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School of Mechanical, Industrial & Manufacturing Engineering

Blade-Strike and Birds Detection for Offshore Wind Turbines

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California Offshore Renewables Environmental Regulatory Workshop

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Motivations of Our Research

Motivations

System Overview

Bird Detection

Blade Strike

Conclusions

Thanks

- Inspired by previous funded project FOA DE-FOA-0001554:

A Synchronized Sensor Array for Remote Monitoring of Avian and Bat Interactions with Offshore Renewable Energy Facilities

- Enable automatic **blade-strike detection** including event images storage in **OFFSHORE** environment
- Decrease **uncertainty** in statistics of birds/bats fatalities
- Support sites **permitting** and wildlife monitoring

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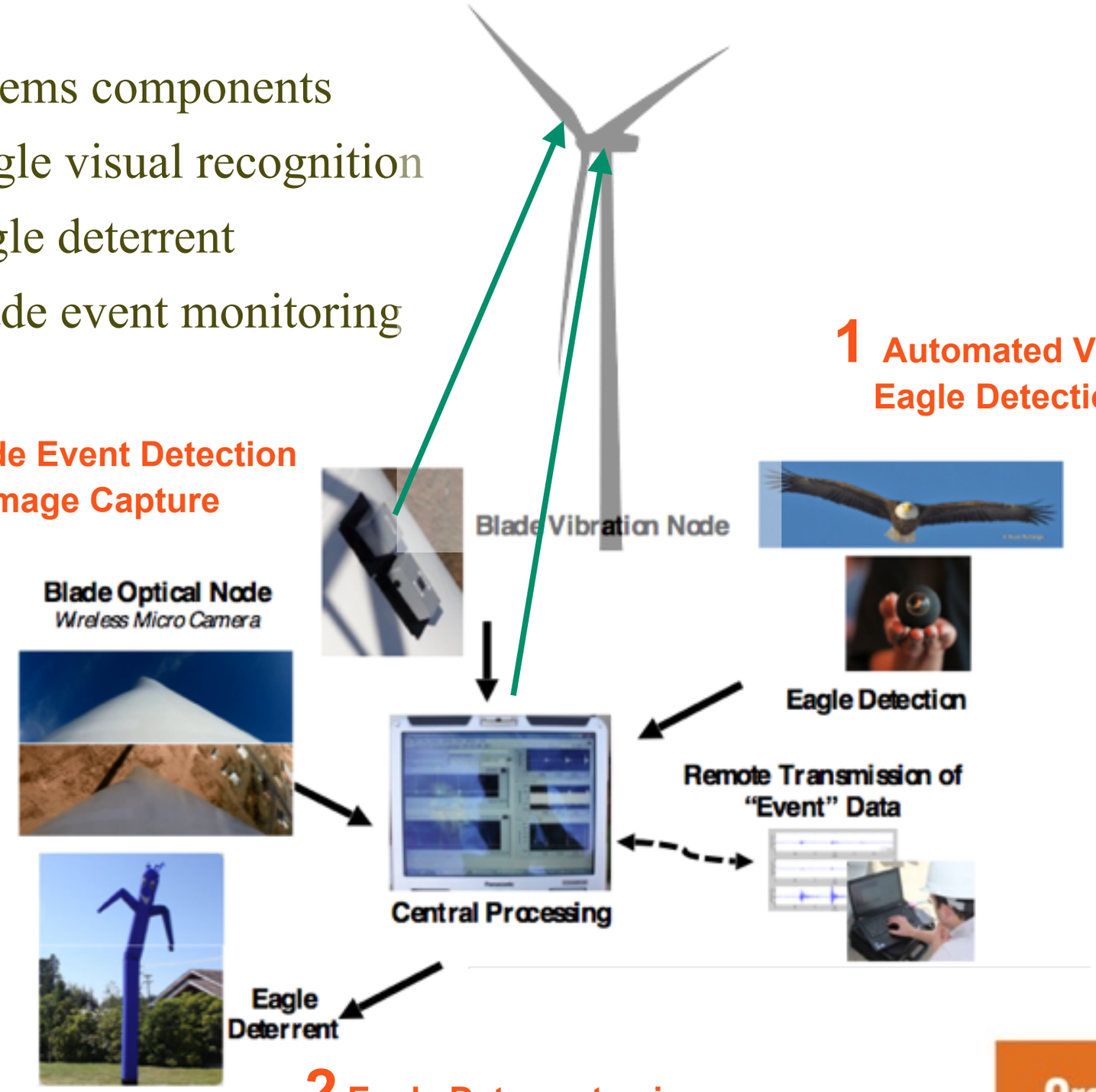
- Subsystems components
  - Eagle visual recognition
  - Eagle deterrent
  - Blade event monitoring



1 Automated Visual Eagle Detection

3 On-Blade Event Detection and Image Capture

2 Eagle Deterrent using Anthropomorphic Kinetic Figure

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Sensors Overview

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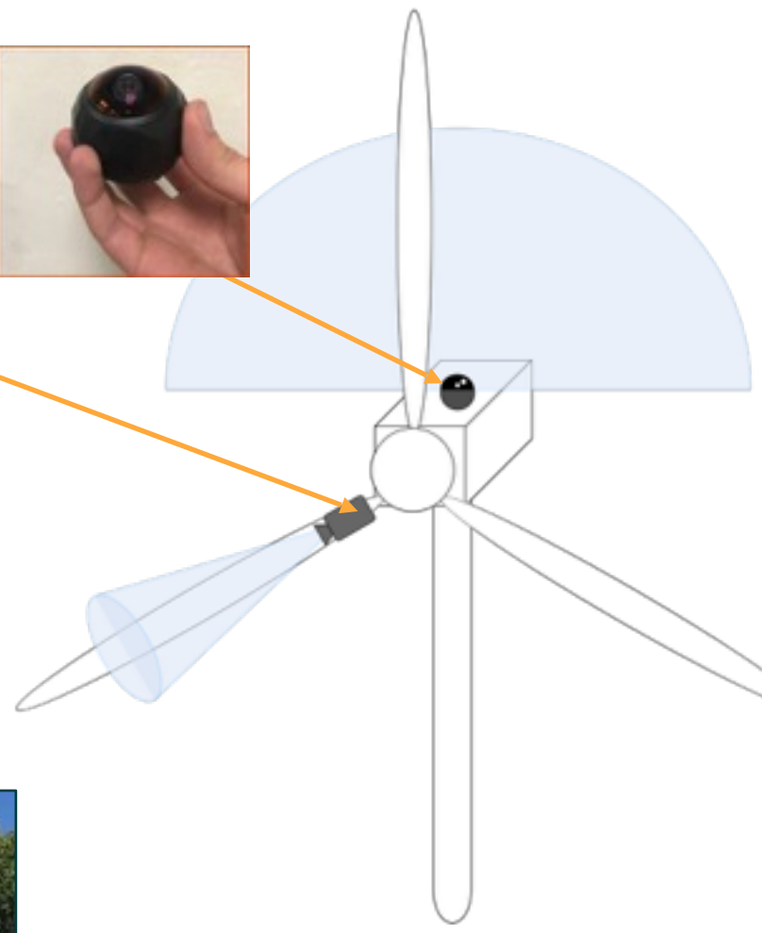
- 360 Cameras mounted on nacelle
- On-blade unit
- Visual Deterrent



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Eagle Detection Vision

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- 360^0 FOV camera mounted on top of turbine
- Training videos: **WALTER**, High Desert Museum, Bend, OR

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On-blade Unit

- **ON BLADE** mounted unit
- Accelerometers + Contact Microphone = Event Detection
- On-board computing for event classification
  - Event **confirmation** is NEEDED
  - Triggered Image Capture = Impact Identification

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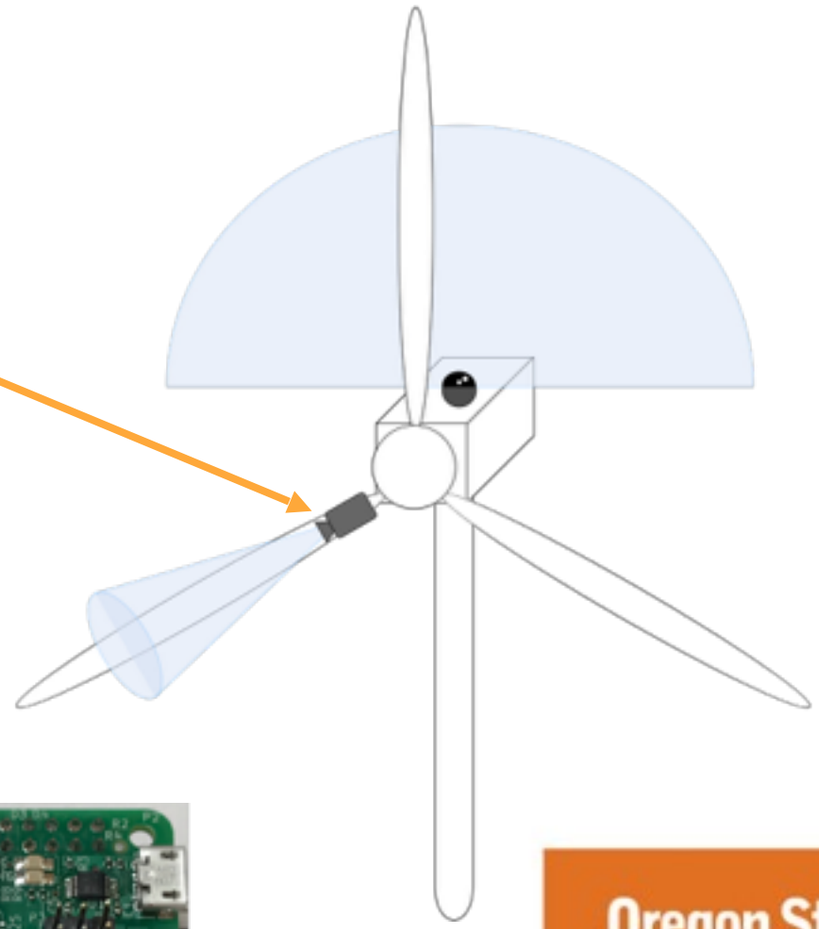

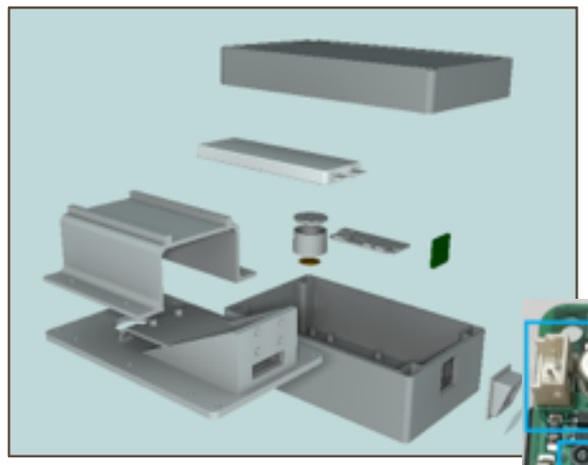

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Synchronized Sensors

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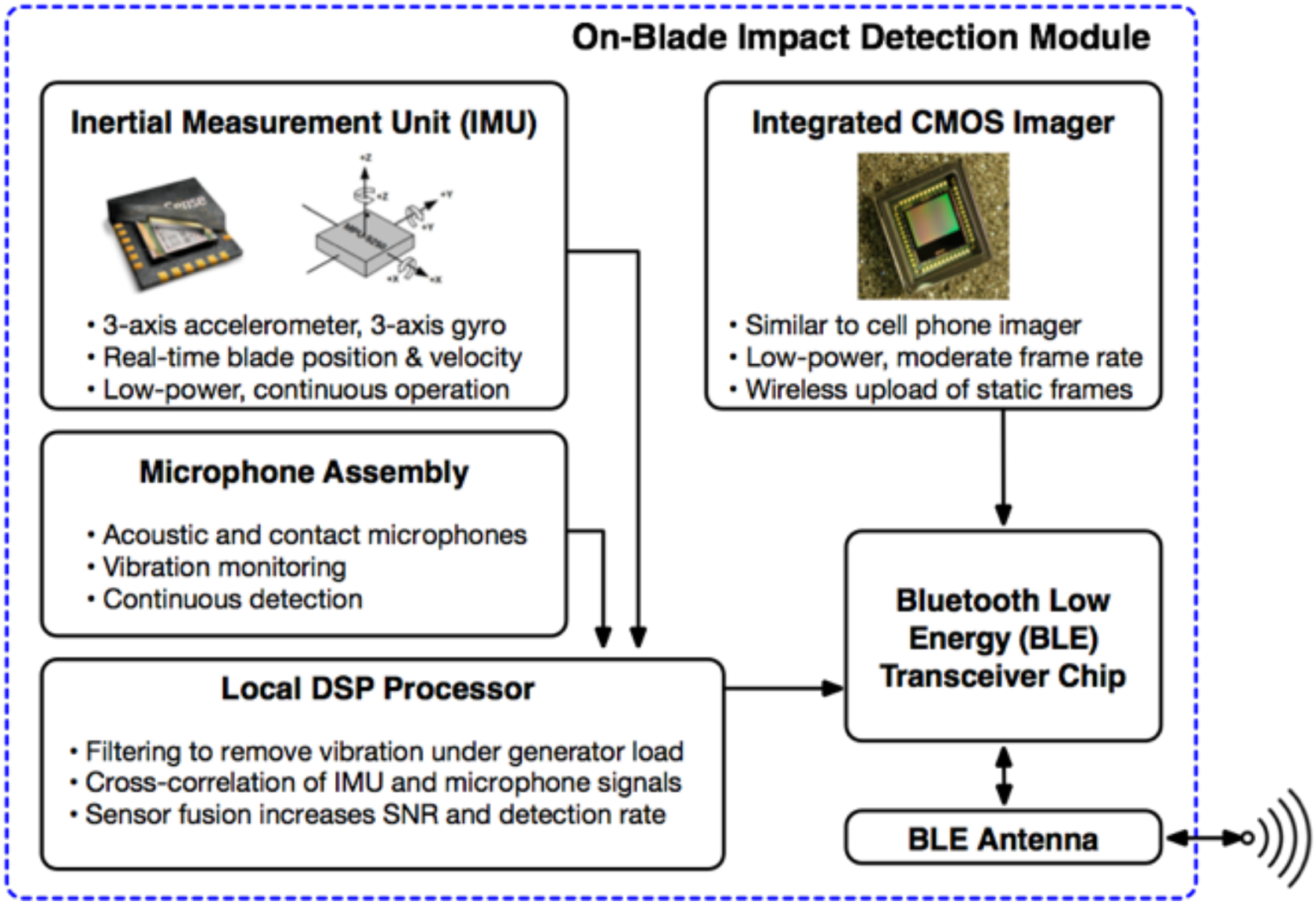

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Experimental Results: Strike on Blade

- Background noise and ONE blade hits **tennis ball** (57 g)
- Microphone detect impact from all three blades

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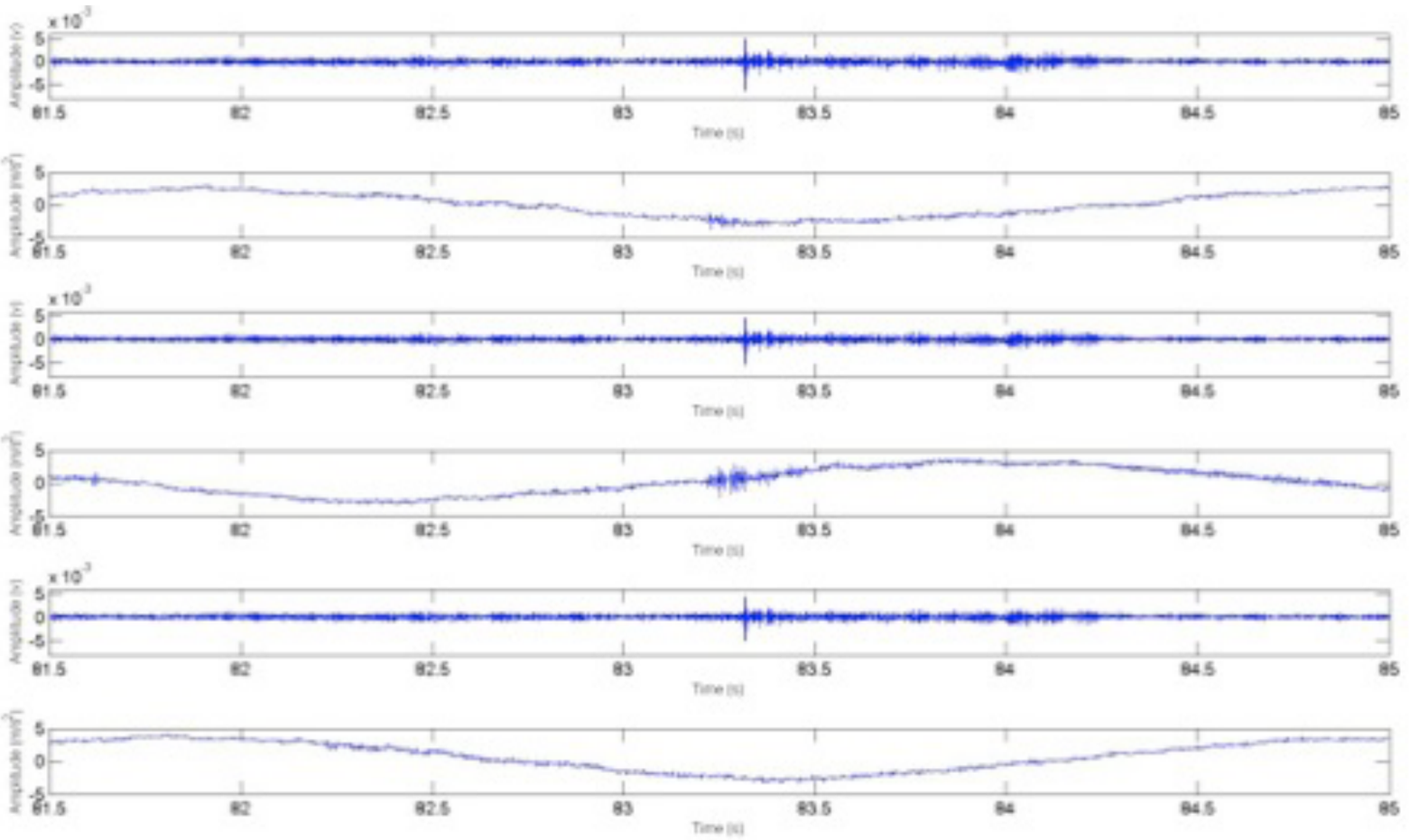

Accelerometers & Contact Microphones – 3 blades

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On-blade Camera View

- Micro-wireless camera
- Event identification and specie recognition
  - CRITICAL
    - For **specie** recognition
    - Event **confirmation**

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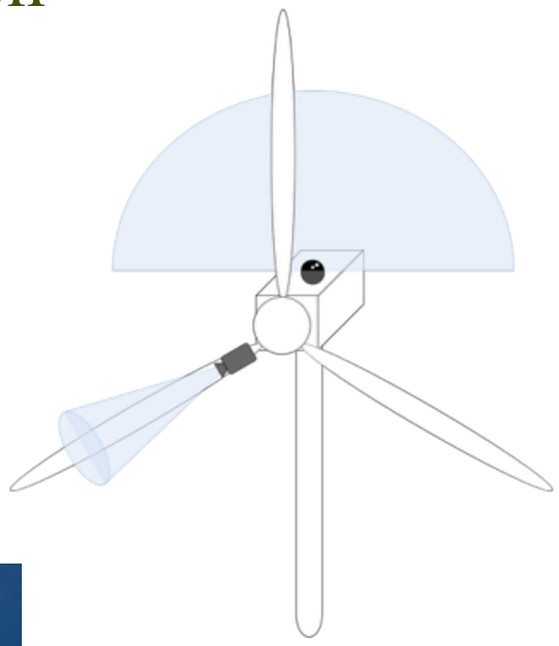

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- A multi-sensors system for automatic
  - Birds **detection**
  - Birds **deterrence**
  - **Automatic blade-strike** event monitoring
- is in advanced experimental phase

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Team members and collaborators:

- Dr. Matthew Johnston, Dr. Sinisa Todorovic, OSU
- Kyle Clocker, Peng Lei and Will Maurer, OSU Graduate Students
- Manuela Huso and Dr. Todd Katzner US Geological Survey
- US Fish & Wildlife Service
- NREL, National Wind Technology Center, Boulder, CO

SPECIAL collaborators:

- High Desert Museum, Bend, OR
- Joe and Cordi Atkinson, Vale, OR

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Questions ?

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Wireless Network Topology

- Wireless communication
  - Blade-unit and turbine nacelle
  - Eagle detection on turbine with ground-based system
    - Bluetooth low energy (BLE) for short range
    - Long-range RF for nacelle mounted module

Outline

Wind Energy

Birds, Raptors

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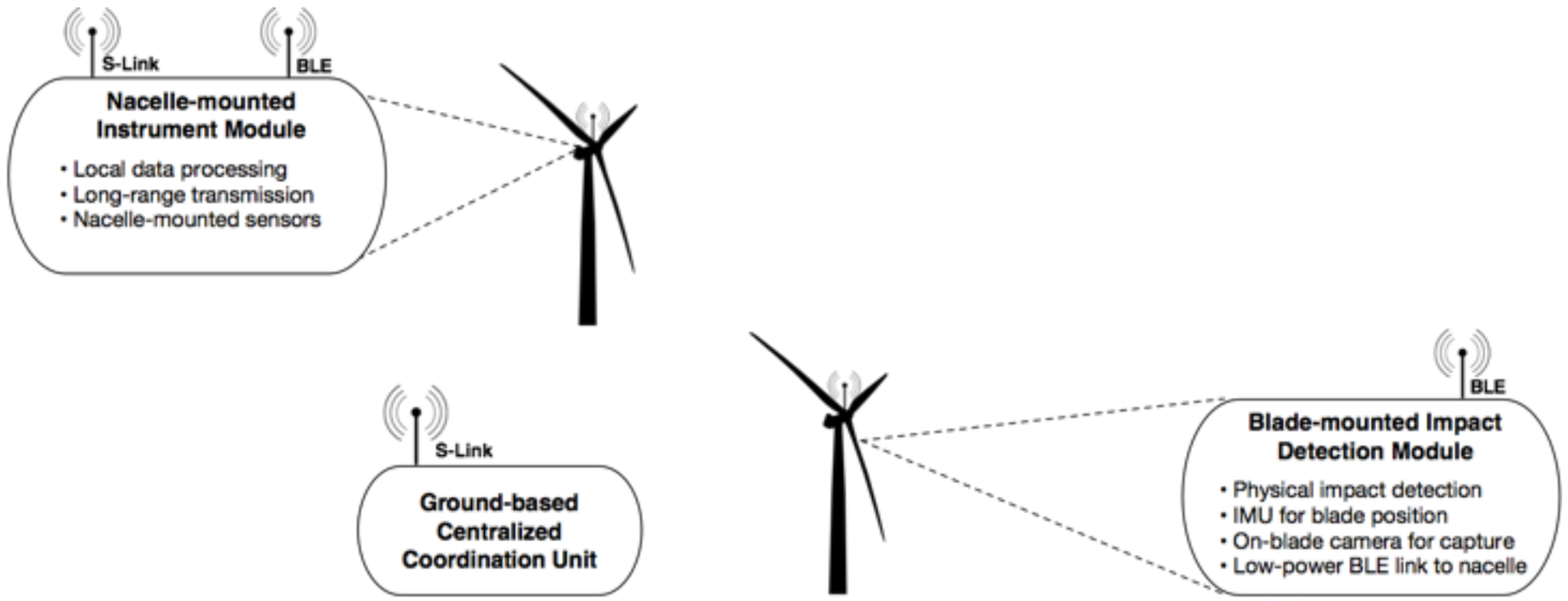

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