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### **Title**

NAMOS: Networked Aquatic Microbial Observing System

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# Networked Aquatic Microbial Observing System

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## Monitoring Aquatic Environments

- Locate, track and study the growth and migration patterns of cyanobacteria and harmful algal blooms.
- Development of an autonomous network of heterogeneous sensors to sample and track changes in aquatic environments.

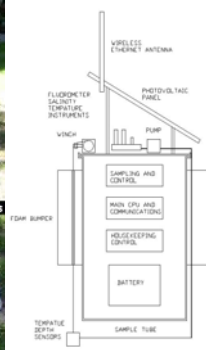


## Robotic Sensor Network Design

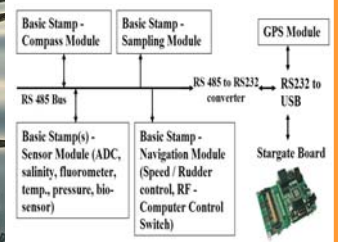
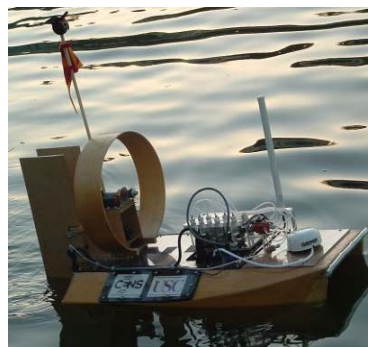
- Static network monitors the environment at low resolution and directs the robot boat for fine-grained sampling.
- Robot boat moves to the location of interest, collects data and samples for lab analysis.
- Sensor suite: thermistors (temperature), fluorometer (chlorophyll), light intensity (PAR), humidity, rain, air pressure, wind speed, wind direction, pH, turbidity, salinity (conductivity).
- Emstar based ad-hoc wireless 802.11b based communication.



### Static Buoy Node



### Robotic Boat



- Continuous real time data acquisition and logging of pertinent environmental parameters.
- Sensor suite: Array of thermistors (for temperature vs. depth profiling) and fluorometer (chlorophyll).
- Real time data visualization at the shore.

- Autonomous sensor guided and/or network guided near-surface sampling system for field operation.
- Outfitted with basic sensor suite for pertinent environmental parameters - thermistor, fluorometer and water sampler.
- Autonomous navigation to GPS waypoints using on-board GPS and compass (PID based control).
- Real time boat location monitoring.

## Field Deployment at the James Reserve, Idyllwild, CA

### Collaborative Operation

- Network of 10 static nodes and 1 robotic boat
- Continuous real time data acquisition and in-network data processing
- Sensor-network directed robotic boat navigation and sampling

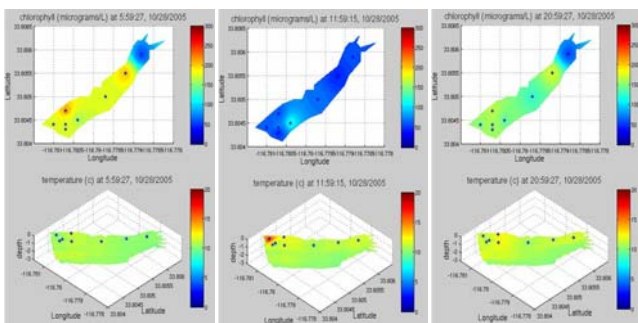


Fig. Chlorophyll and temperature variation over the length of the lake and over the course of the day.

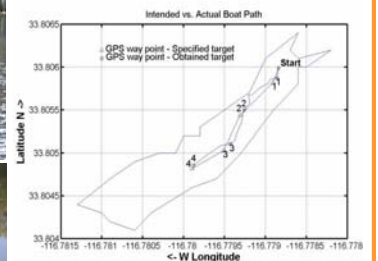


Fig. Autonomous navigation between GPS waypoints.