Caveat:** study conducted in a flight cage without the potential attraction of a wind turbine



Graduate students reviewing thermal video (Photo by Sarah Fritts)

# Next Steps

- 2020: Spring season suspended. Resume testing in autumn
- 2021: Report results
- 2021+: Continue using the flight cage to investigate additional treatments that further enhance the effectiveness of deterrents

Western red bat (Photo by Cris Hein)

# Acknowledgements


- This material is based upon work supported by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) under the Wind Energy Technology Office Award #DE-FOA-0001924-1535


- https://www.energy.gov/eere/wind/environmental-impacts-and-siting-wind-projects

Brazilian free-tailed bats (Photo by Cris Hein)

# Thank you

**www.nrel.gov**

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by U.S. Department of Energy Office of Energy Efficiency and Renewable Energy. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

NREL
Transforming ENERGY