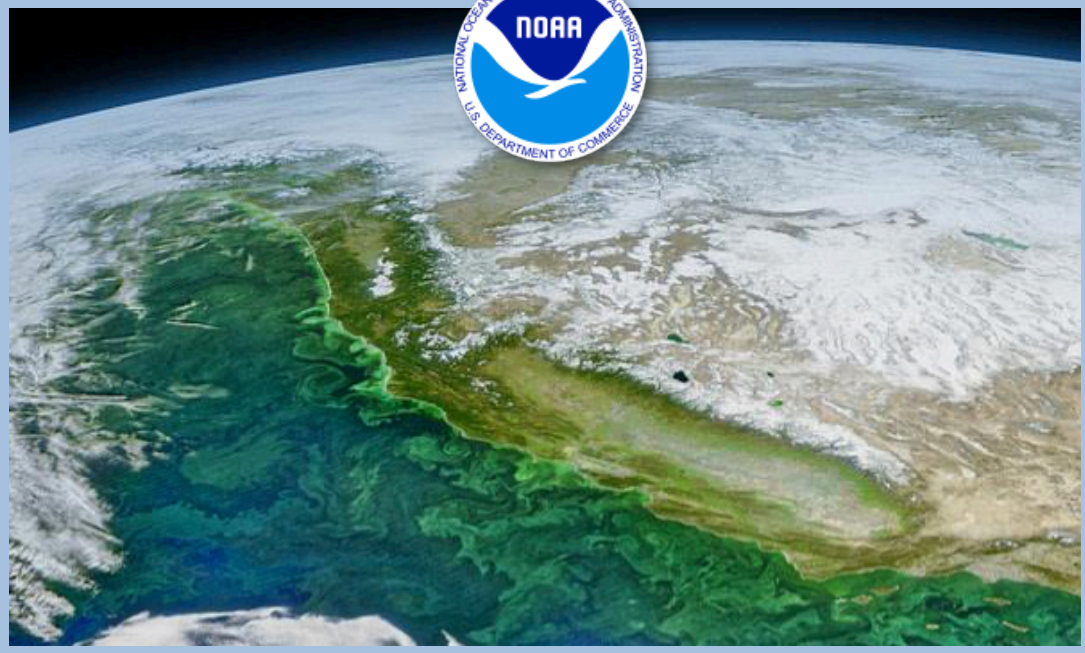
Advancing HAB Ocean Sensor Technologies

NATIONAL OCEAN SERVICE

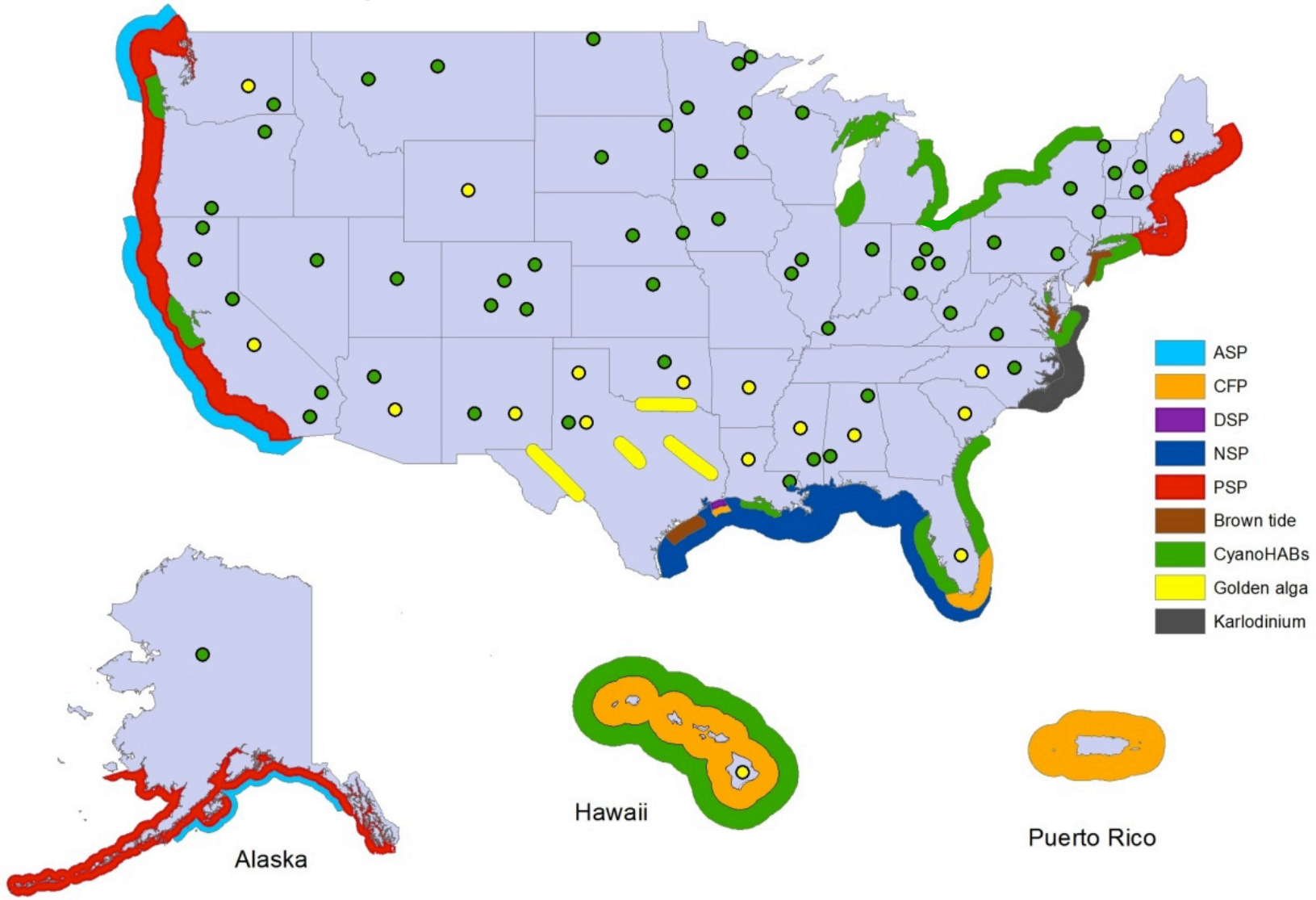


Marc Suddleson
HAB Program Manager, MERHAB
National Centers for Coastal Ocean Science

Jenifer Rhoades
OTT Program Manager
Integrated Ocean Observing System Program

Silver Spring, MD

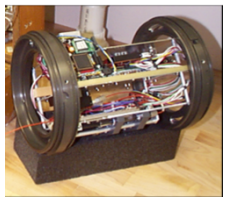
Harmful Algal Blooms – A National Problem



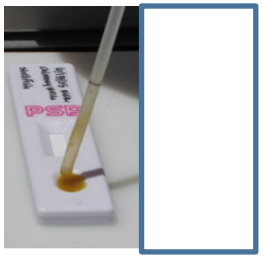
A National Response to HABs – NOAA's Mandate

2014 - Harmful Algal Bloom and Hypoxia Research & Control Act

- Improve interagency coordination
- Conduct research
  - Understand causes & impacts
  - Develop better monitoring, prediction and response
  - Understand roles of climate, nutrients, etc.
  - Toxins in foods and water
  - Methods to suppress\control, prevent.
- Event Response
- Reports to Congress

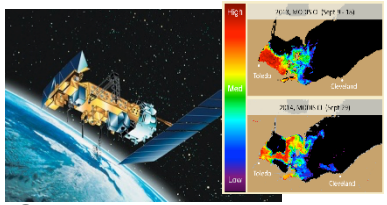


Breve Buster\Glider
Karenia cell counts.
G.Kirkpatrick Mote,. NOAA ECO\PCMHAB & NCCOS



Jellet & Mercury Science toxin kits. NCCOS and partners

SPATT toxin sampler.
R.Kudela UCSC.
NCCOS and partners



Satellite detection\tracking:
Karenia & Microcystis blooms.
R. Stumpf. NCCOS

A National Response to HABs - Accomplishments

- Guidelines for freshwater toxins, health advisories
- Enhanced HAB Detection
  - low cost\simple screening
  - Better regulatory confirmation
  - Real-time HAB sensors
- HAB modeling & forecast products
- HAB event response
- Understanding effects of HAB toxins on human, animal health

HAB-scope:" *Karenia* cell counts. G.Kirkpatick Mote. NASA & NCCOS labs

"Tricorder:" *Karenia* cell counts. J.Paul USF. NOAA ECO\PCMHAB

POSSE: Alexandrium cell ID. L. Connell U.Maine. NOAA MERHAB

NOAA Mandate for National Ocean Observing System

Integrated Coastal & Ocean Observation System Act of 2009

Created IOOS, with NOAA as lead Federal agency "The purposes of this subtitle are to–

(1) establish a **national integrated System** of ocean, coastal, and Great Lakes observing systems, comprised of **Federal and non-Federal** components coordinated at the national level by the National Ocean Research Leadership Council and at the regional level by a network of regional information coordination entities, and that includes in situ, remote, and other **coastal and ocean observation, technologies, and data management and communication systems**, and is designed **to address regional and national needs for ocean information**, to gather specific data on key coastal, ocean, and Great Lakes variables, and to ensure timely and sustained dissemination and availability of these data…"

CONSISTENT NATIONAL CABABILITY

assure

Reg. Assn's

engage

Observations
Forecasts/Modeling
Data Management
User Products
Outreach and Education
Leverage and Link

DIVERSE LOCAL STAKEHOLDERS

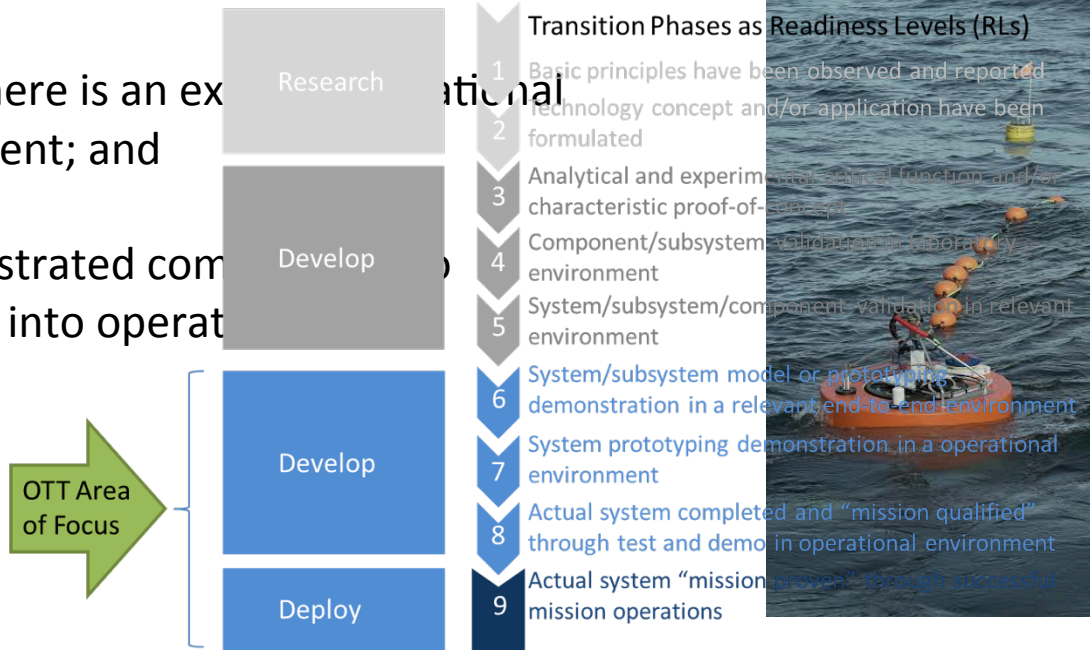
Ocean Technology Transition

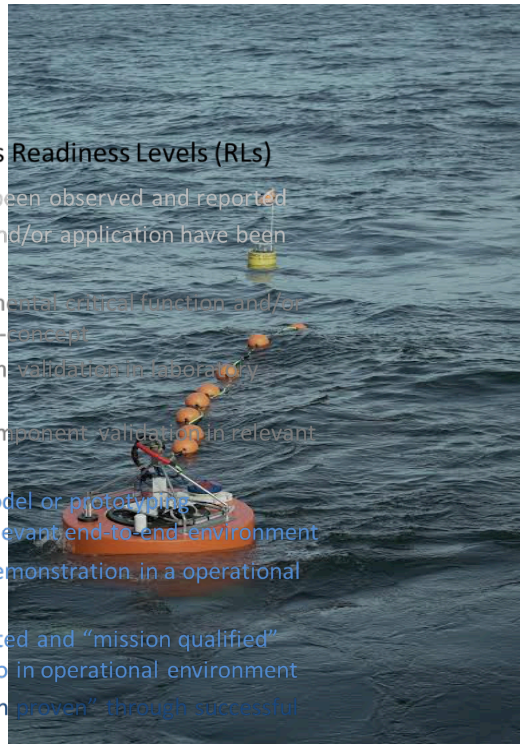
- IOOS advances technology through the transition of ocean, coastal, and marine sensors and platforms to operations

➢ Sponsors the transition of emerging marine observing technologies;

➢ Where there is an ex ational requirement; and

➢ A demonstrated com integrate into operat

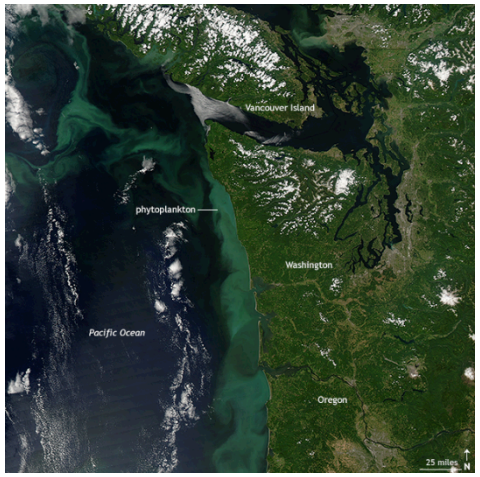




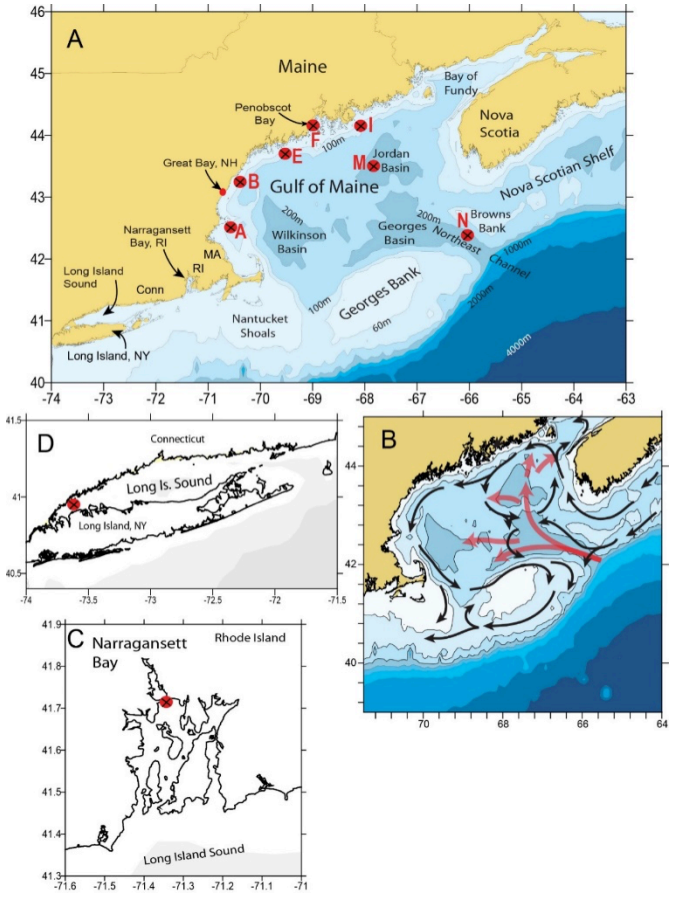
HAB Sensors – Ocean Conditions

- Nitrate sensor (U. Maine)
- Northeast Nutrient Observatory
- SST/HAB pigments (Satellites)

Temporary HF Radar Site.
Credit: Libe Washburn



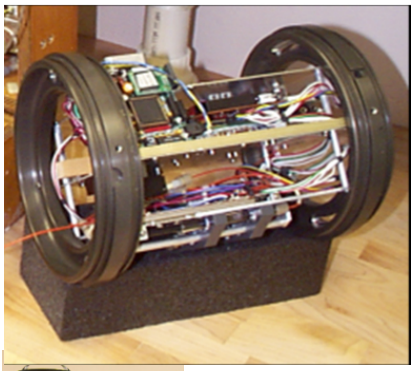
California Dept. of Fish and Wildlife



NE Nutrient Observatory, Credit: NERACOOS

HAB Sensors – Cells and Toxins

- In situ observations
  - cells
  - toxins
- Remote Detection
  - Proxy measurements
  - Satellites
- Rapid "hand-held" field tests
  - Toxins in water
  - Toxins in shellfish/fish

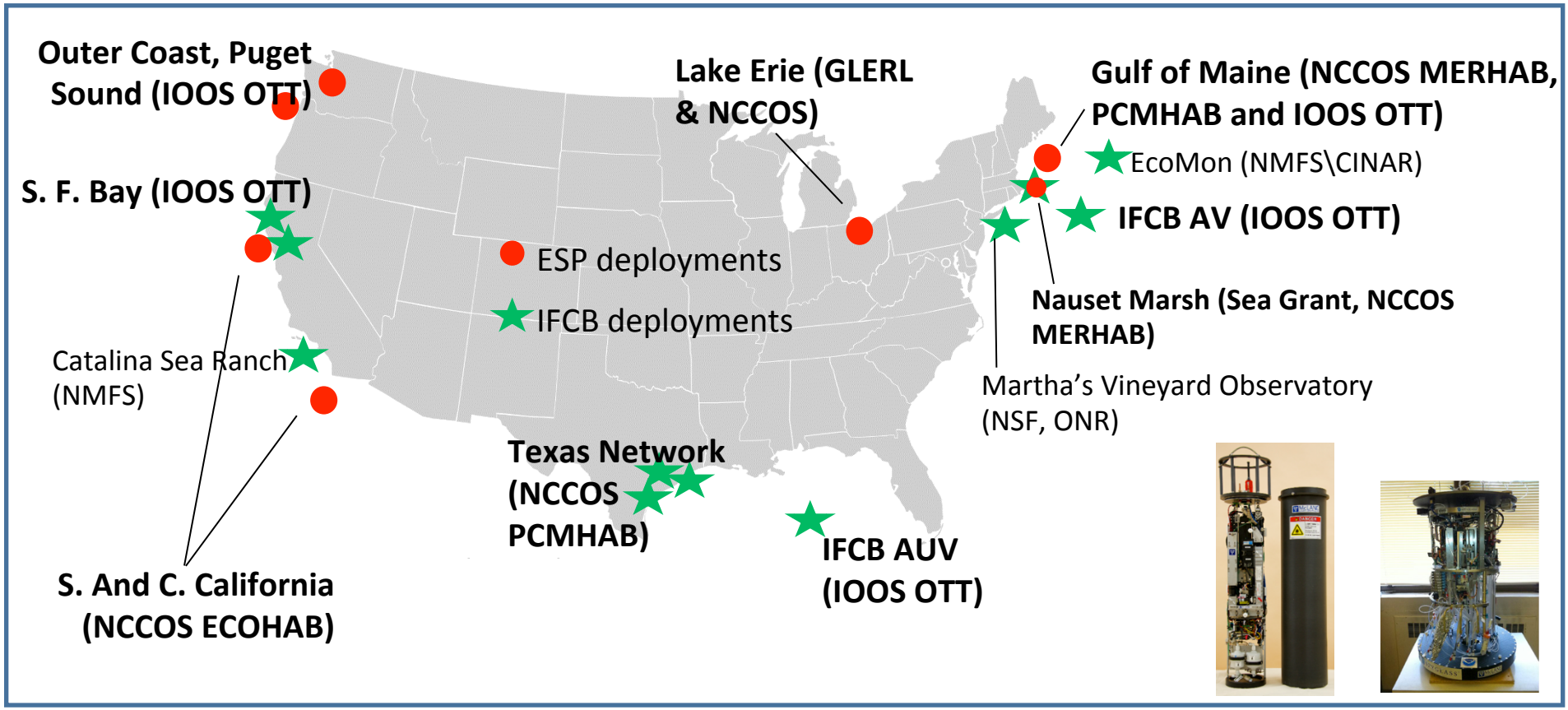




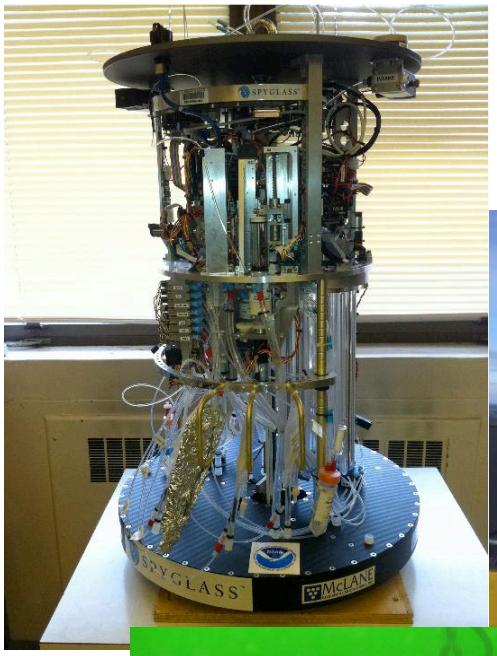


HAB Sensor Examples - ESP and IFCB

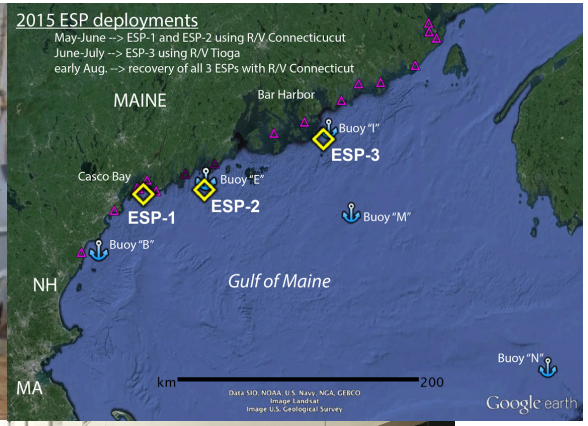
Advancing Harmful Algal Blooms, Water Quality, Ocean Observing, Aquaculture Missions

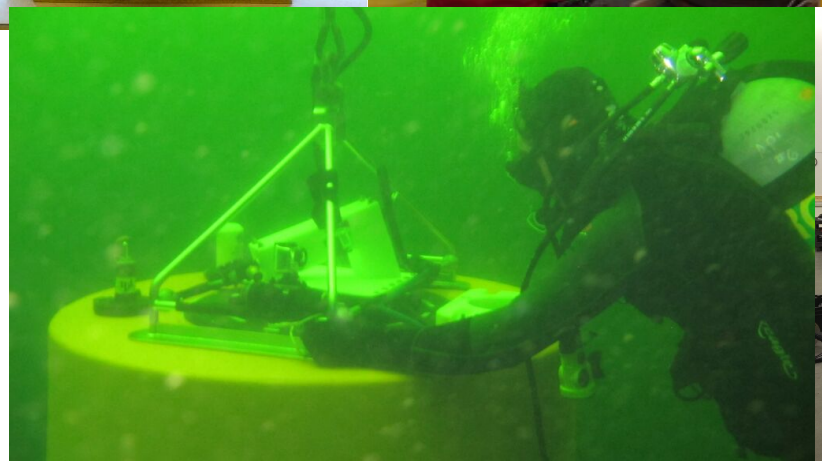


HAB Sensors - ESP Story

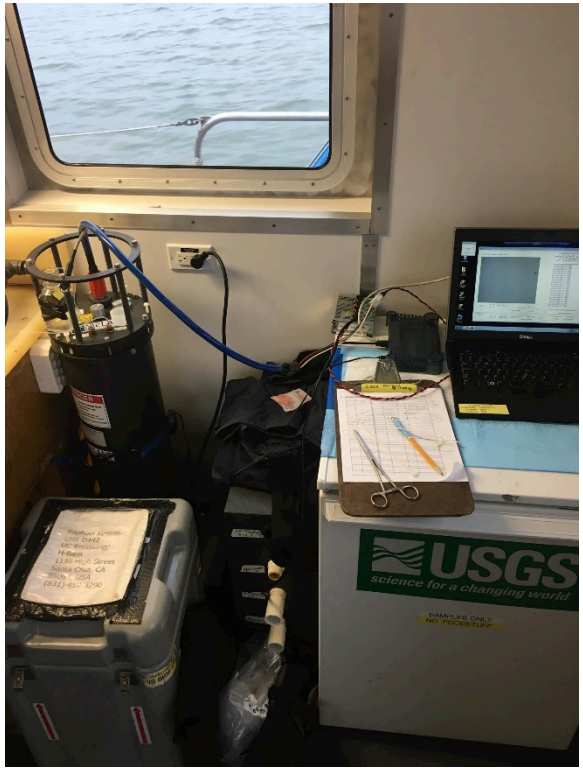


- Gulf of Maine (2013-2014)
- Pacific Northwest (2014-2017)





HAB Sensors - IFCB story

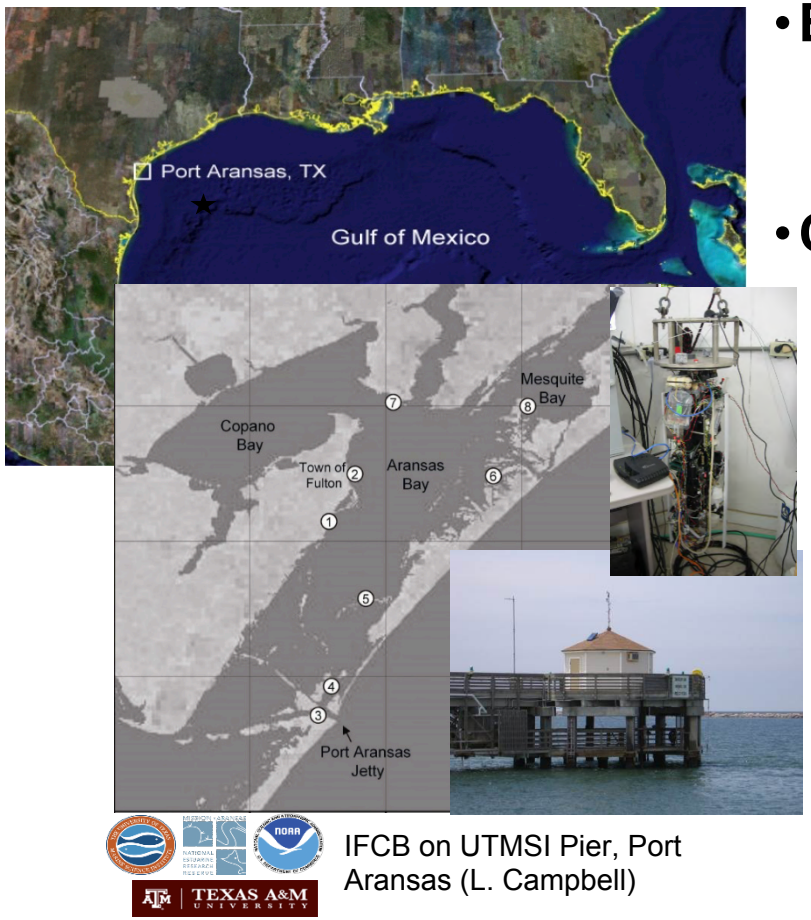


UCSC

- WHOI Project (2015-2018)
  - *Research prototype field tested Salt Pond, MA early spring of 2016.*
  - *Prototype IFCB-AV has successfully field tested in a JetYak vehicle in Woods Hole Harbor and Salt Pond*
  - *Production of a pre-commercial IFCB-AV developed.*
  - *Starting testing on a Liquid Robotics Wave Glider.*
  - *Future tests in Gulf of Mexico*
- San Francisco Bay Project (2014-2017)
  - *Lab IFCB Tests Successful*
  - *IFCB successfully deployed in Santa Cruz Wharf and on a USGS vessel*
  - *Upcoming Deployment on Dunbarton Bridge*
  - *USGS and SFEI to fund project in 2017*

HAB Sensors : IFCB story

Reduces Harmful Algal Bloom Impacts



IFCB on UTMSI Pier, Port Aransas (L. Campbell)

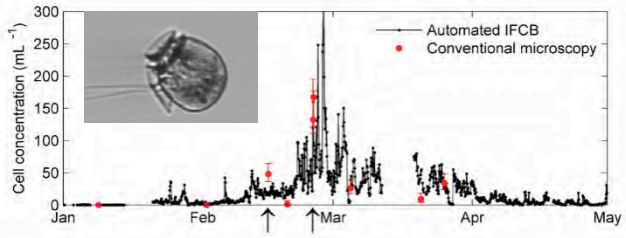
- **Efficient and Effective Shellfish Monitoring**

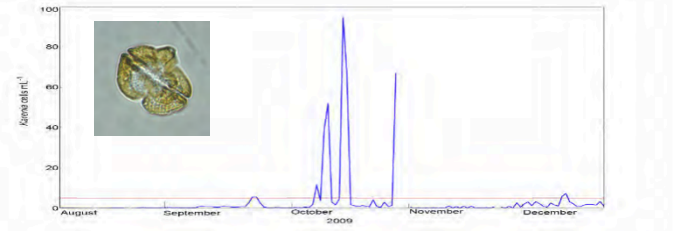
  7 HAB early warnings since 2007

- **Confidence in Shellfish Product Safety**

  No shellfish recalls since 2008.

***Dinophysis spp.* Diarrhetic Shellfish Poisoning**





***Karenia spp.* Neurotoxic Shellfish Poisoning**

HAB Sensors : IFCB story

HAB Shellfish Harvesting Closures
March 7-April 12, 2008

Oyster Festival in Fulton, TX
March 7-9, 2008

Town Of FULTON Texas

Oysterfest in Fulton, Texas

Cash Prizes

Men's & Women's Raw Oyster Eating Contests

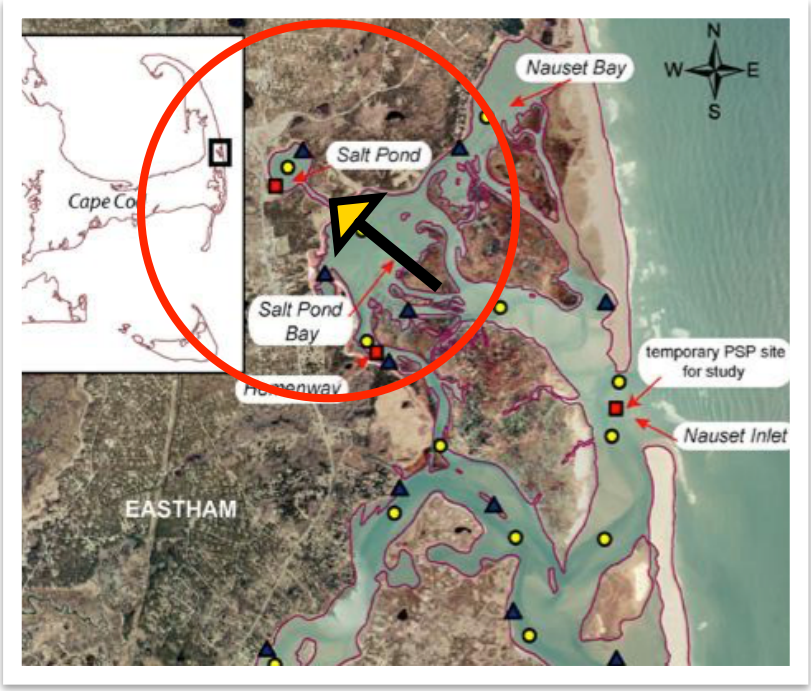
1st – Prize $200, 2nd – Prize $100, 3rd – Prize $50

Oyster Shucking Contest

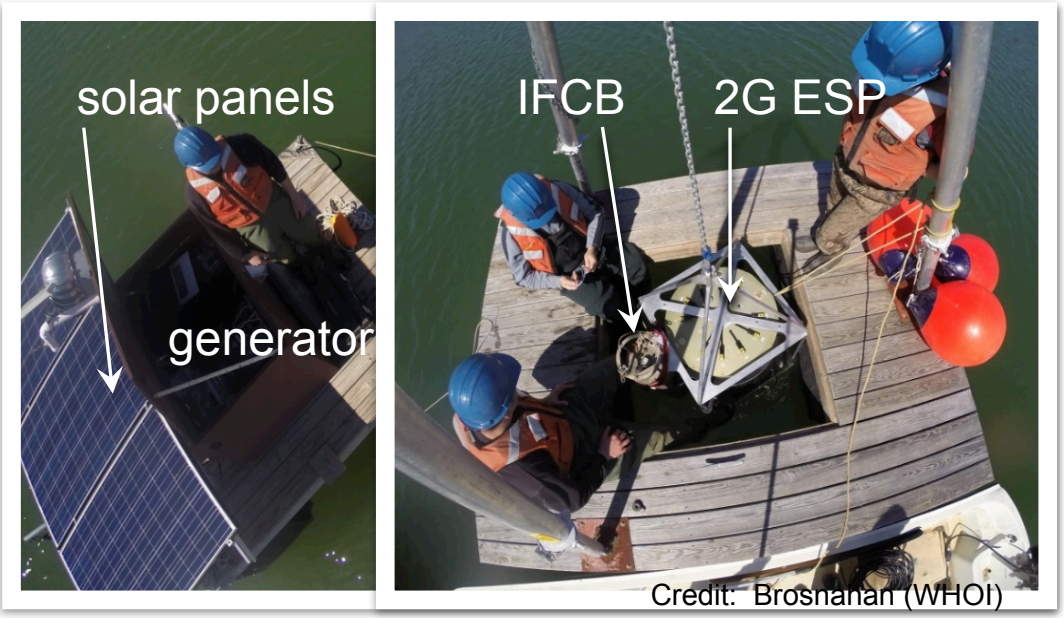
1st – Prize $700, 2nd – Prize $200, 3rd – Prize $100

HAB Sensors : ESP and IFCB story

In situ measurement of phytoplankton cells and toxins



IFCB and 2G ESP in Nauset Marsh, Cape Cod Spring 2016



IFCB powered by solar panels and generator

HAB Sensors: ESP Summary

Active NOAA Program Investments	NOS\NCCOS HAB Research IOOS Ocean Tech Transfer OAR GLERL, NMFS NW Fisheries Science Ctr.	HAB species & toxins Observations & Technology Transfer Ecological Forecasting Aquaculture
Partnerships Universities, States, Companies	Woods Hole Oceanographic Institution, MBARI, U.C. Santa Cruz, USC, U. Washington, NANOOS, and NERACOOS. Washington Departments of Health and Fish & Wildlife McLane Research Laboratories, Inc. Taylor Shellfish, Lummi Indian Tribe	

ESP Capabilities

- Continuous, autonomous HAB species and toxin abundance + pathogen detection.
- 10 yrs of buoy, pier-based, and cabled underwater deployments
- Data supporting NOAA and state science and management needs
- 2nd generation commercially available
- New applications and next generation formats emerging

HAB Sensors: IFCB summary

Active NOAA Program Investments	NOS\NCCOS HAB Research IOOS Ocean Tech Transfer OAR Sea Grant M.I.T. & TX NMFS Saltonstall-Kennedy	HAB species\community Water quality Observations & Tech Transfer Ecological Forecasting Aquaculture
Partnerships Universities, States, Companies	Woods Hole Oceanographic Institution Texas A&M and U.C. Santa Cruz Texas State Departments of Health Services and Wildlife McLane Research Laboratories, Inc. Catalina Sea Ranch, LLC (new)	

IFCB Status

- Continuous, autonomous ID & counts of phytoplankton species.
- 10 yrs of shipboard, pier-based, and cabled underwater deployments
- Data supporting NOAA and state science and management needs
- 1st generation commercially available
- New applications and next generation formats emerging

NCCOS HAB Programs

- FY17 PCMHAB and ECOHAB FFO closed, peer review underway
- Future FFOs for ECOHAB, MERHAB and PCMHAB programs likely to continue HAB sensor technology advances.

Disclaimer: plans are pending federal appropriations

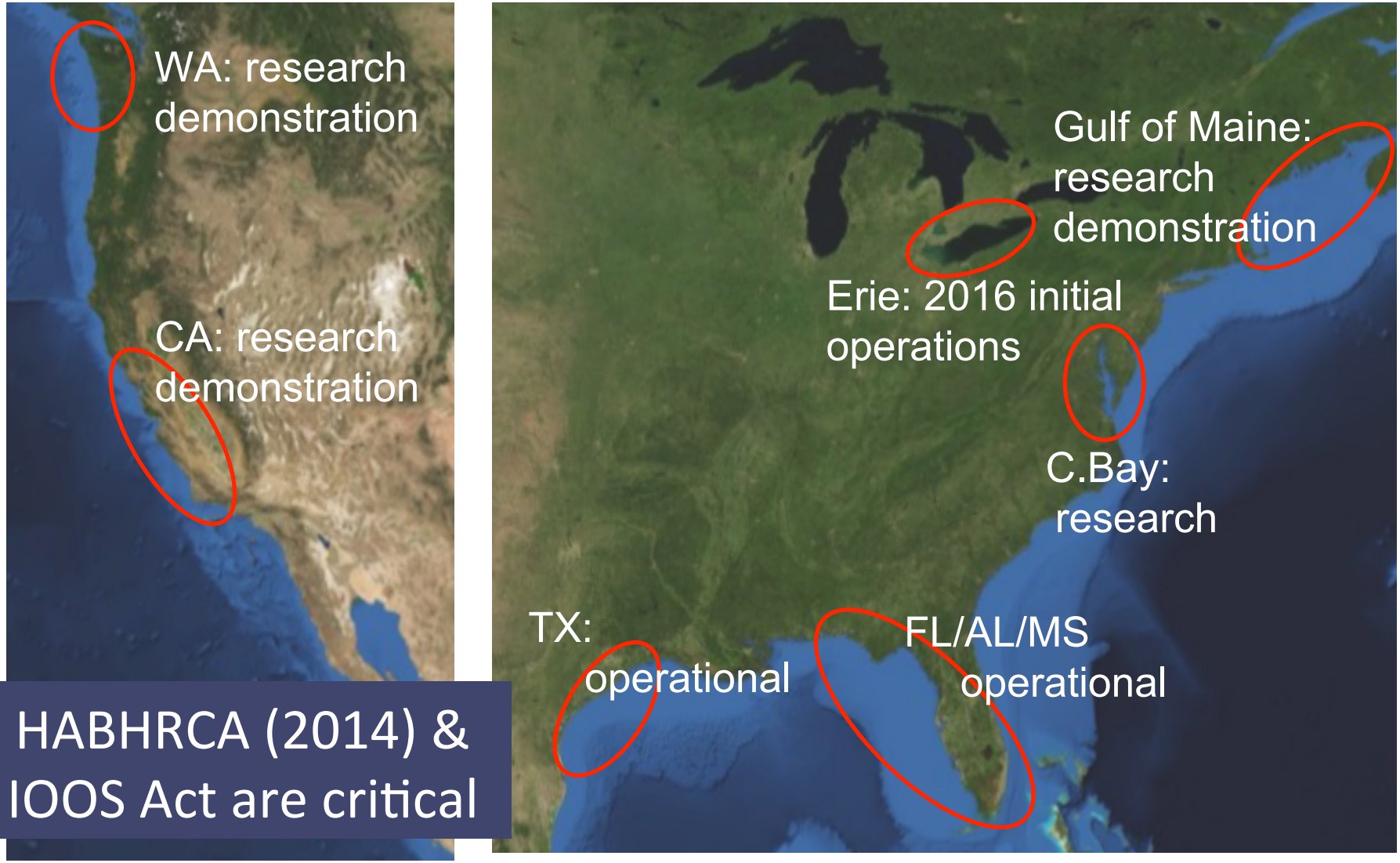
Ocean Technology Transition

- **FFO Open – Closes March 20, 2017**
- Innovative proven tech
- Proof of Concept
- Proof of Operational Need
- Committed Sponsor

http://www.ioos.noaa.gov//project/ocean-technology-transition/

McLANE RESEARCH LABORATORIES, INC.

National HAB Forecasting and Sensor Networks



HABHRCA (2014) & IOOS Act are critical

What can sensor industry and partners do?

- Support NOAA Operational HAB Forecasting System to provide early warning for HABs useful to industry
- Educate partners on how sensors can address about HAB-related disruptions to their businesses.
- Engage in developing of monitoring networks and foster regional collaborations.
- Develop regional collaborations
- Support regional Integrated Ocean Observing System associations—urge them to include HAB sensors

Thank You!

Contact Information

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