Gloucester Maritime Summit

Some on going research
David Burke
Nov 15-16, 2011

CENSAM

- center for environmental sensing and monitoring (CENSAM)

- MIT research Program

  - Sponsored by National Research Foundation of Singapore

- View of former Program Manager

CENSAM sources

- http://censam.mit.edu/

- http://smart.mit.edu/research/censam/censam.html

CENSAM Research Project Areas

- Built and Natural Environment

- Urban Hydrology and Water Resources

- Coastal Environment

- Integrated Environmental Models

- Marine and Underwater Sensing

# CENSAM Research Projects-cont'd

- Marine and Underwater Sensing

  - Coral-Based Study Of Marine Environmental Metals And Regional Paleoclimate

  - Chemical Sensors For AUV's

  - Underwater Optics

  - MEMS Pressure Arrays For Near-Field Flow Patterns

  - Autonomous Marine Systems

  - Algorithms For Adaptive Sampling In The Coastal Environment & Creation Of Solid Models From AUV Sensing Systems

CENSAM Research Projects-cont'd

- Marine and Underwater Sensing

  - Coral-Based Study Of Marine Environmental Metals And Regional Paleoclimate

  - Chemical Sensors For AUV's

  - Underwater Optics

  - MEMS Pressure Arrays For Near-Field Flow Patterns

  - Autonomous Marine Systems

  - Algorithms For Adaptive Sampling In The Coastal Environment & Creation Of Solid Models From AUV Sensing Systems

Chemical Sensors For AUV's

- Using mass spectrometry detect low molecular weight hydrocarbons and volatile organic compounds to monitor pollution.

- Using laser-induced fluorescence identify higher-molecular-weight hydrocarbons to detect older oil spills and biological entities e.g. chlorophyll.

- PI: Prof. Harold Hemond MIT CEE
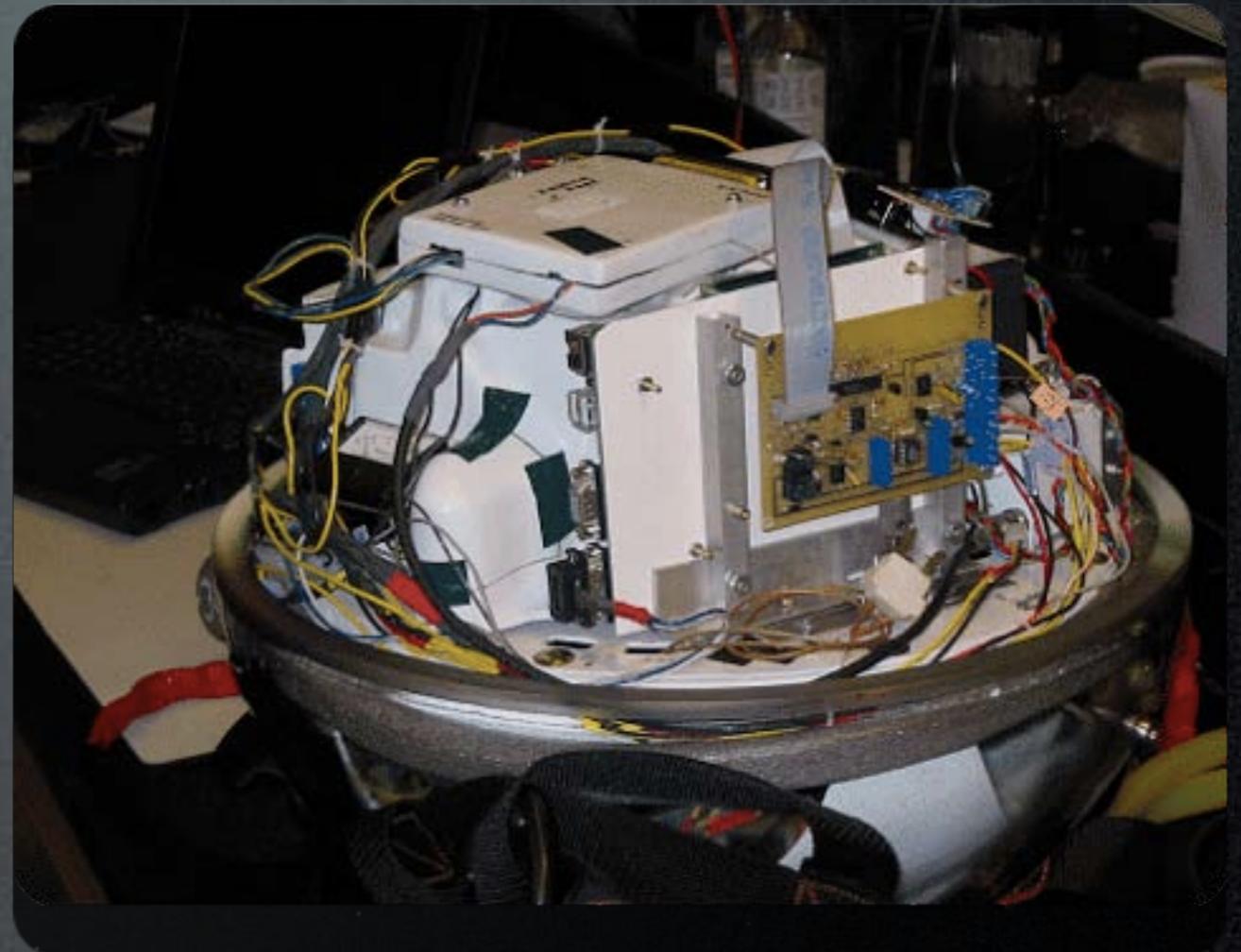
MEMS Pressure Arrays For Near-Field Flow Patterns

- Develop MEMS sensors and processing software that emulate and extend the capabilities of the lateral line in fish.

- Detect near-field flow patterns and near- and far-body obstacles and vehicles.

- Enable navigation in shallow-water and/or cluttered environments, and flow control in conventional and biomimetic vehicles.

- PI: Prof. Michael Triantafyllou MIT ME
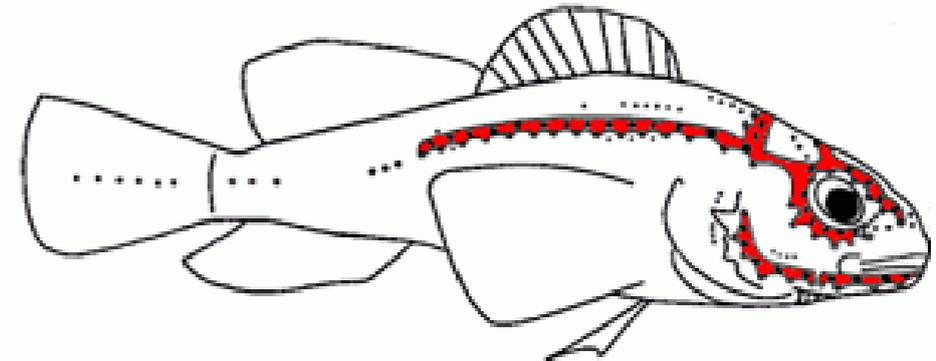
Neuromast distribution in Lake Michigan mottled sculpin

(adapted from Coombs, *Aut. Rob.*, 2001)
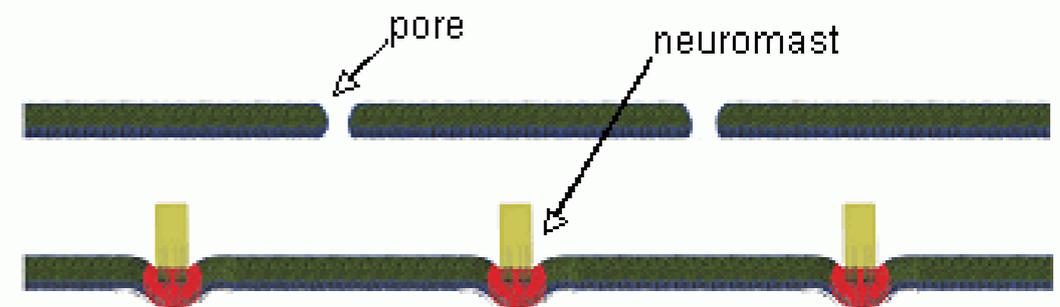
Neuromast canal diagram

Autonomous Marine Systems

ASV

- Monitor and survey the Singapore Harbour area, using autonomous surface and underwater vehicles.

- Develop a system capable of individual and coordinated actions relative to feature maps, and adaptive sampling.

- Incorporate new acoustic communication and navigation systems.

- Explore broader ultrasonic propulsion.

- PI: Prof. George Barbastathis, Nicholas M. Patrikalakis MIT ME

AUV

Algorithms For Adaptive Sampling In The Coastal Environment & Creation Of Solid Models From AUV Sensing Systems

- Develop algorithms for planning cooperative adaptive sampling of the coastal ocean environment.

- Assimilate data from sensors on autonomous surface and underwater vehicles to improve forecasts.

- Develop algorithms for reconstruction of natural and man-made marine structures.

- PI: Prof. Nicholas M. Patrikalakis MIT ME
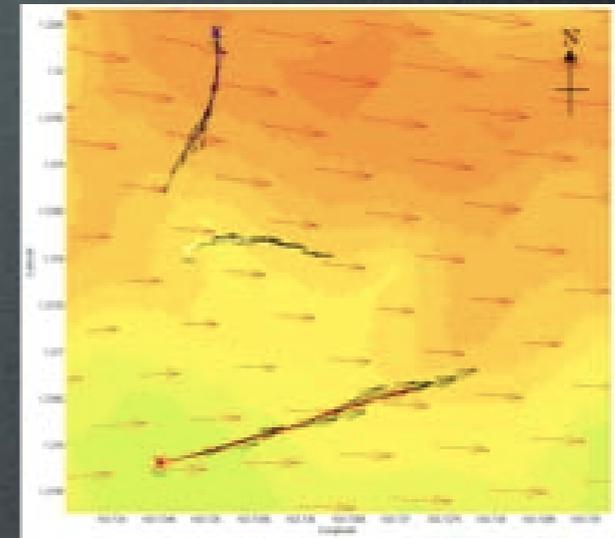
ASV Trajectories 2009 trial
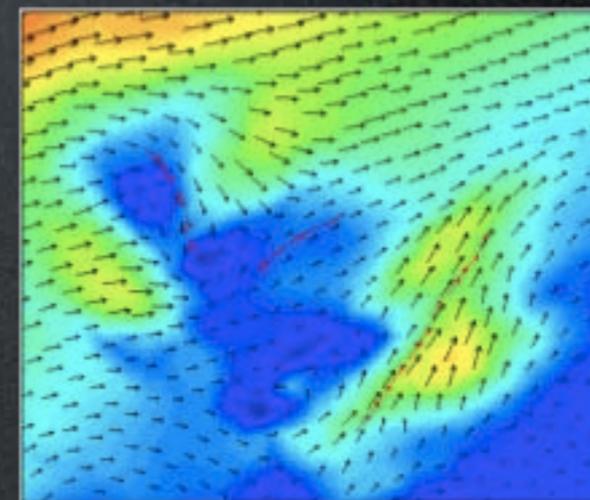
Data assimilation

Summary

- Brief overview of MIT/Singapore program with significant application to marine research

- Significant developments in sensors and application of autonomous vehicles