

# New Technologies for Offshore Wind Wildlife Studies



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# Normandeau Associates

- Biological consultants specializing in natural resource issues
- 16 offices, ca. 250 employees in U.S.
- Wind-wildlife specialists concentrated in Gainesville, FL office, which was “Pandion Systems,” until recently acquired
- Full range of wind-wildlife research and consulting services, known for bat and bird scientific expertise, offshore wind-wildlife research, ReBat™ bat monitoring system



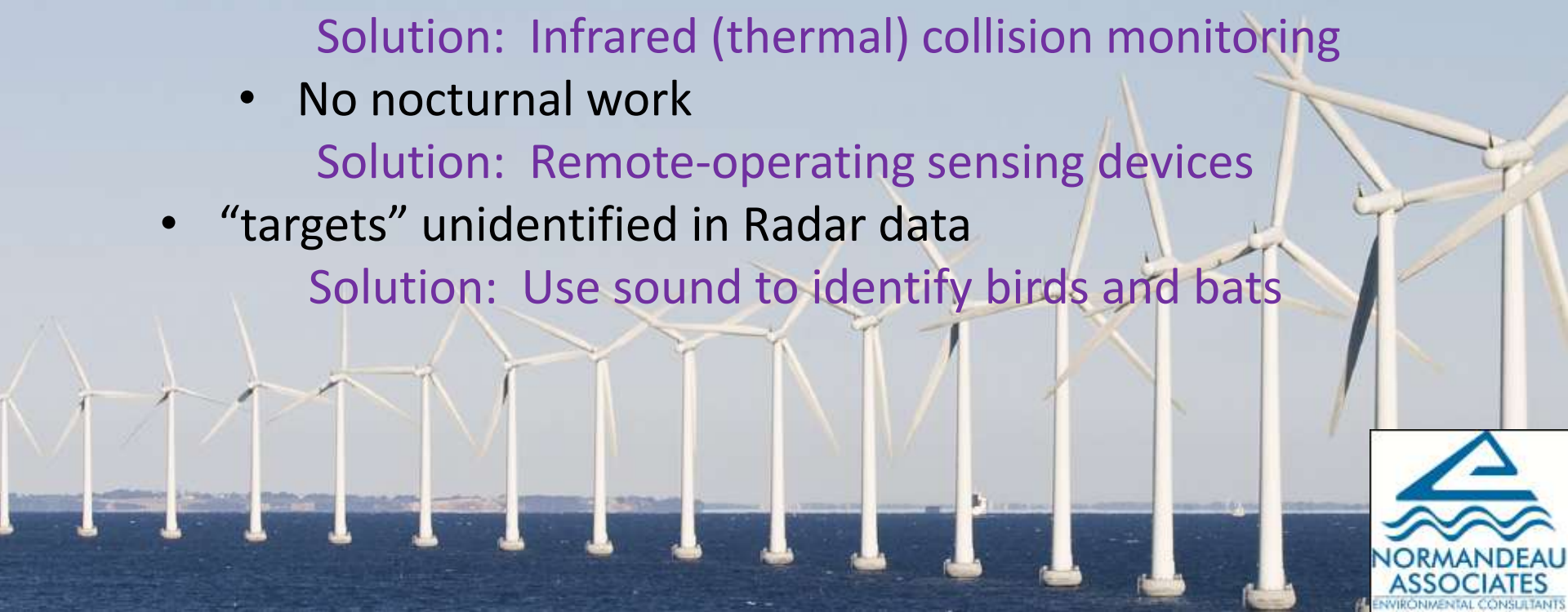
# Offshore Wind Wildlife Study Challenges

- Limited background knowledge of marine ecology
- Expensive to work in the ocean
  - Plane or boat needed for field surveys
- Physically difficult to work in the ocean
  - No carcass counting
  - No nocturnal work
- “targets” unidentified in Radar data



# Emerging Technology Offers Solutions

- Expensive to work in the ocean
  - Plane or boat needed for field surveys
    - Solution: Remote-operating sensing devices
    - Solution: Large-area surveys for cost-effectiveness
- Physically difficult to work in the ocean
  - No carcass counting
    - Solution: Infrared (thermal) collision monitoring
  - No nocturnal work
    - Solution: Remote-operating sensing devices
- “targets” unidentified in Radar data
  - Solution: Use sound to identify birds and bats



# Two US Federal Government Initiatives to Advance Offshore Wildlife Sensing Technology

Current research and development projects by Normandeau Associates for the Bureau of Ocean Energy Management, Regulation, and Enforcement (USDOI-BOEMRE)

1. Acoustic/Thermographic Offshore Monitoring System
2. Aerial High-definition Imaging Pilot Study



# Acoustic/Thermographic Offshore Monitoring System (ATOM)

## •Objective

Gather species-specific data on birds and bats flying at rotor swept altitudes at proposed offshore wind facility locations

- Day and night
- Throughout the seasons
- Cost-effective

## •Scope

Design/develop ATOM, deploy in US waters to gather 1-3 years of data

## •Key Partners

Cornell Laboratory of Ornithology (bird sound ID)

IA tech, Inc. (microphone array design, range testing)

Previous BOEMRE research project partners, including M. Desholm

# Acoustic/Thermographic Offshore Monitoring System (ATOM)

System prototype testing, Cape Cod, MA

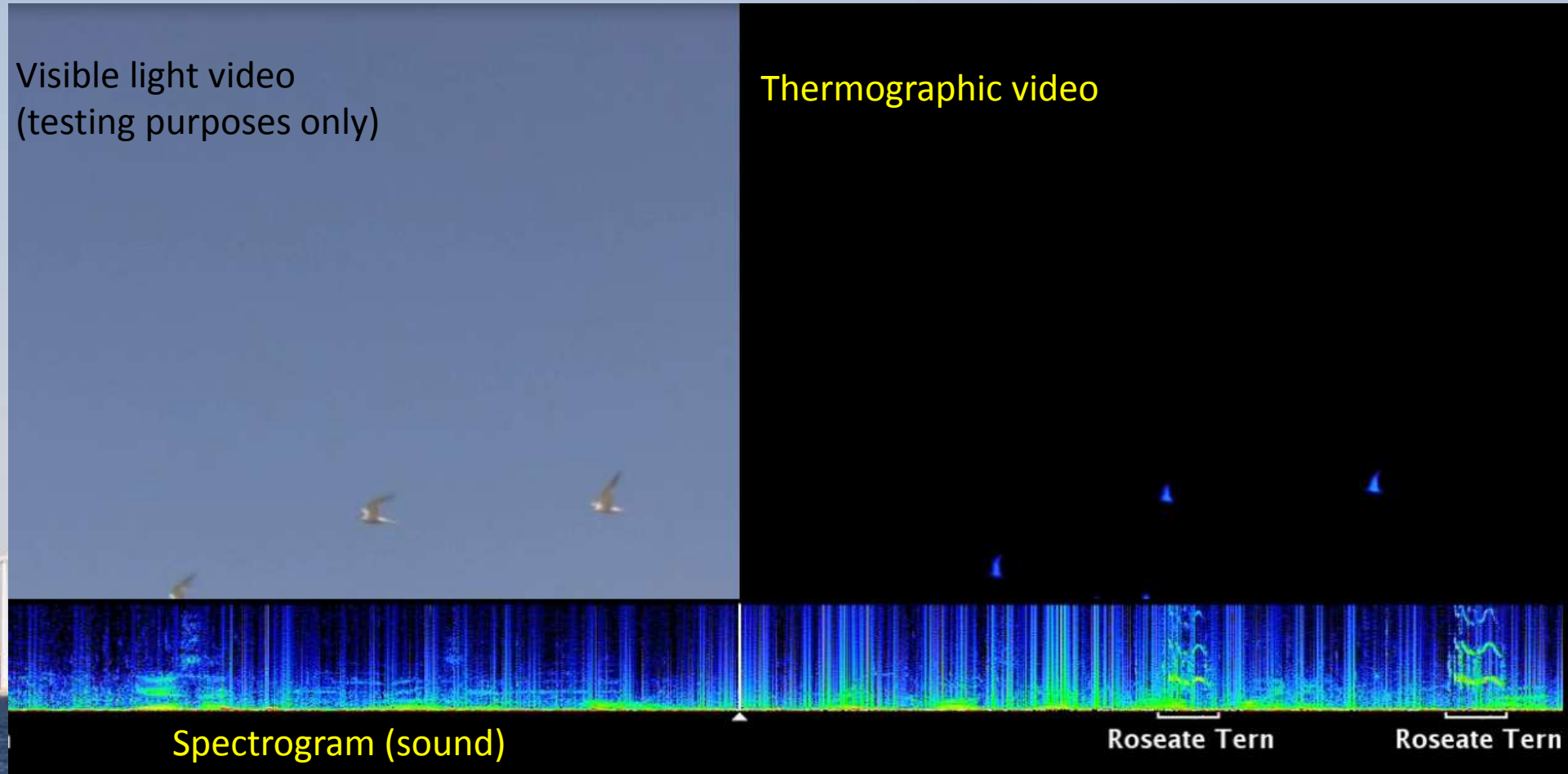
Visible light video  
(testing purposes only)

Thermographic video

Spectrogram (sound)

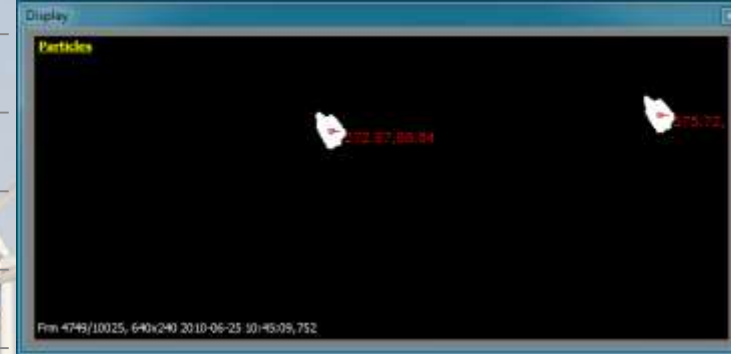
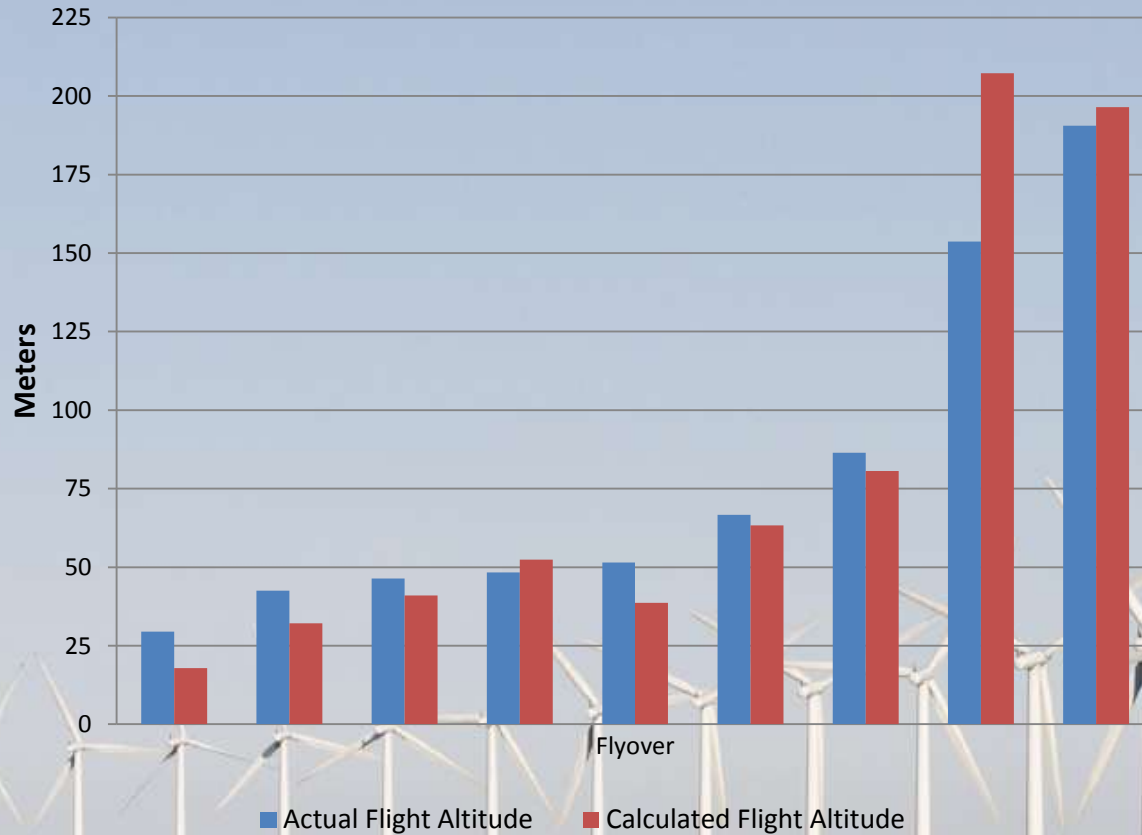
Roseate Tern

Roseate Tern



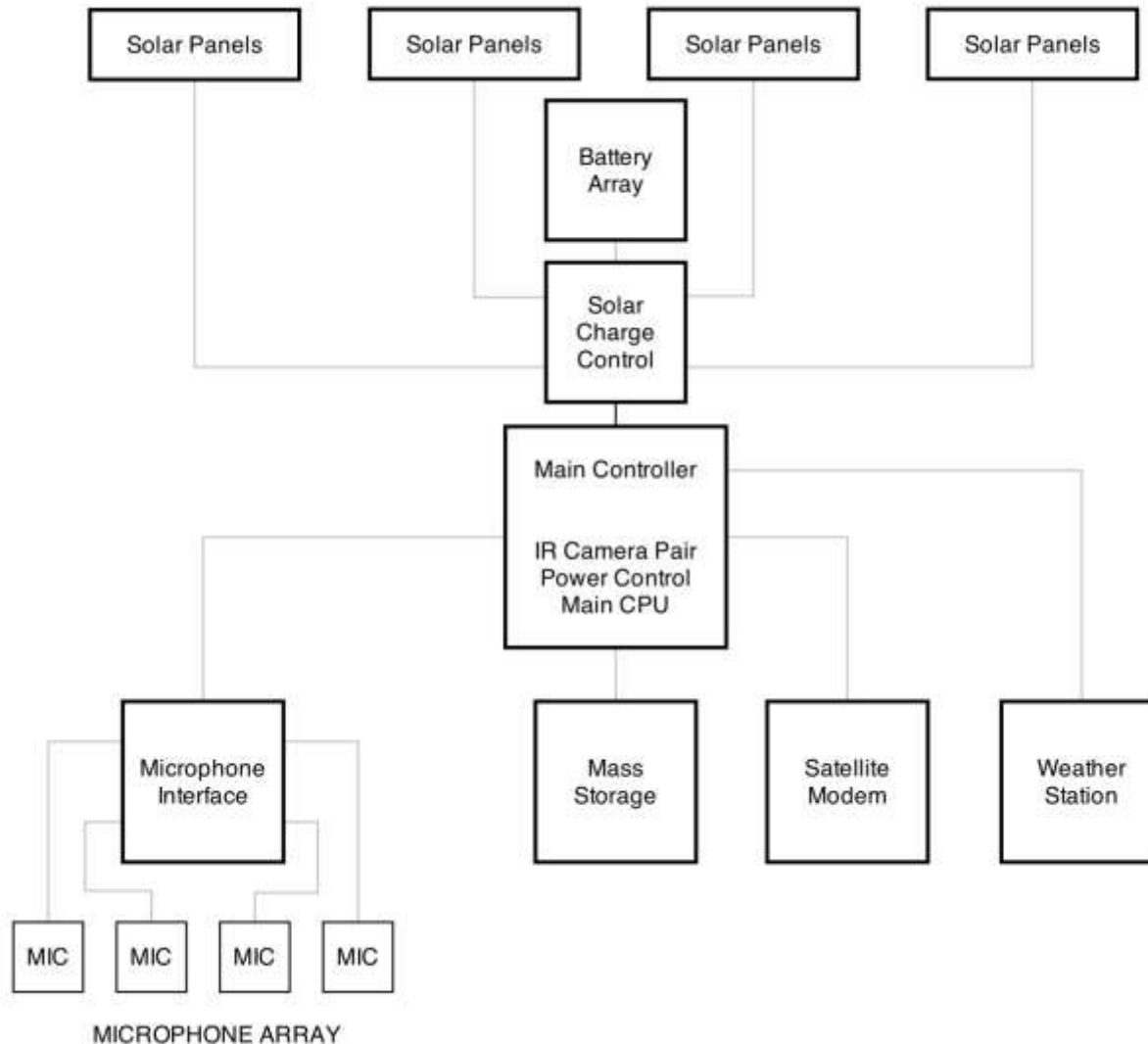
# Acoustic/Thermographic Offshore Monitoring System (ATOM)

## Radio Controlled Aircraft Flight Altitude Tracking Results





# Acoustic/Thermographic Offshore Monitoring System (ATOM)



# Acoustic/Thermographic Offshore Monitoring System (ATOM)



Data storage system (64TB)



Thermal cameras, beam, and controller



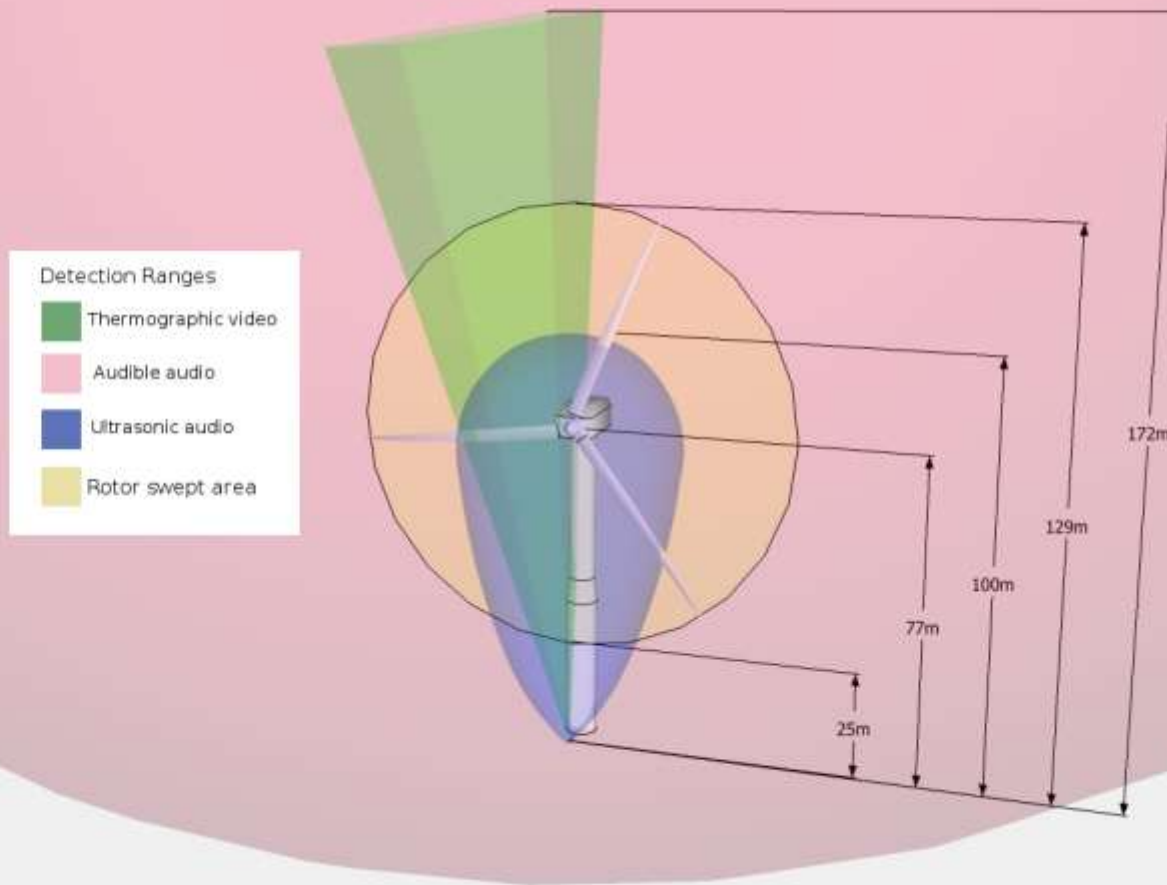
Mike node computer



Weather- and bird-proof mikes

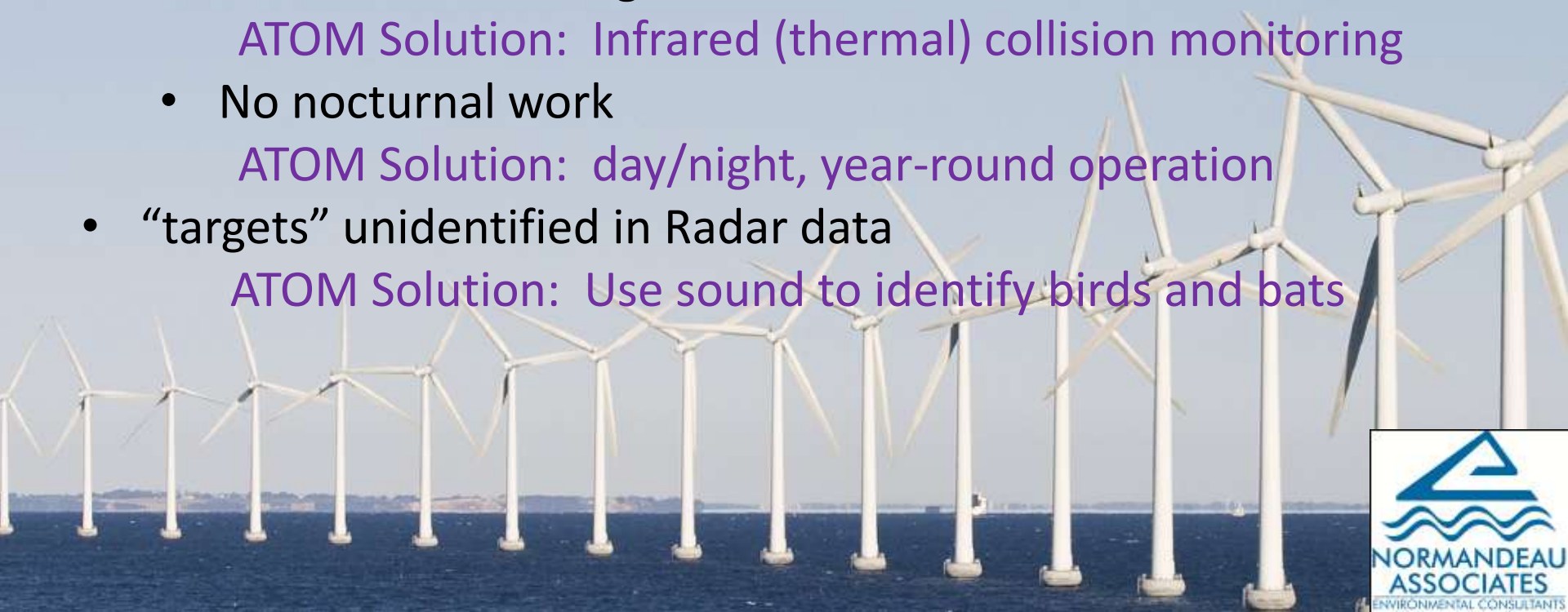
# Acoustic/Thermographic Offshore Monitoring System (ATOM)

## ATOM Predicted Detection Beams



# Acoustic/Thermographic Offshore Monitoring System (ATOM)

- Expensive to work in the ocean
  - Plane or boat needed for field surveys  
ATOM Solution: Remote-unmanned operation
- Physically difficult to work in the ocean
  - No carcass counting  
ATOM Solution: Infrared (thermal) collision monitoring
  - No nocturnal work  
ATOM Solution: day/night, year-round operation
- “targets” unidentified in Radar data  
ATOM Solution: Use sound to identify birds and bats



# Two US Federal Government Initiatives to Advance Offshore Wildlife Sensing Technology

Current research and development projects by Normandeau Associates for the Bureau of Ocean Energy Management, Regulation, and Enforcement (USDOI-BOEMRE)

1. Acoustic/Thermographic Offshore Monitoring System
2. Aerial High-definition Imaging Pilot Study



# Aerial High-definition Imaging Pilot Study

## •Objective

Determine optimal technology and methodology for conducting high-definition aerial ocean wildlife surveys in the U.S.

- Birds, marine mammals, and sea turtles
- Cover a very large area in a very short time
- Cost-effective and safe

## •Scope

Conduct pilot studies, evaluate image-gathering tech. configurations, develop large area survey protocol

## •Key Partners

Boulder Imaging  
IA tech, Inc. (unmanned aircraft)  
Gemini Renewables  
British Trust for Ornithology

AIS observers  
ECOES, inc.  
Pinnacle 1 Aviation

# Aerial High-definition Imaging Pilot Study

Pioneering European studies show that this can work



# Aerial High-definition Imaging Pilot Study

Biology dictates need for “snapshot” surveys

- **Birds fly**

- Seabirds and migrating coastal and pelagic birds move many miles per day

- **Turtles and marine mammals swim**

- These taxa may also cover many miles in a day

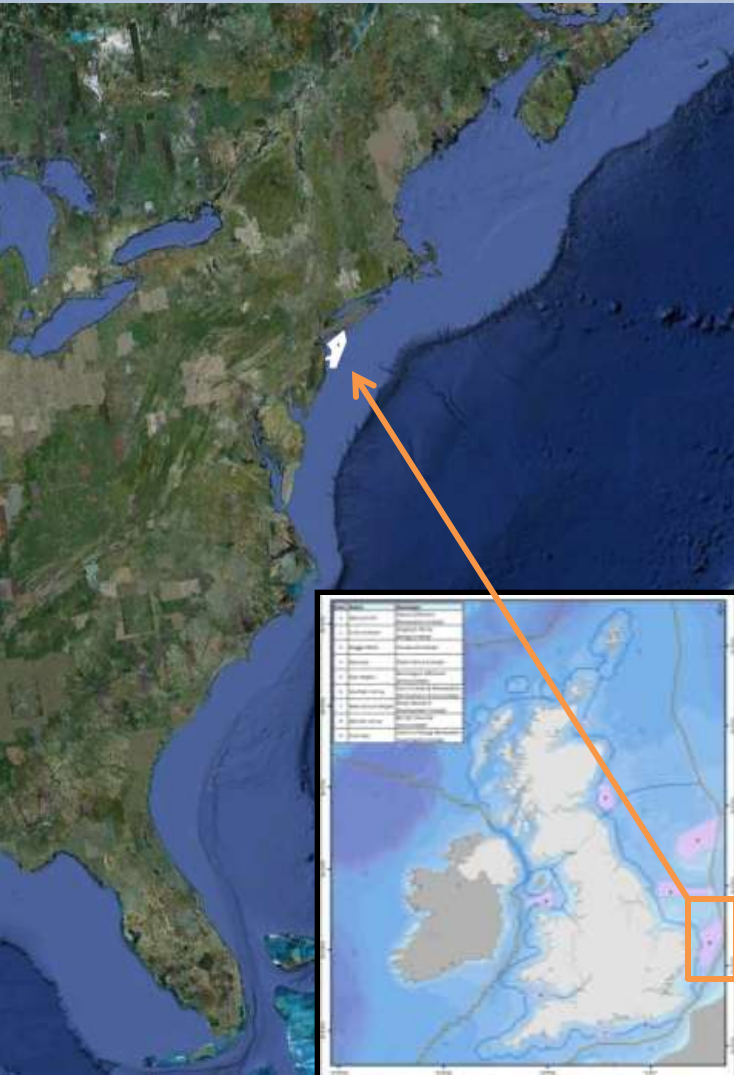
- **Survey implication**

- Surveys conducted in adjoining areas on successive days may either miss, or double count large numbers of individuals, particularly in N-S movements (e.g. migration)





# Aerial High-definition Imaging Pilot Study



- COWRIE zone 5 (East Anglia), July 2009, survey area shown transposed onto AOCS (in white) (HiDef Aerial Surveying Ltd, 2009)

- 40 m image width
- 10% sampling → 400m transect separation
- 2316 mi<sup>2</sup> survey area
- 610 meter flight altitude
- 174 mph airspeed

• Survey time: 3 days

← Crown Estate Round 3 Zones

# Aerial High-definition Imaging Pilot Study

Envisioned  
multi-camera  
high def  
surveys



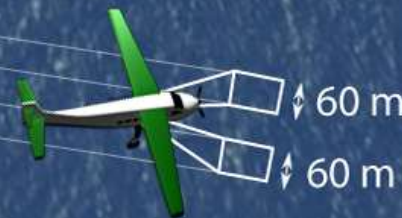
1000 m

2000 m



European  
high def  
surveys

300 m



Conventional  
visual survey

60 m

60 m

# Aerial High-definition Imaging Pilot Study

“Pelican” Unmanned Aircraft. IA tech, inc.



# Aerial High-definition Imaging Pilot Study

Applying high-definition technique to mammals and turtles



# Aerial High-definition Imaging Pilot Study

## Advantages of high definition imaging relative to visual observer surveys

- Images archived, data are “repeatable”, not subject to unknown observer bias
- Higher altitude flight doesn’t alter results by disturbing wildlife
- Higher altitude flight is safer (safer still with unmanned system)
- Faster flight, larger survey beam allow more cost-effective sampling of large areas



# Emerging Technology Offers Solutions

- Expensive to work in the ocean
  - Plane or boat needed for field surveys
    - Solution: Remote-operating sensing device (ATOM)
    - Solution: Large-area high-definition aerial surveys for cost-effective collection of high-quality data
- Physically difficult to work in the ocean
  - No carcass counting
    - Solution: Infrared collision monitoring (ATOM)
  - No nocturnal work
    - Solution: Remote-operating sensing device (ATOM)
- “targets” unidentified in Radar data
  - Solution: Use sound to identify birds and bats (ATOM)

Thanks

