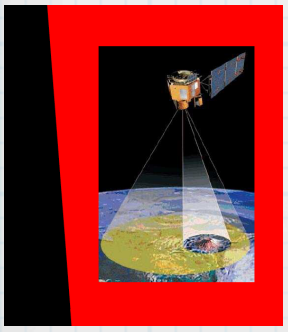
Networked Architecture for Robotic Environmental Ocean Science Sensors

Gregg Podnar
Program Manager



2008 November 19
Sensing a Changing World
Wageningen University — Centre for Geo-Information

Carnegie-Mellon University – Robotics Institute

THE ROBOTICS INSTITUTE

Outline

- Telesupervised Adaptive Ocean Sensor Fleet
  - Investigate Harmful Algal Blooms
  - Using long-duration Autonomous Surface Vehicles
- Telesupervision Architecture
  - Telesupervision Workstation
  - Sensor Platforms
- Drift-Compensated Bloom Mapping
  - Navigation and Aerial Sensor Validation
- River Water Quality Sensor Fleet

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Telesupervised Adaptive Ocean Sensor Fleet

- Investigate Harmful Algal Blooms
  - Carnegie-Mellon Robotics Institute
  - NASA Jet Propulsion Laboratory
  - NASA GSFC Wallops Flight Facility
  - NASA Goddard Space Flight Center
- Using Autonomous Robot Boats
  - Ocean Atmosphere Sensor Integration System
  - Developed for National Oceanographic and Atmospheric Administration
  - In-situ air and ocean surface observations
  - Added algae sensors
- Telesupervised Fleet
  - Adaptive path planning
  - Human monitoring and intervention

John Dolan - Senior Systems Scientist
Gregg Podnar - Program Manager
Alberto Elfes - Principal Member of Technical Staff - JPL

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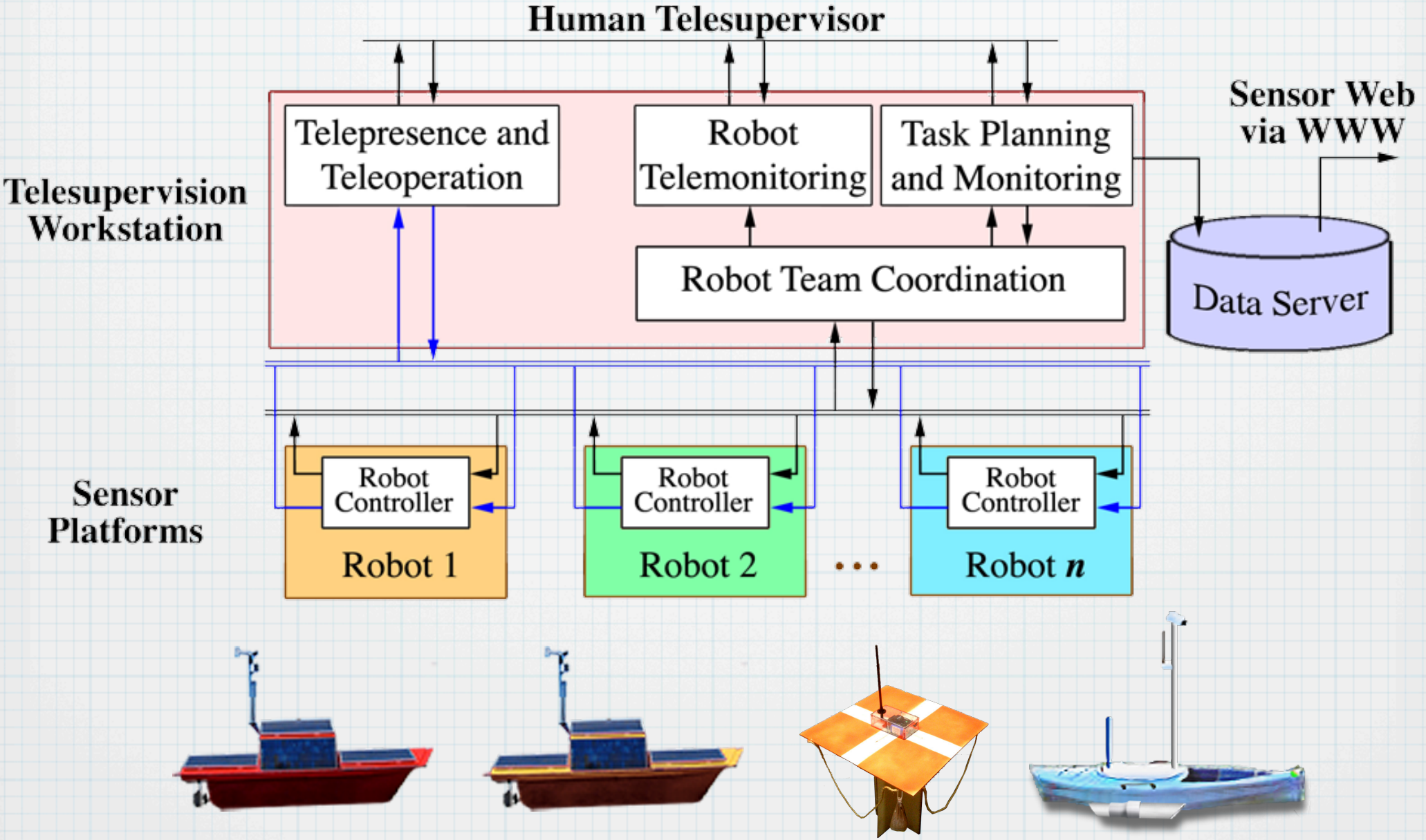
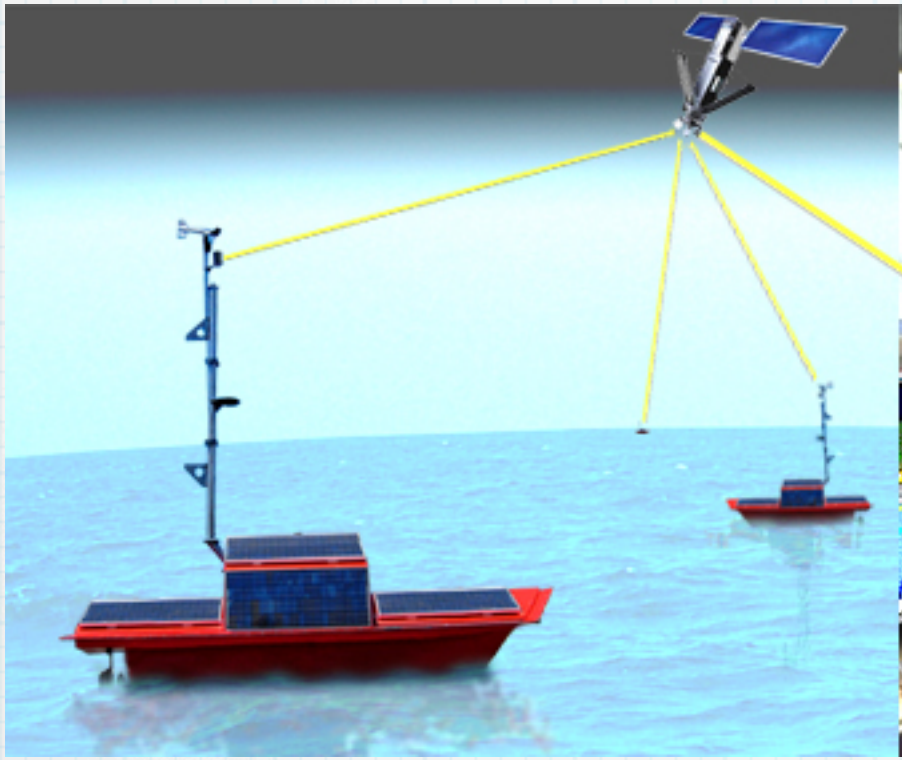
TAOSF Telesupervision Architecture



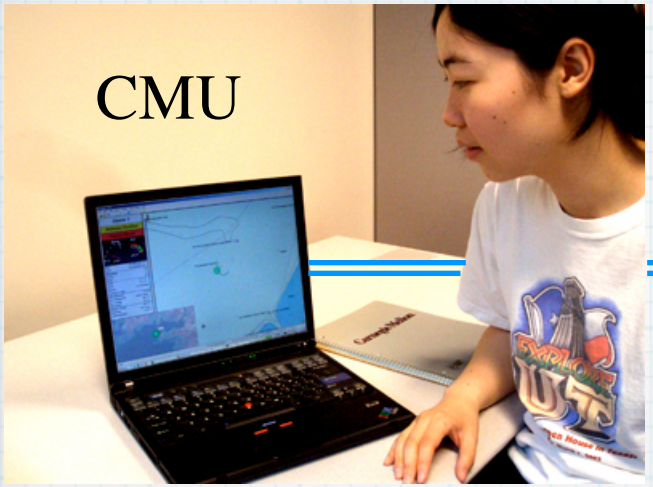
Telesupervised Adaptive Ocean Sensor Fleet



- Networked Telesupervision
  - Plan paths from initial bloom observation: satellite or surface vessel report
  - Monitor fleet operation and science data while investigating algal bloom
  - Analyze data to characterize bloom: extent, concentration, movement
  - Identify species and measure toxicity
  - Alert affected aquaculture businesses, fisheries, and tourism sites
  - Share data with other scientists via the Internet

Telesupervised Adaptive Ocean Sensor Fleet

TAOSF — First Full System Test



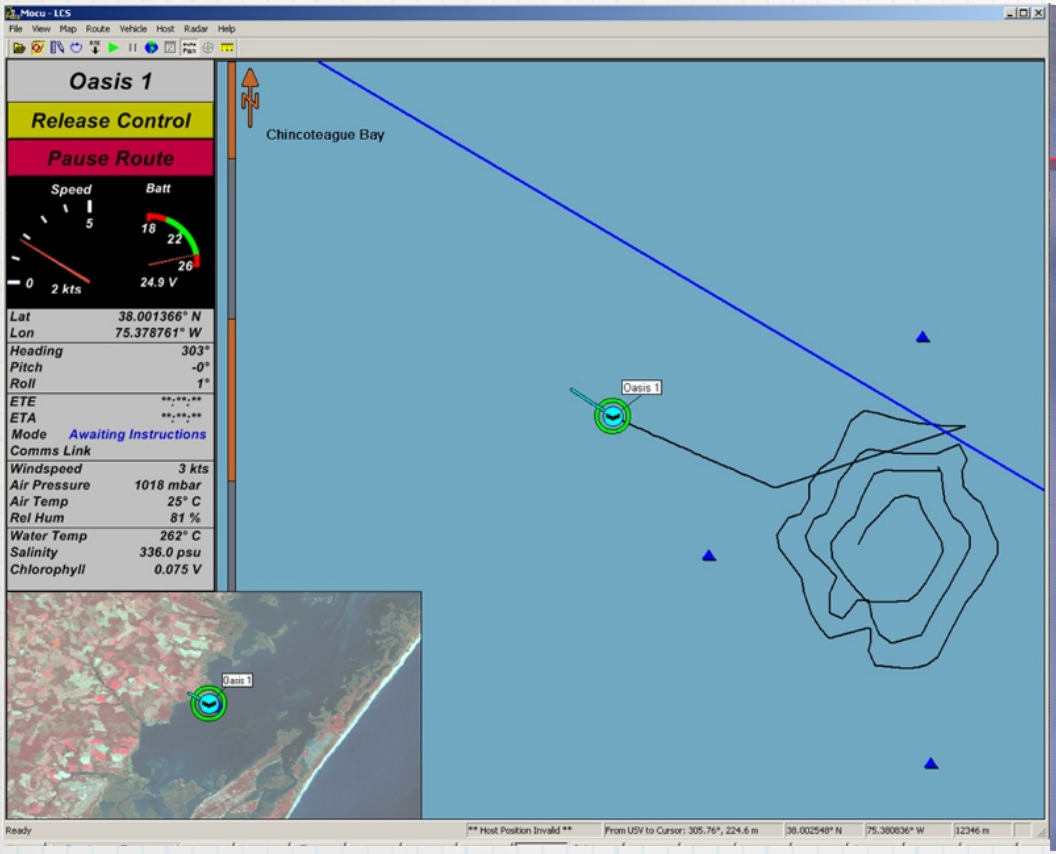
GSFC

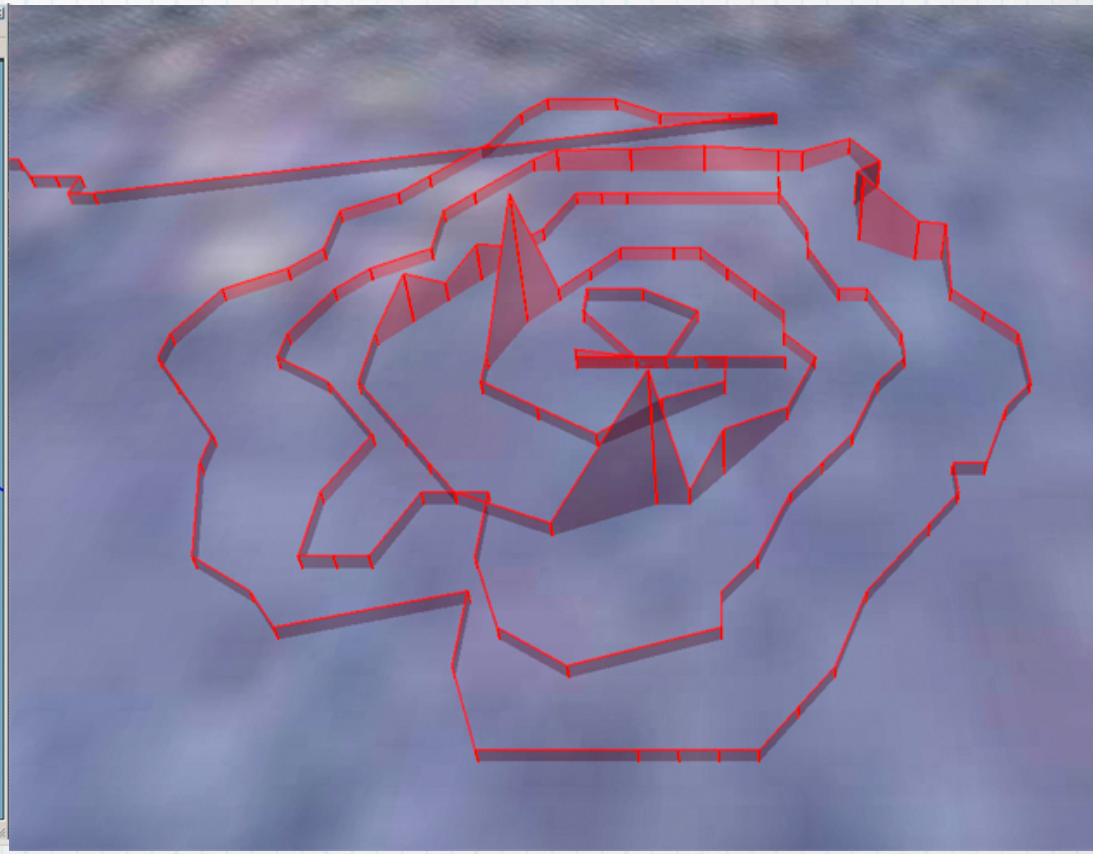
Chincoteague VA

Ethernet

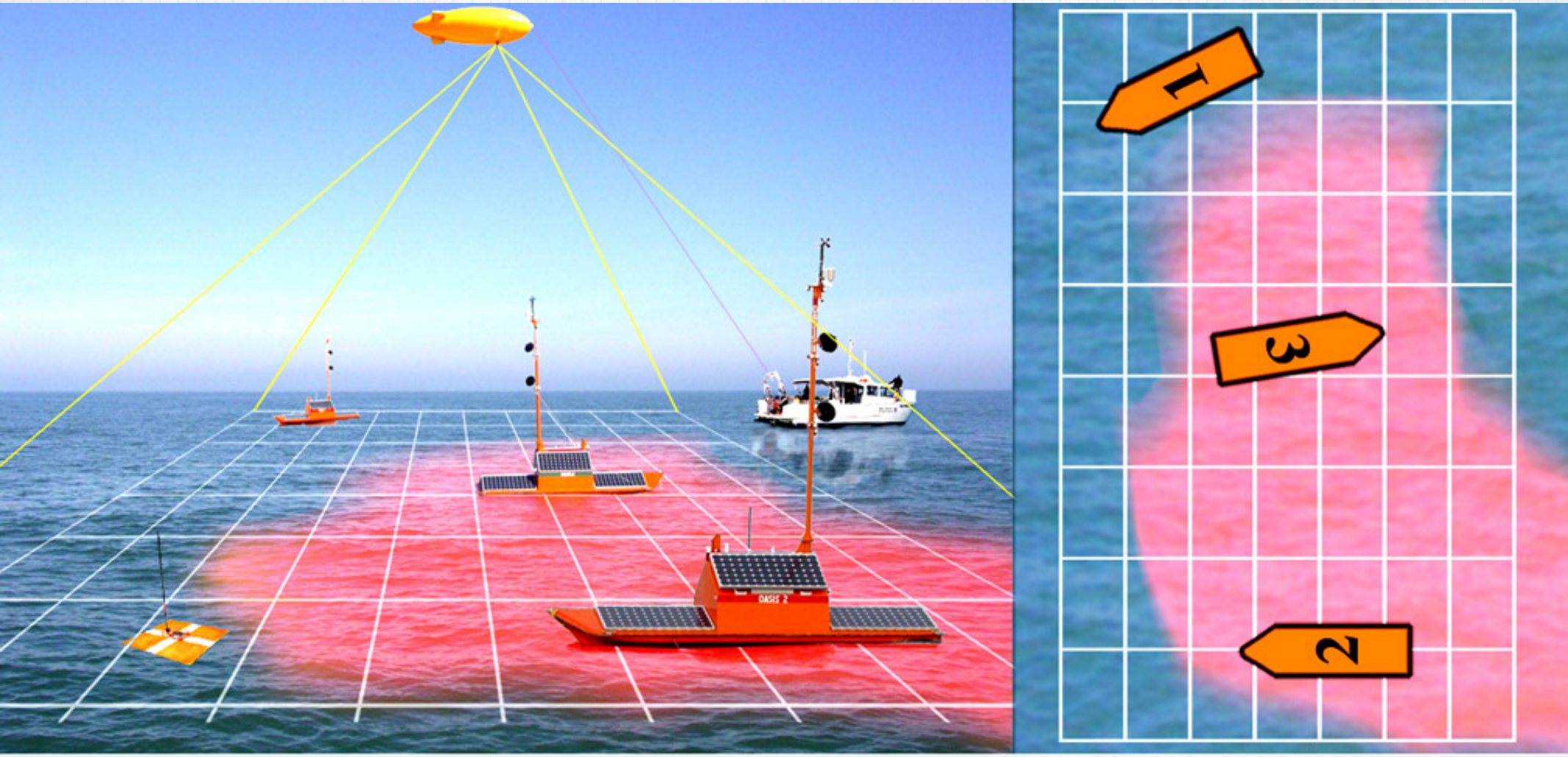
Cellular

Radio





Mapping a Bloom with Aerial Sensor Validation



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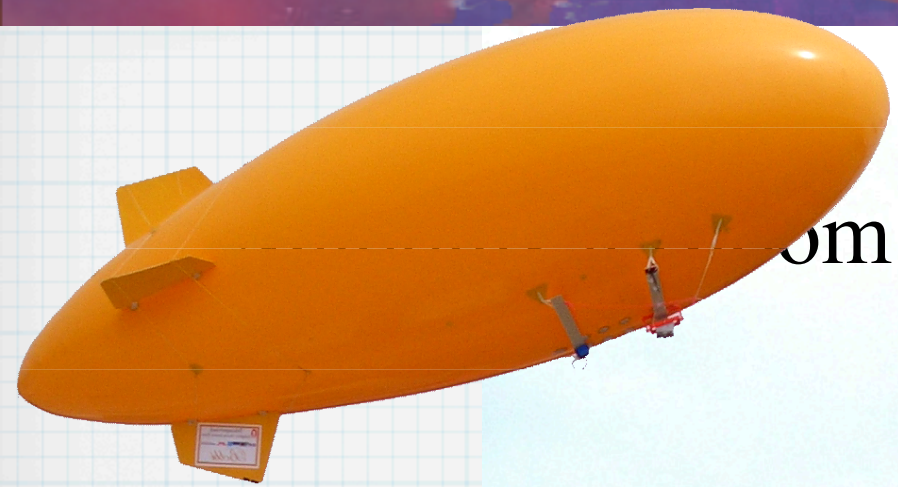

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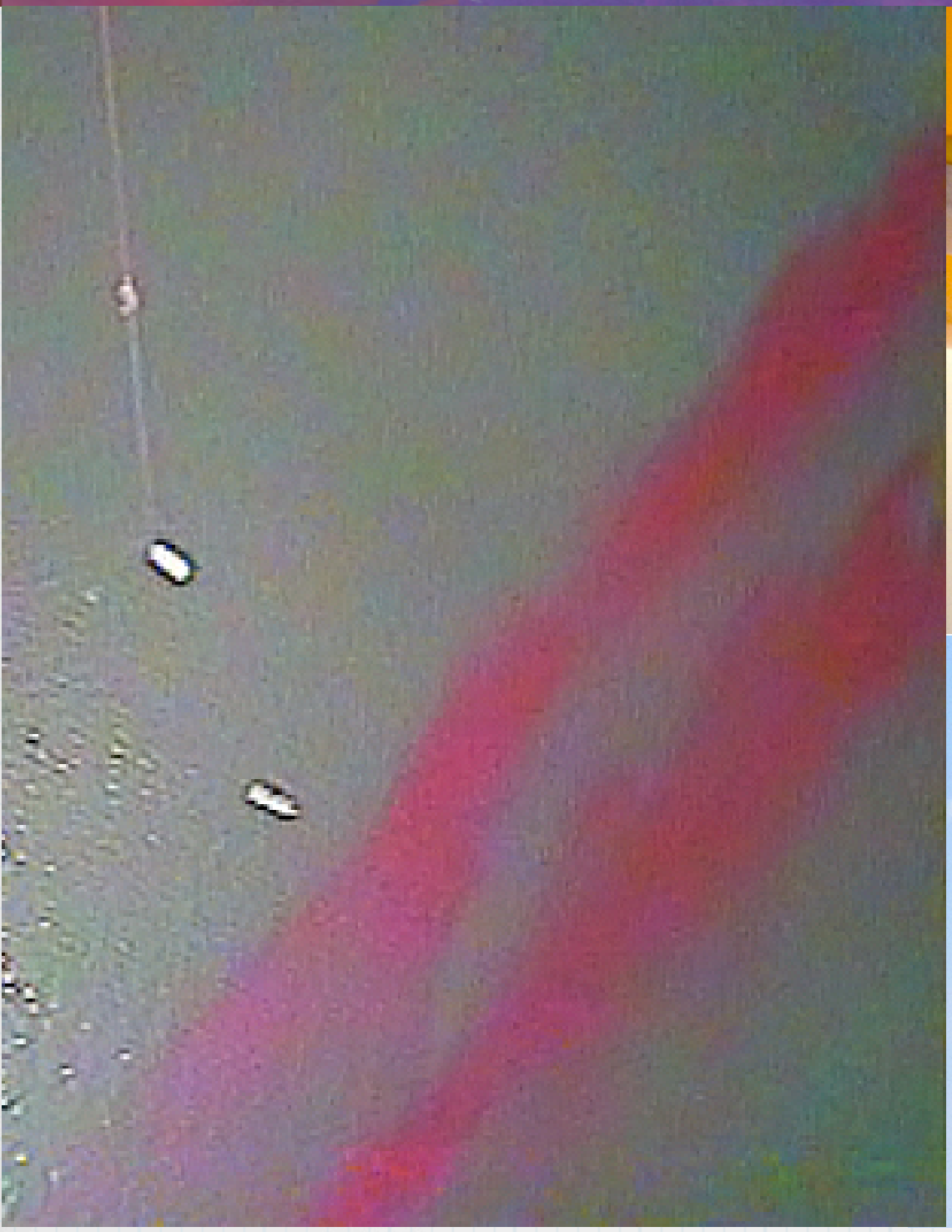
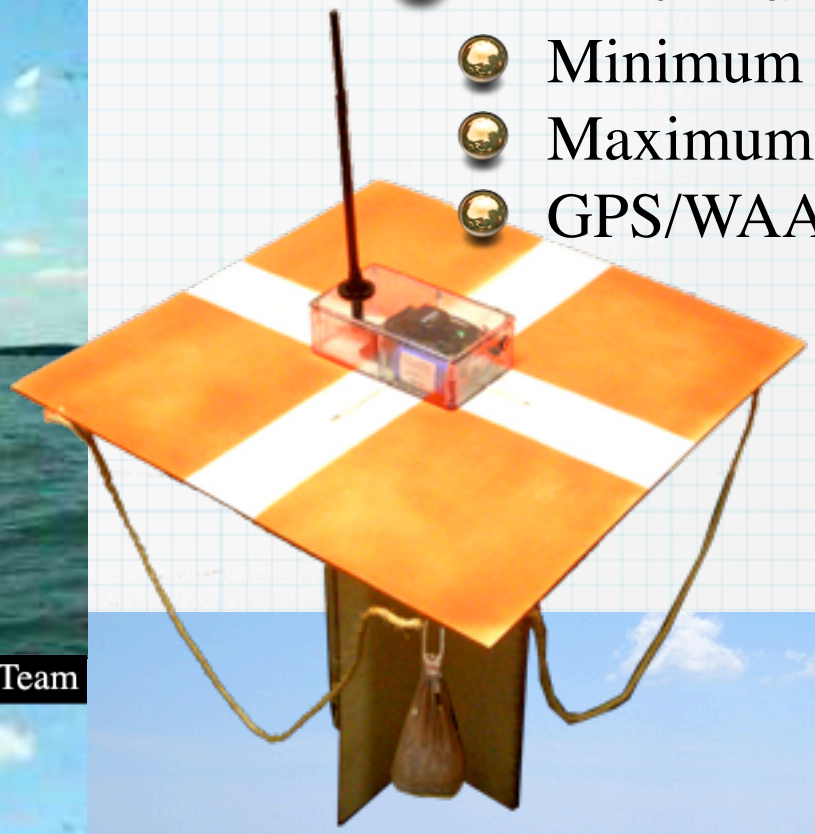


Aerostat Instruments

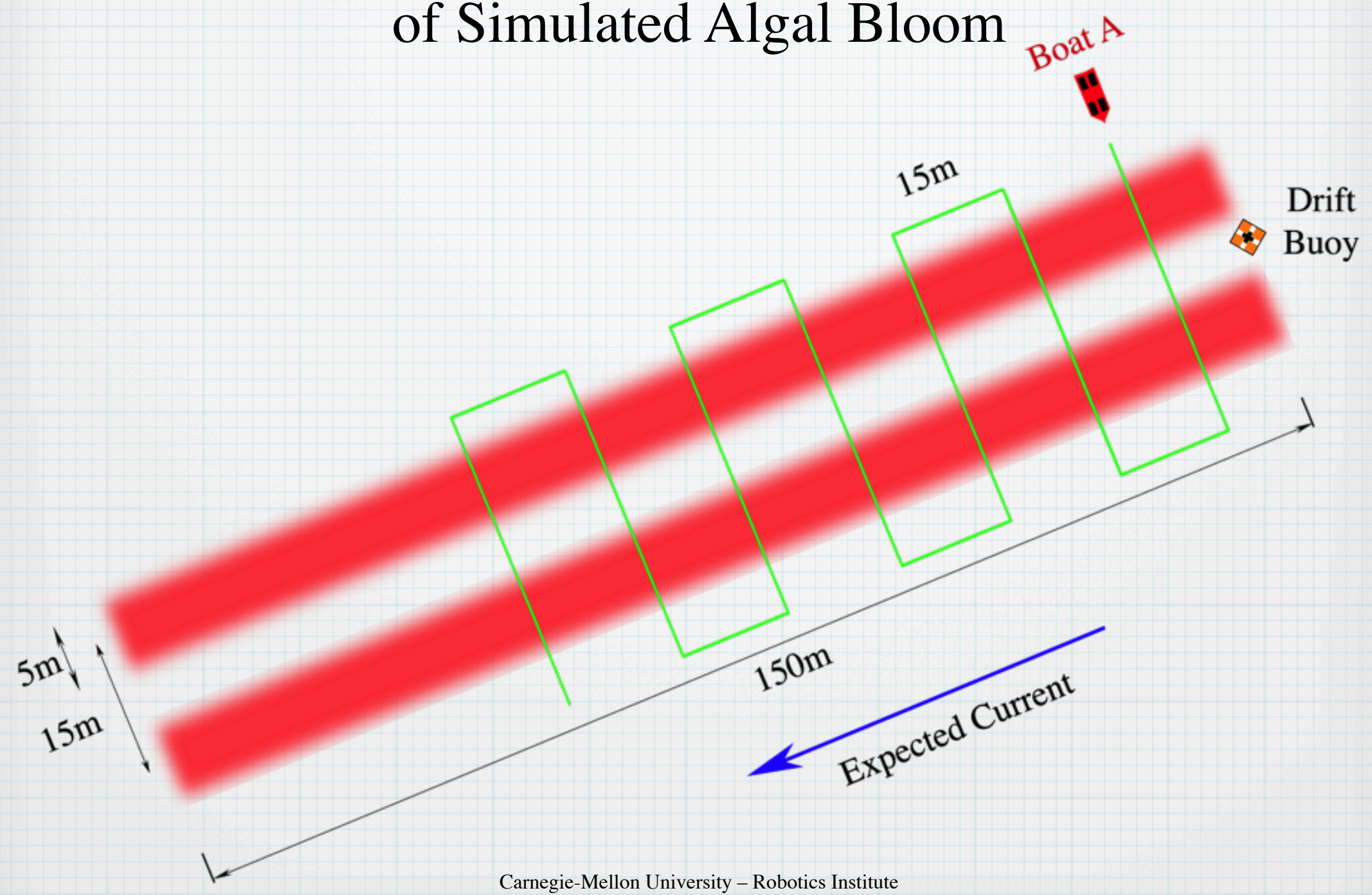
- GPS/WAAS
- Magnetic Compass
- Barometric Altimeter
- Color Video Camera
- Gimbled Mount

Drift Buoys

- Minimum Wind Area
- Maximum Water Area
- GPS/WAAS



Drift-Compensated Mapping of Simulated Algal Bloom



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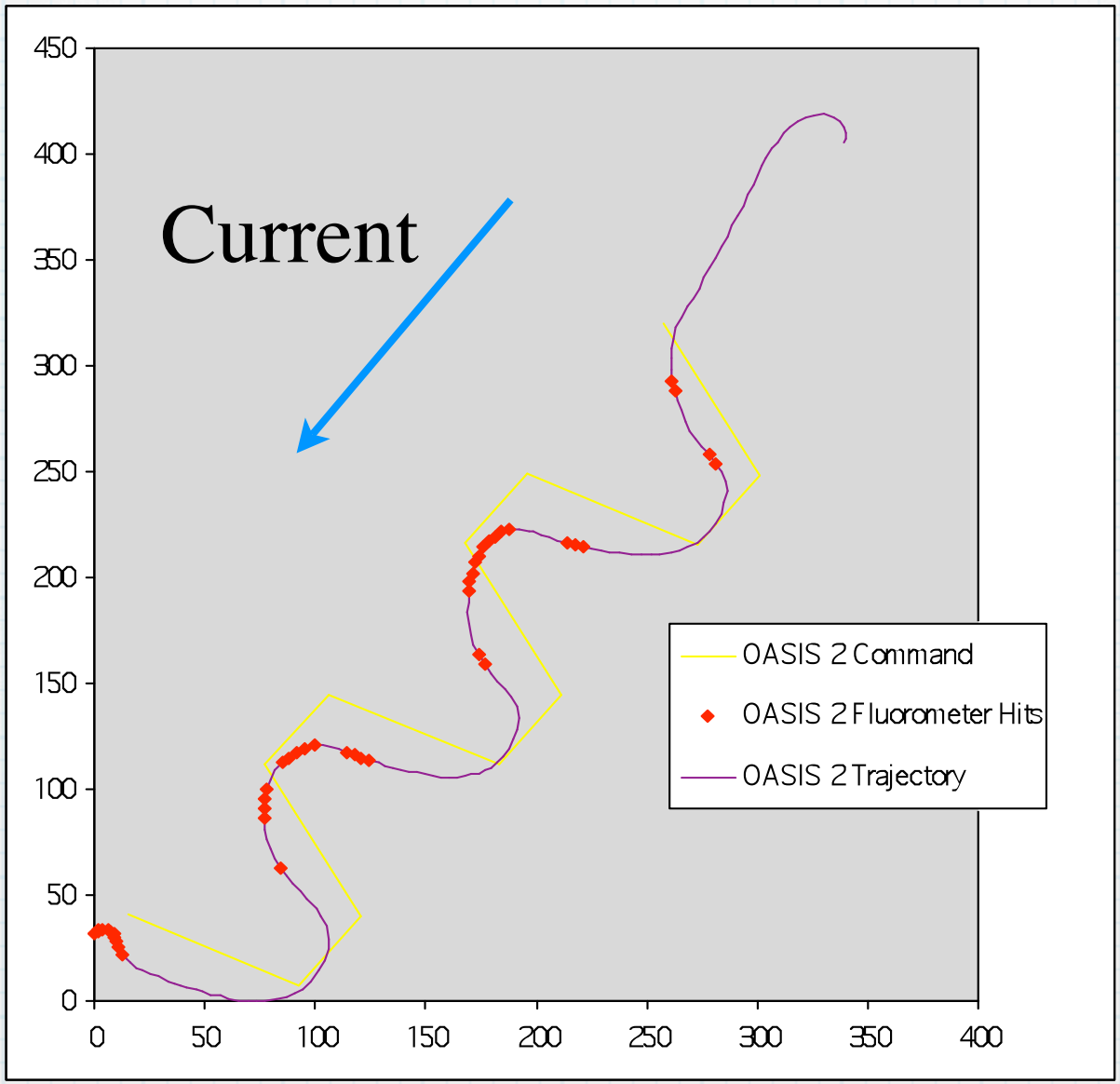

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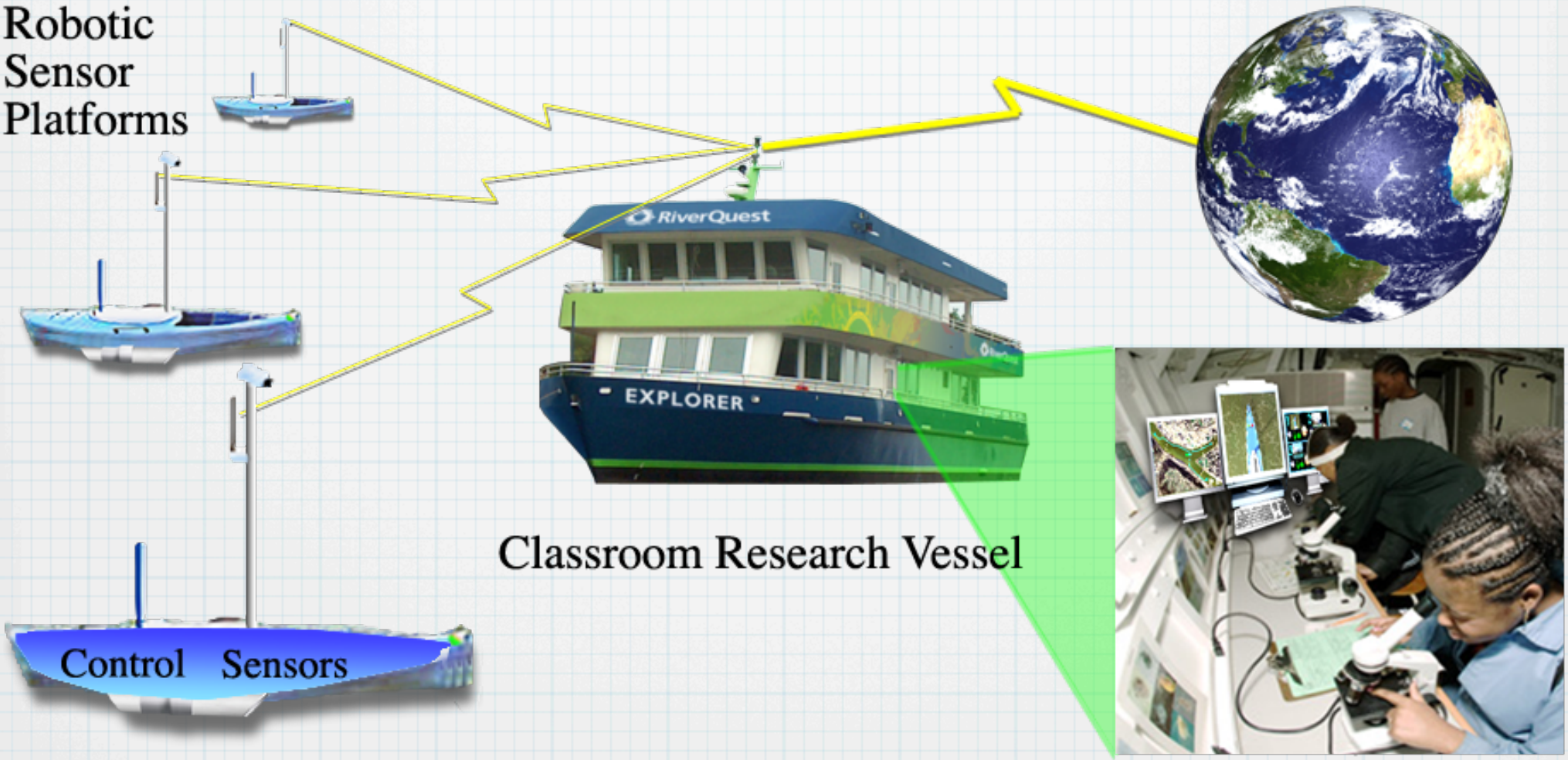
River Sensor Boats

- Remote Navigation
- Measuring water quality in rivers and at sewer outfalls.

TAOSF - Robot Sensor Boats



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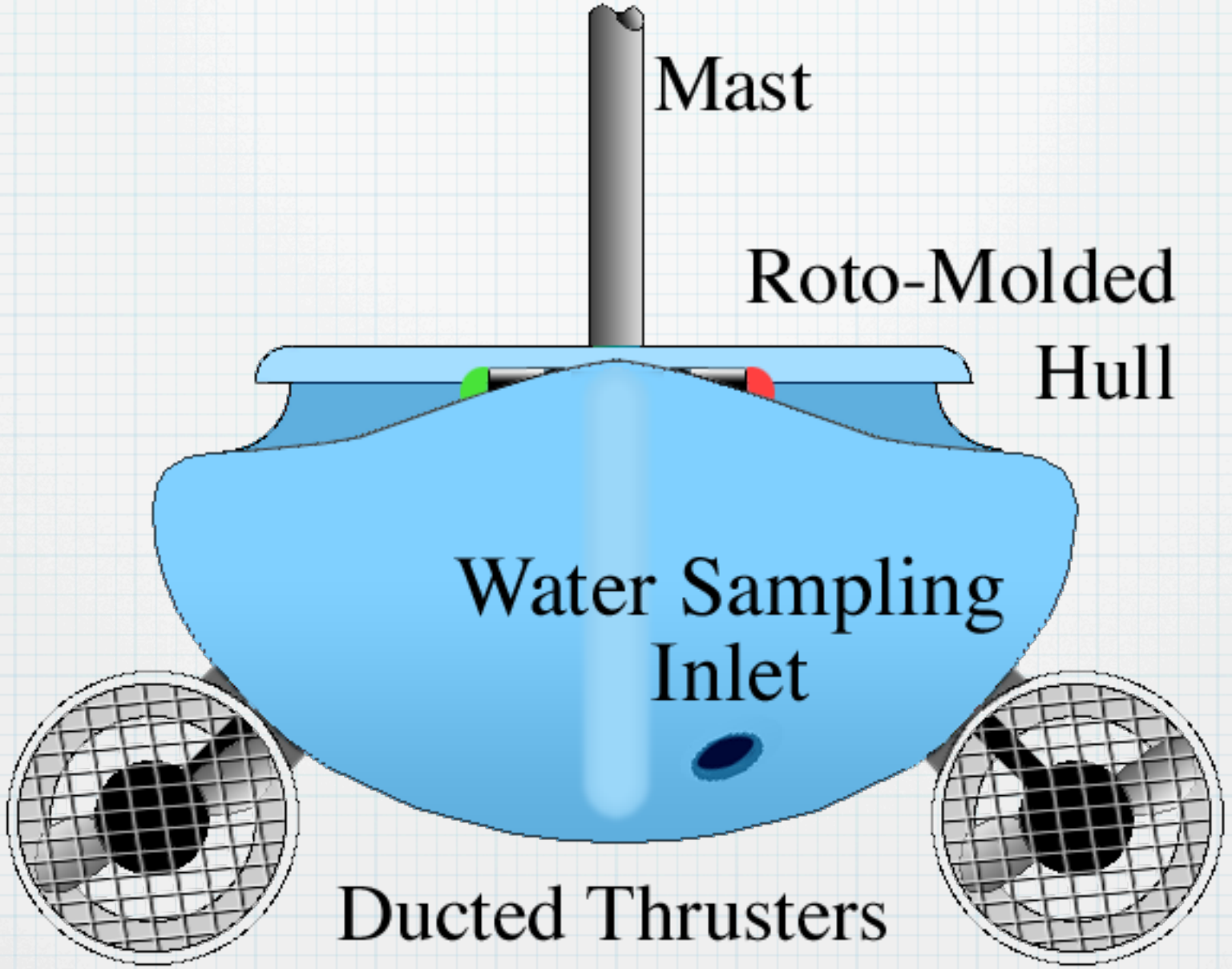
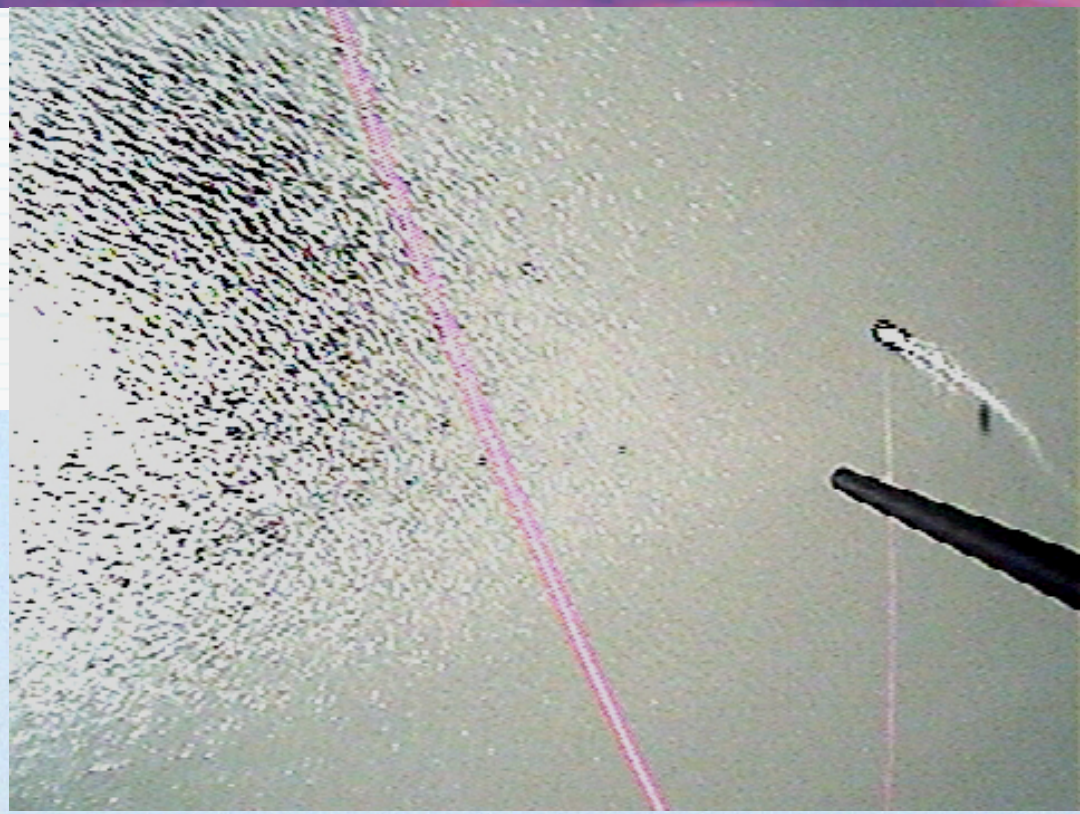
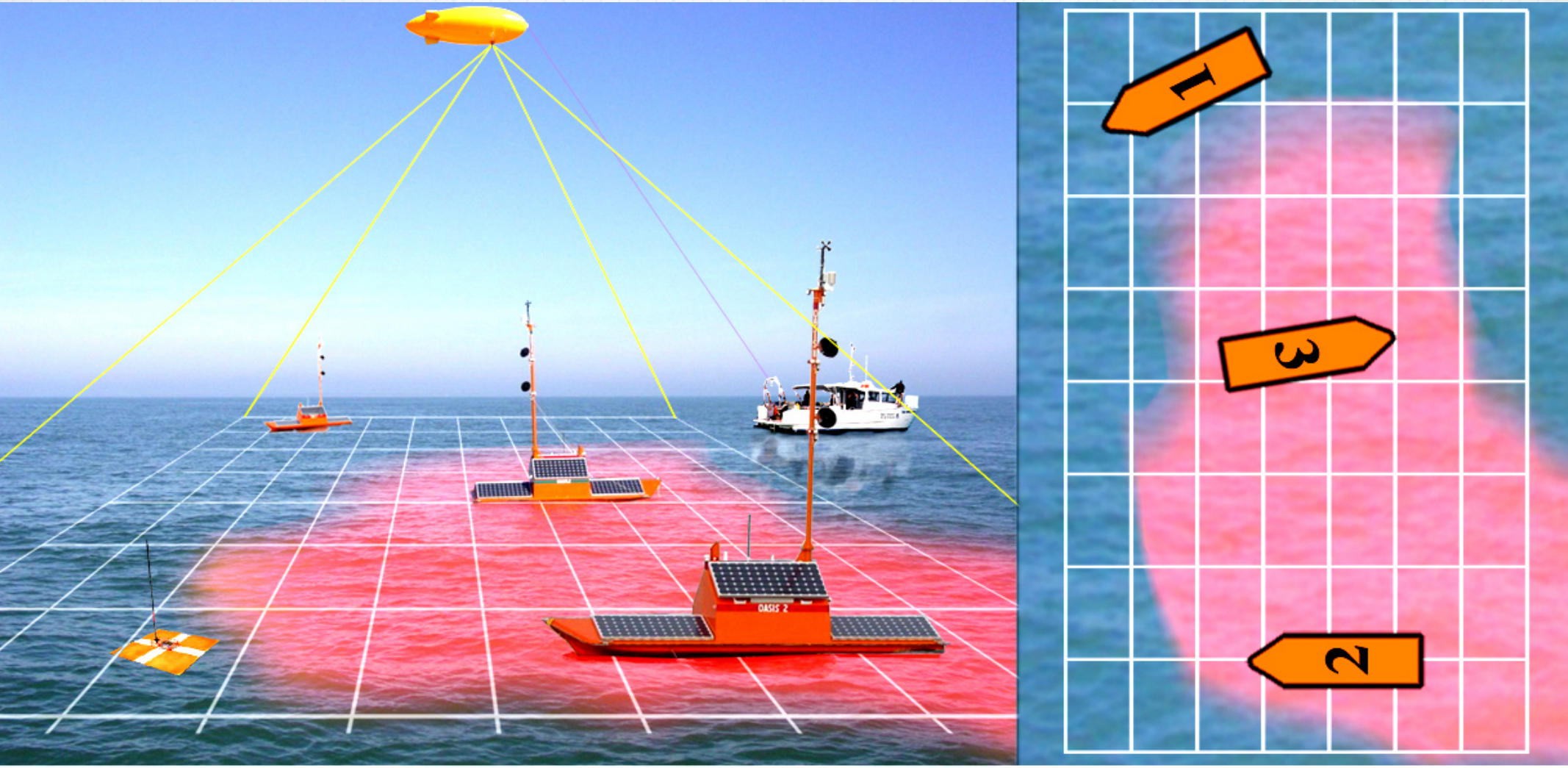


TAOSF - Robot Sensor Boats

Aerostat

- New Instrument Package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