

# Underwater Sensor Network Lab Kick-off Meeting



UWSN @ UCONN

<http://uwsn.engr.uconn.edu>

*BECAT, University of Connecticut*

Seed-Fund from  
CSE, ECE, ENVE, BECAT, SOE

Special Thanks to  
Reda, Robert, Ross, Raj, Amir

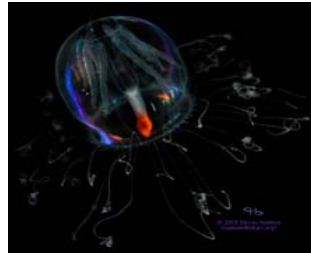
# Applications and Challenges

# Why Underwater?

- The Earth is a water planet
  - About 2/3 of the Earth covered by oceans
    - Uninhabited, largely unexplored
    - A huge amount of (natural) resources to discover
- Many potential applications
  - Long-term aquatic monitoring
    - Oceanography, marine biology, deep-sea archaeology, seismic predictions, pollution detection, oil/gas field monitoring ...
  - Short-term aquatic exploration
    - Underwater natural resource discovery, hurricane disaster recovery, anti-submarine mission, loss treasure discovery ...

# What are the Application Requirements?

- Desired properties
  - **Unmanned** underwater exploration
  - **Localized and precise** data acquisition for better knowledge
  - **Tetherless** underwater networking for motion agility/flexibility
  - **Scalable** to 100's, 1000's of nodes for bigger spatial coverage

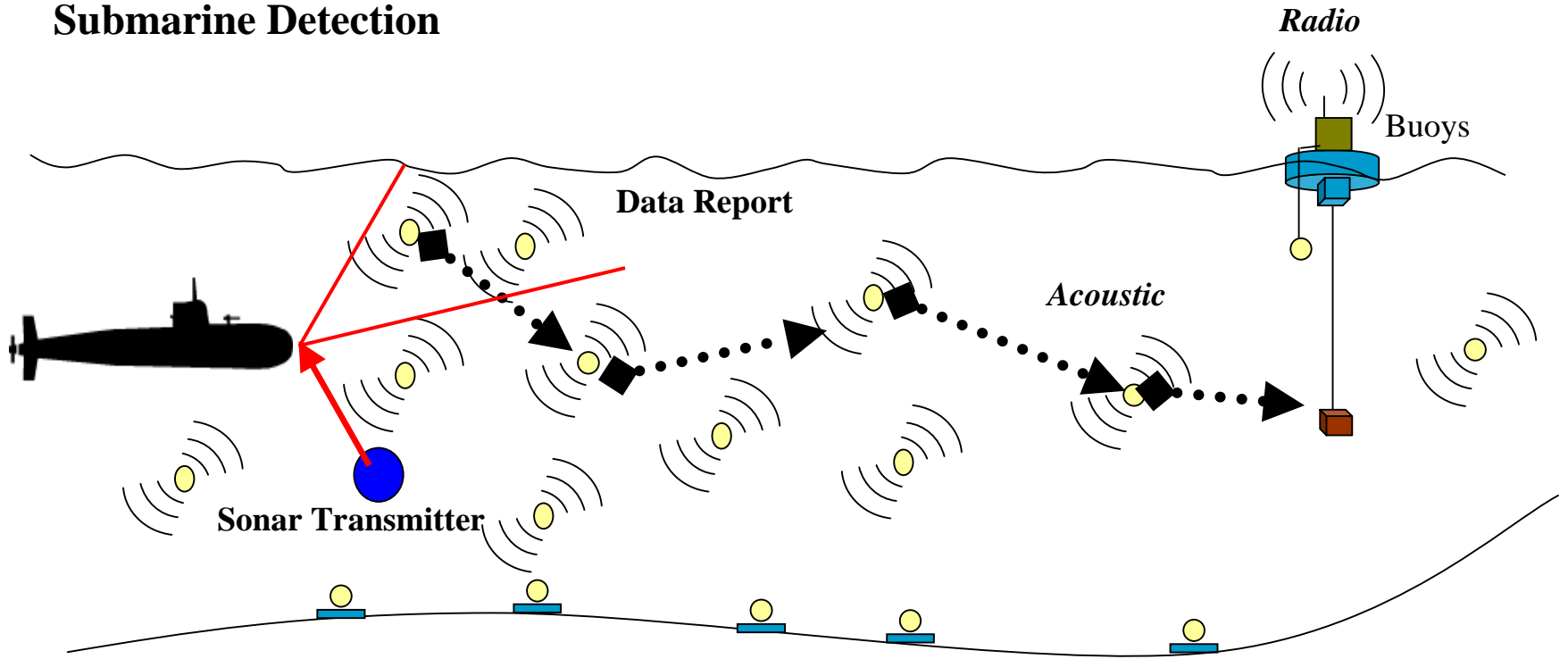


The Ideal Technique:

Underwater Sensor Networks  
(UWSNs)

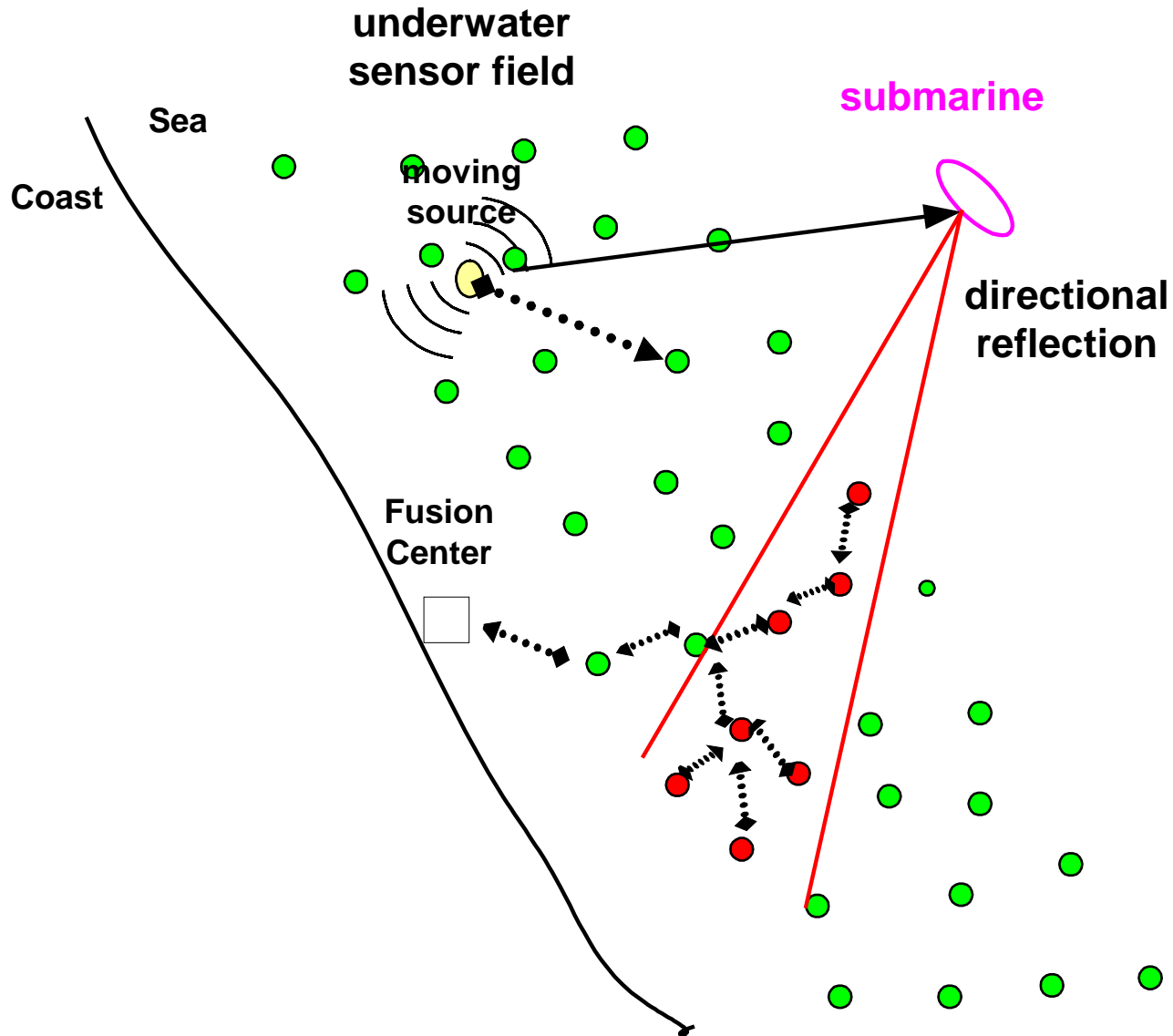
# Application Scenario I

## Submarine Detection



# Application Scenario I

## Submarine Localization



# Why UWSN for Submarine Detection?

## ■ Existing Approaches

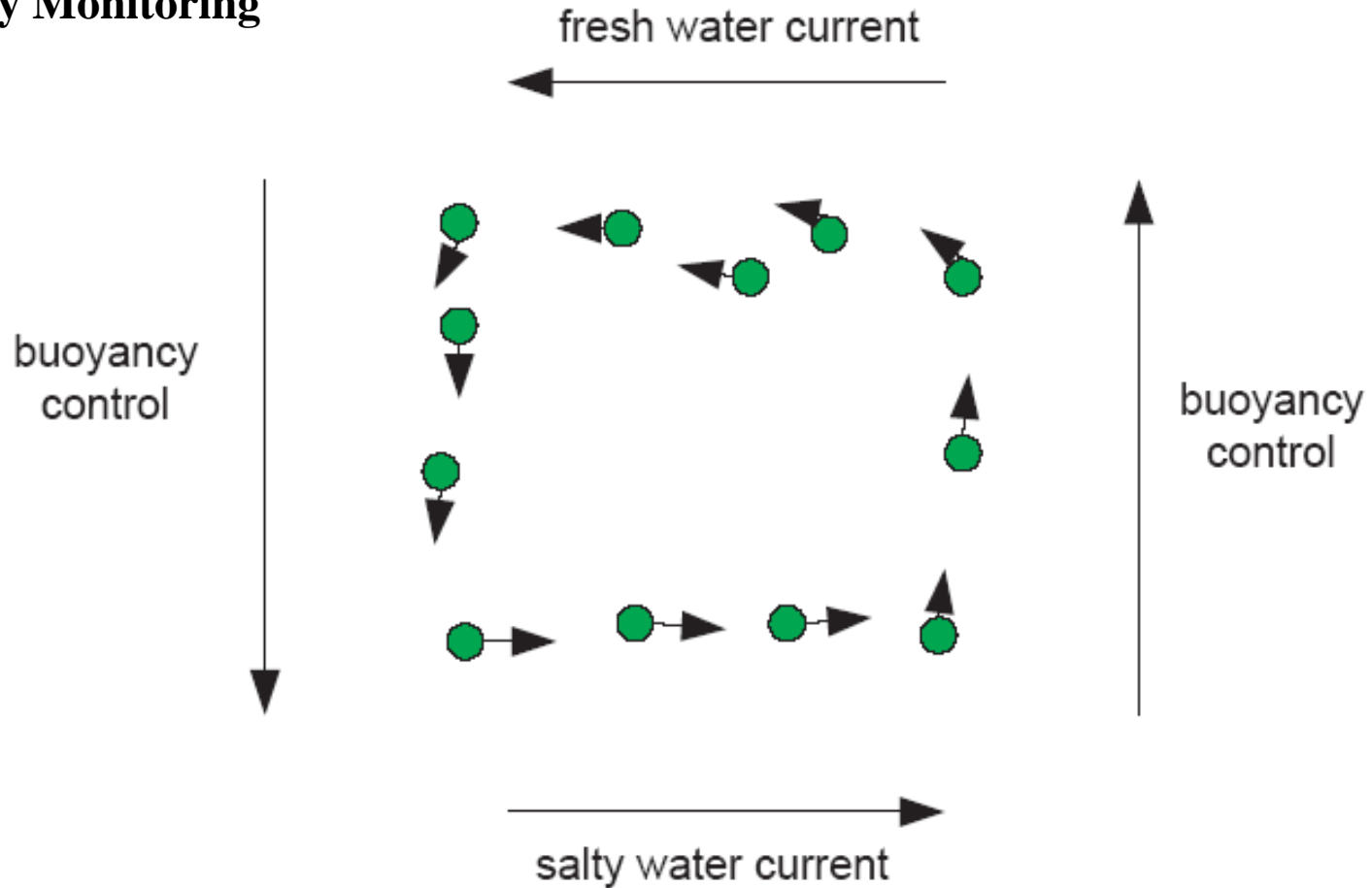
- Active or passive sonar
- Cons: submarine anti-detection techniques (e.g., sonar absorption) make them less-effective

## ■ Using UWSN

- Collaborative detection
  - Multiple sensors, and/or multi-modal data
- Large coverage
- Timely reporting
- High reusability

# Application Scenario II

## Estuary Monitoring



# Why UWSN for Estuary Monitoring?

## ■ Existing Approaches

- Ship tethered with chains of sensors moves from one end to the other
- Cons: no 4D data, either  $f(x, y, z, \text{fixed } t)$ , or  $f(\text{fixed } (x, y, z), t)$ ; and cost is high

## ■ Using UWSN

- Easily get 4D data,  $f(x, y, z, t)$ , sensors move
- Reduce cost significantly
- Increase coverage
- Have high reusability

# Research Issues (I)

- Sensor node system design
  - Sensing, computing, communication integration
  - Power management: energy saving, life time
- Autonomous network system design
  - Communication, multiple access
  - Routing, forwarding, reliable transfer
  - Localization, synchronization
  - Security, robustness
  - Energy efficiency

# Research Issues (II)

- Applications and data management
  - Application characterization
  - Data sampling, structure, storage
- Collaborative estimation & detection
  - Data fusion, dissemination, tracking
- Modeling, simulation, evaluation
  - Network simulator
  - Sensor node simulator
- Hardware, middleware, software design

# Research Personnel (I)

- Jun-Hong Cui, CSE (*Director*)
  - Routing, multiple access, wireless sensor networks
- Shengli Zhou, ECE (*Co-Director*)
  - Communication, localization
- Reda Ammar, CSE
  - Data management, performance evaluation
- Amvrossios Bagtzoglou, CEE
  - Water resources, geo-statistical simulation
- John A. Chandy, ECE
  - Storage network, distributed systems
- Yunsi Fei, ECE
  - Power management, embedded system design

# Research Personnel (II)

- Jerry Shi, CSE
  - Sensor node design, computer architecture
- Thomas Torgersen, Marine Science
  - Hydrology, aqueous process geochemistry
- Lanbo Liu, CEE
  - Acoustic wave modelling and simulation
- Sanguthevar Rajasekaran, CSE
  - Routing, security, applied algorithms
- Bing Wang, CSE
  - Data management, performance evaluation
- Peter Willet, ECE, UCONN
  - Detection, estimation, localization

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