Integrated, Real-Time, Multi-Scale System for Monitoring Avian Interactions with Offshore Wind Energy Technologies

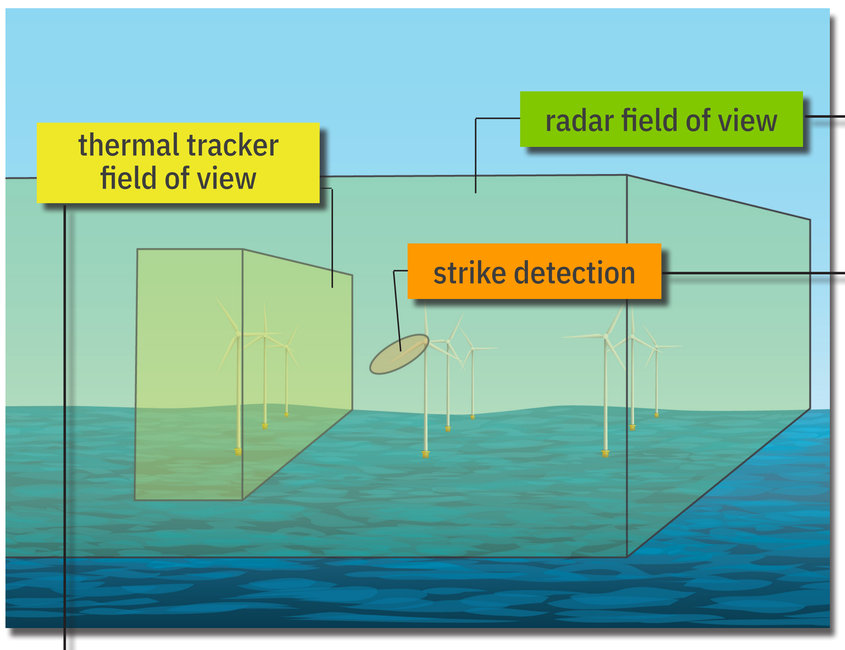
Grace Chang, Frank Spada, Michael Macrander, *Integral Consulting*; Sharon Kramer, Stephanie Schneider, *H.T. Harvey & Assoociates*; Shari Matzner, *PNNL*; Jesse Lewis, *DeTect, Inc.*; Lawrence Cheung, Myra Blaylock, Evan Anderson, *Sandia National Laboratories*; Charles Seeley, *GE Vernova*; Marcus Chevitarese, *Sightir, Inc.*; Eric Bodnar, *Velvetwire*

CHALLENGE

Knowledge of avian interactions with offshore wind technologies over multiple scales is a critical knowledge gap.

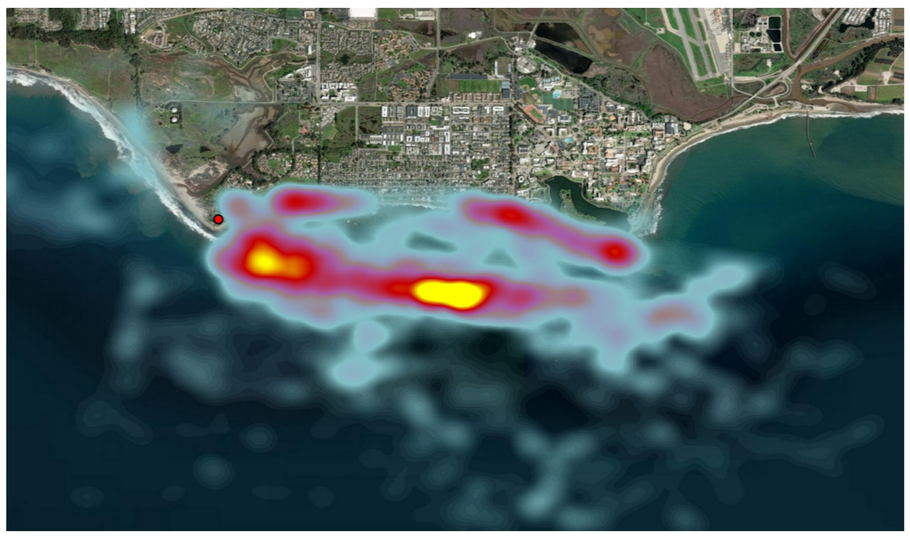
SOLUTION

Integrated real-time sensing technologies across macro-, meso-, and micro-scales to improve wildlife monitoring and bird and bat collision risk model-based forecasting.



MACRO-SCALE

Marine S-band, pulsed Doppler 3-dimensional radar systems provide presence/absence, relative abundance, passage rate, flight height, and flight direction to 2–3 km range at 360° and 6–8 km range at 90°.



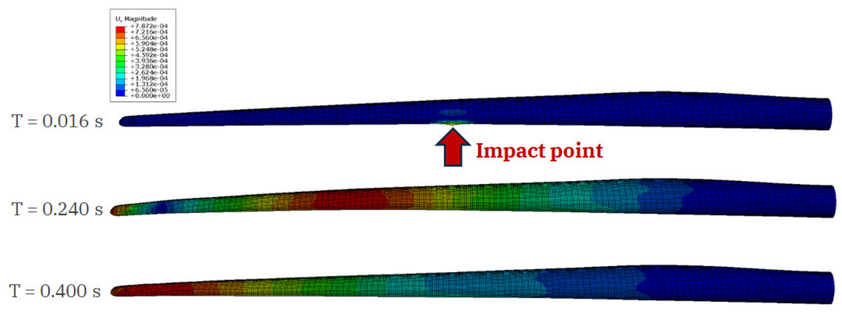
Heat map of 20 minutes of radar detections of birds off coastal California.

Radar tracking of birds and drone-simulated bird flight at around 4–4.5 km from the radar.

- *Drone flight path*
- *Radar detections of the drone*
- *Detections of real birds, primarily pelicans, gulls, and cormorants*

MICRO-SCALE

Structural health monitoring system to detect and characterize blade strike events; informed by models, calibrated and validated on actual blades.

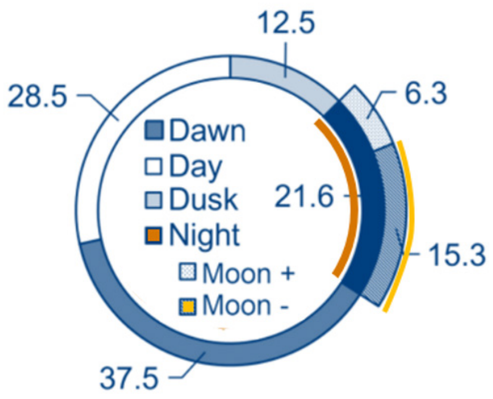


Transient impact displacement response to a finite element analysis model simulation of a 1 kg object striking the leading edge of the IEA-15 MW reference turbine blade.

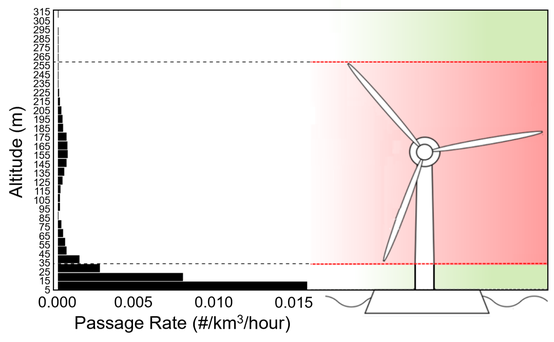
MESO-SCALE

ThermalTracker-3D (TT3D) flight trajectory with feature extraction for species-level identification based on shape, size, and flight behavior.

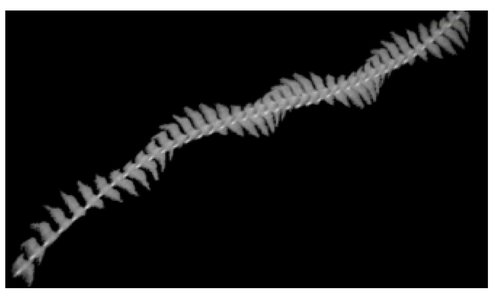
Bird activity recorded by the TT3D while deployed offshore California for 3 months:



Daily distribution



Flight height distribution



Bird flight composite

Reference: Schneider, S.R., S.H. Kramer, S.B. Bernstein, S.B. Terrill, D.G. Ainley, and S. Matzner. 2024. Autonomous thermal tracking reveals spatiotemporal patterns of seabird activity relevant to interactions with floating offshore wind facilities, *Front. Mar. Sci.* 11. https://doi.org/10.3389/fmars.2024.1346758

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Grace Chang, Ph.D.
Integral Consulting Inc.
831.576.2881
gchang@integral-corp.com