NOAA IOOS Program Office Regional Status Assessment for NANOOS

4 June 2008

Jan Newton, David Martin

IOOS
Integrated Ocean Observing System

National Oceanic and Atmospheric Administration
NOAA
U.S. Department of Commerce

NANOOS: The Northwest Association Of Networked Ocean Observing Systems

http://www.nanoos.org

RA Structure and Governance

- *RA leadership* **(NANOOS Executive Committee)**

Staff:

– Executive Director: Jan Newton, UW

Officers:

– President: David Martin, UW
– President Elect: Antonio Baptista, OHSU
– Secretary: Fritz Stahr, Ocean Inquiry Project
– Treasurer: Vicki McConnell, OR Dept Geology & Mineral Industry

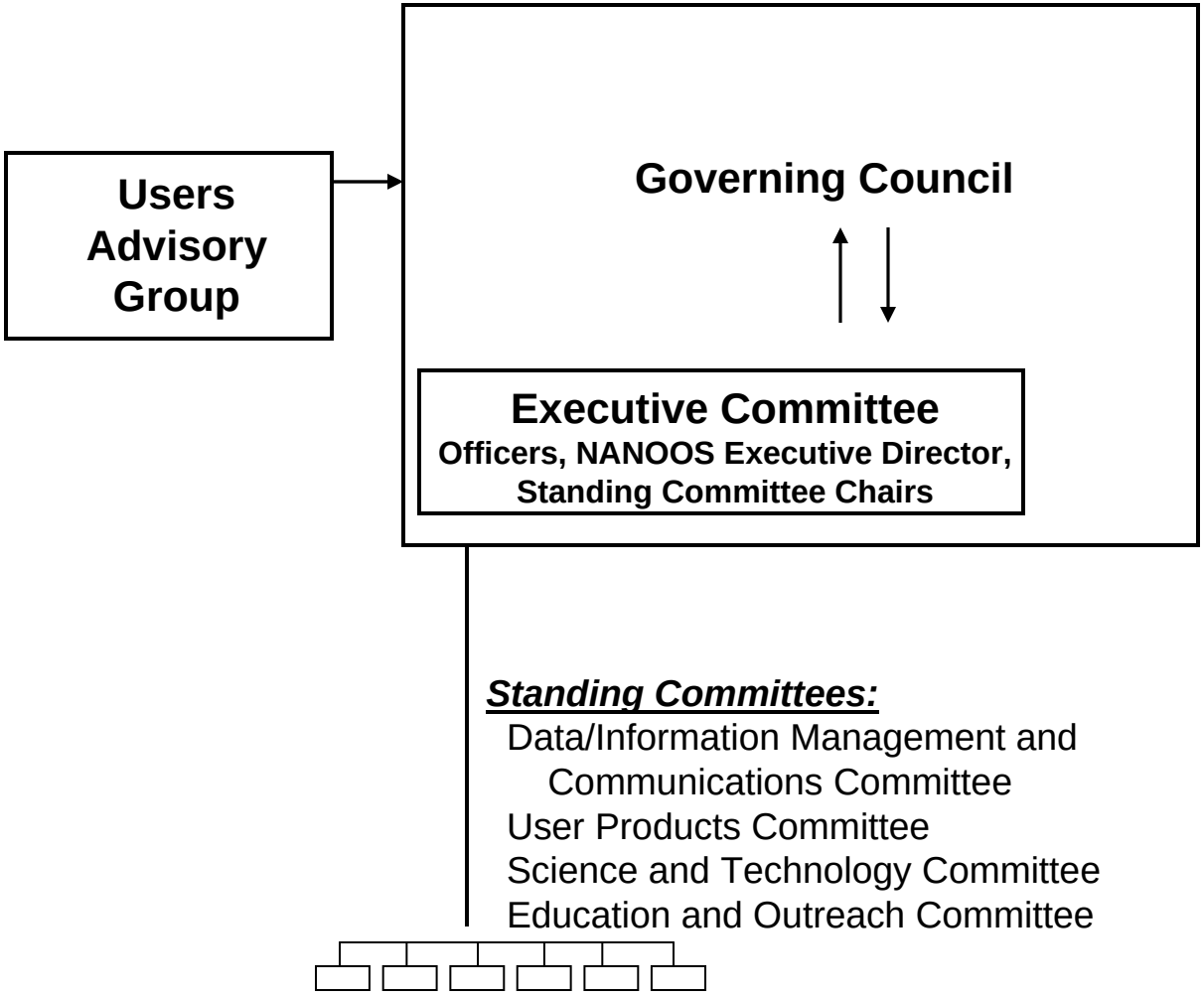
Standing Committee Chairs:

– DMAC: Steve Uczekaj, The Boeing Company
– User Products: Jonathan Allan, OR Dept Geology & Mineral Industry
– Education and Outreach: Mike Kosro, OSU
– Science and Technology: Casey Moore, WET Labs, Inc.

RA Structure and Governance

- *Organizational structure*
  - Defined per NANOOS MOA, see next slide
  - NANOOS Business Plan

Governance structure



RA Structure and Governance

- *Board*
  - *Meetings (frequency, focus)*
- NANOOS Governing Council (GC) meetings semi-annually, telecons more frequently
- 25 March 2008 GC meeting at WSU-Vancouver attended by 21 participants
- NANOOS EXCOM used to frame decisions, then presented to GC for discussion and vote
- Focus: national and regional updates; governance decisions as needed; specific focus as needed

NANOOS Members *to date…*

1. Ocean Inquiry Project
2. Oregon Dept of Land Conservation & Development
3. Surfrider Foundation
4. The Boeing Company
5. Oregon State University
6. Puget Sound Partnership
7. University of Washington
8. WET Labs, Inc.
9. Oregon Health and Science University
10. Quileute Indian Tribe
11. Oregon Dept of Geology and Mineral Industries
12. Humboldt University
13. Marine Exchange of Puget Sound
14. Washington State Dept of Ecology
15. Pacific Northwest National Laboratory
16. Port of Newport
17. Puget Sound Harbor Safety Committee
18. Sound Ocean Systems, Inc.
19. Council of American Master Mariners
20. Hood Canal Salmon Enhancement Group
21. Pacific Northwest Salmon Center
22. Northwest Indian Fisheries Commission
23. Sea-Bird Electronics, Inc.
24. Western Association of Marine Laboratories
25. SAIC
26. OR Dept Fish and Wildlife
27. King County Dept Natural Resources & Parks
28. Western Resources and Applications
29. OR Dept of State Lands
30. Columbia River Crab Fisherman's Association
31. Quinault Indian Nation

- Tribal Gov't
- State/local Gov't
- Industry
- Academia/Research
- NGO

Stakeholder Engagement

- *Stakeholder types*
- *Key stakeholder groups or individuals*
- *Types and frequency of engagement (workshops, regular meetings, etc.)*
- *Level of involvement*

NANOOS has a wide diversity of members who we consider our stakeholders. Their "type" has been reflected in the emergence of our four priority areas. Their engagement have been frequent and real, as they constitute our Governing Council.

ID of PNW User Groups

NEEDS

SYSTEM

From NOAA/NANOOS analysis:

- Marine shipping and oil transport/spill remediation
- Search and rescue
- Shellfish fishery and aquaculture
- Marine recreation
- Natural resource/environmental management
- National and homeland security
- Finfish aquaculture
- Research institutions
- Education
- Commercial groundfishing
- Crab fishery

Stakeholder Engagement

- *Key issues of importance to regional stakeholders, & how the RA addresses them*

The NANOOS GC selected four topical areas from the results of numerous regional workshops to be the highest regional priorities as "these issues represent those having the greatest impact on PNW citizenry and ecosystems and, we believe, are amenable to being substantively improved with the development of a PNW RCOOS":

- Maritime Operations
- Ecosystem Impacts including hypoxia and HABs
- Fisheries
- Mitigating Coastal Hazards

These priorities were put forth in our NANOOS RCOOS proposal and are being addressed by the development of our regional observing system.

Stakeholder Engagement

- Quantifiable, tangible expressions of support from stakeholders

There were 18 letters of support attached for the NANOOS RCOOS proposal:

Quinault Indian Nation - *Operations Section Manager*
WA State Dept of Fish and Wildlife - *Coastal Shellfish Lead Biologist*
WA State Dept of Ecology - *Coastal Training Program Coordinator*
Oregon Coastal Ocean Observing System - *Director*
King County Water and Land Resources Division - *Science and Technical Support Section Manager*
Surfrider Foundation - *Washington Policy Coordinator*
Ocean Inquiry Project - *Chairman of the Board*
Hood Canal Salmon Enhancement Group - *Assistant Director*
UW School of Oceanography - *Manager of Marine Operations*
Marine Technology Society - *Vice President for Education and Research*
Seattle Yacht Club - *Fleet Captain Power*
Coast and Harbor Engineering Inc. - *Principal Coastal Engineer*
Oregon Sea Grant - *Extension Agent*
Washington Dept of Community Trade and Economic Development - *Senior Planner*
NSF Science and Technology Center for Coastal Margin Observation and Prediction - *Director*
OR Dept of Land Conservation & Development, Coastal Management Program - *Coastal Program Manager*
OR Dept of Fish and Wildlife - *Marine Resources Program Assistant Manager*
US Dept of the Interior Fish & Wildlife Service, Willapa National Wildlife Refuge Complex - *Wildlife Biologist*
Friends of Grays Harbor - *Vice President, Board of Directors*
Oregon Parks and Recreation Department - *Director*

Some NANOOS RCOOS Letter of Support quotes:

–"... the larger NANOOS network of data will give us both **boundary conditions and context** for our internal data.." ***King County***

–"This proposal to enhance the Regional Coastal Ocean Observing Systems will provide our membership with better access to **real-time beach and water conditions**." ***Surfrider Foundation***

–"This proposal contains education and outreach plans that will expand on that concept and provide a real foundation for improving the **ocean literacy** of this region's citizens." ***Ocean Inquiry Project***

–"NANOOS gives CHE, and many other firms, the tools necessary for collecting and disseminating data and information on **past, present, and future states of the oceans** and other marine ecosystems."

Coast and Harbor Engineering, Inc.

–"The ideas and goals of NANOOS are things that the **fishing community** is excited about, and they will be eager to engage in the opportunities outlined by the grant."

OR Sea Grant

–"On a personal level, as a member of a fishing community, the loss of life we experience each year is enormous and at times unbearable. The potential of NANOOS observations to be available in real time to help in **search and rescue efforts** is something that would be extremely valuable to communities' coast wide."

Scientists And Fishermen Exchange (SAFE)

–"These activities provide **local governments** with baseline information and help them make informed decisions about sustainable development. The NANOOS program is a very important part of building that local capacity."

WA Dept of Community Trade and Economic Development

–"The NANOOS data portals, linking fishery data to habitat and other geographic data will provide an essential tool in **fisheries management**."

OR Dept of Fish and Wildlife

Stakeholder Engagement

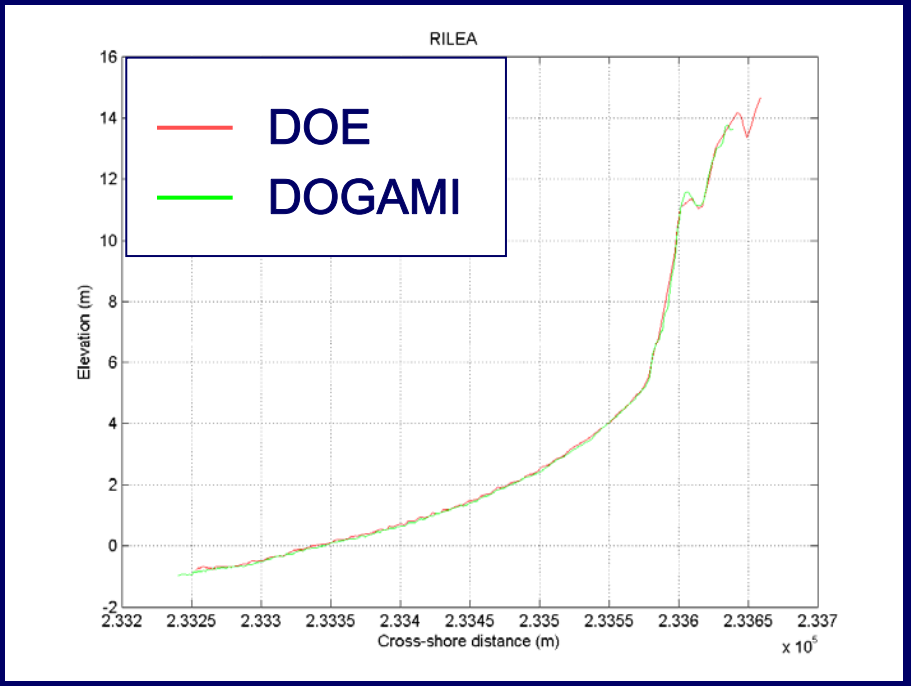
- *Quantifiable, tangible expressions of support from stakeholders*
  - West Coast Governor's Agreement on Ocean Health identified development of RAs as a priority issue in their Action Plan
  - Olympic Coast Intergovernmental Policy Council Resolution approved the Ocean Research and Monitoring Initiative defining ocean observing buoys a priority
  - Stakeholders contacted NANOOS requesting "talking points" for D.C. communications

Stakeholder Engagement

- *Quantifiable, tangible expressions of support from stakeholders*
  - *Specific examples that demonstrate benefit of the RA to the region*

1. Cross-state Shoreline Technology Transfer: NANOOS working with WA DOE and OR DOGAMI
2. Real-time Water Quality info for Shellfish Grower Industry: NANOOS – NERRS partnership

Cross-state Shoreline Technology Transfer:



DOGAMI: Oregon Department of Geology & Mineral Industries

DOE: Washington State Department of Ecology

NANOOS

Technology transfer

Real-time Water Quality Data
for Shellfish Growers in the Pacific NW

A pilot project between NANOOS and the National Estuarine Research Reserve System

home
about
reference
e-mail alerts
contacts
links

email address:
password:
remember me
login
forgot? | join

Make Informed Decisions Based on Real-Time Data! This pilot project represents an effort to bring real-time water quality data to shellfish growers in the Pacific Northwest. The project has started with nine monitoring sites in Alaska, Washington, and Oregon. Expansion to other sites is anticipated.

Alaska
Are you at risk for a Vibrio bacterium outbreak in Kachemak Bay? Check temperature and other readings here.

Washington
Do your oysters have enough oxygen to thrive in the Hood Canal? Get the latest information now.

Oregon
What impact did the last rainfall have on salinity? See what's happening near Charleston and Valino Island.

Spotlight Data

Padilla Bay Research Reserve:
Joe Leary Slough
Bayview, WA
48° 31' 5.16 N, 122° 28' 22.80 W
5/16/2008 1:15:00 PM

Temperature	**61.7 degrees F**
Salinity	**0.2 ppt**
DO concentration	**5.5 mg/L**
DO Saturation	**56 %**
Turbidity	**31 NTU**
pH	**6.6**
Insitu Chlorophyll	**No Data**

Pacific Northwest Water Quality Data Sponsored by NANOOS and NERRS - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.nanoos-shellfish.org/PageID/151/id/Twanoh/default.aspx

Getting Started Latest Headlines Welcome to the Hood...

Real-time Water Quality Data
for Shellfish Growers in the Pacific NW

A pilot project between NANOOS and the National Estuarine Research Reserve System

National Estuarine Research Reserve System

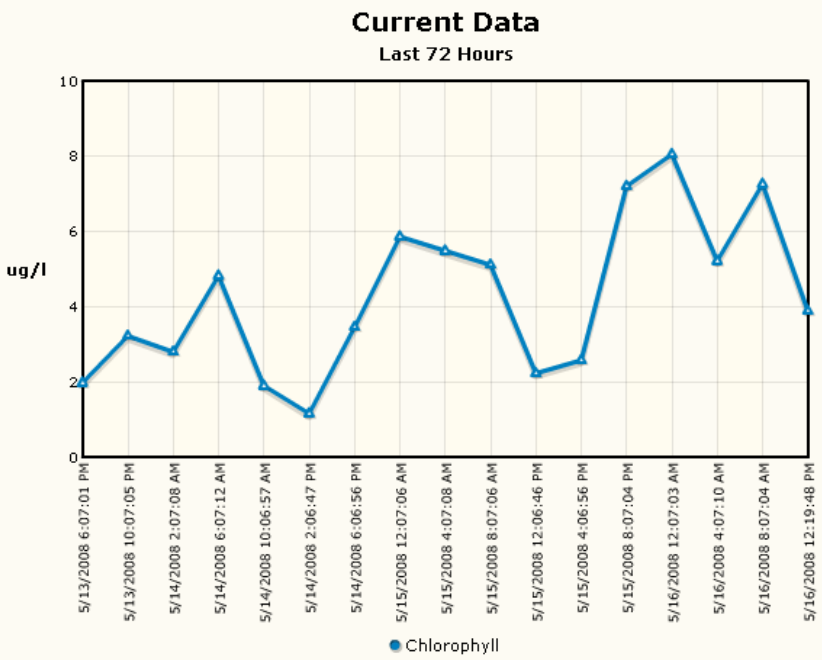
Current Data : Twanoh

home
about
reference
e-mail alerts
contacts
links

email address:
password:
remember me
login
forgot? | join

Ak
WA
OR

Temperature | Salinity | Dissolved O2 | Chlorophyll



Time Period ○12 hrs ○24 hrs ○48 hrs ◉72 hrs

This interface was designed by Growers, allows definition of units (e.g., °F or C), time period, and gives definitions/reference material.

Transferring data from www.nanoos-shellfish.org...

Stakeholder Engagement

- *Key issues of importance to regional stakeholders, and how the RA addresses?*

As NANOOS becomes aware of regional issues, e.g., from a new member, we have taken action to address, if possible, or to relay concern to appropriate party:

"As indicated one of our major concerns and high priorities is the operation and maintenance of our NOAA - NWS weather data collection and reporting system on our coasts which is in shambles and in much need of modernization. Weather buoys need redesign and deployment systems to better fit the rigors of the NE Pacific to improve and integrate other ocean data gathering requirements in real time to help make daily decisions for the fishing communities along our coasts." *Columbia River Crab Fisherman's Association*

Current Activities and Funding

- *A summary of key activities in the region that are related to or support IOOS, including those not funded by NOAA IOOS*

Representative activities include:

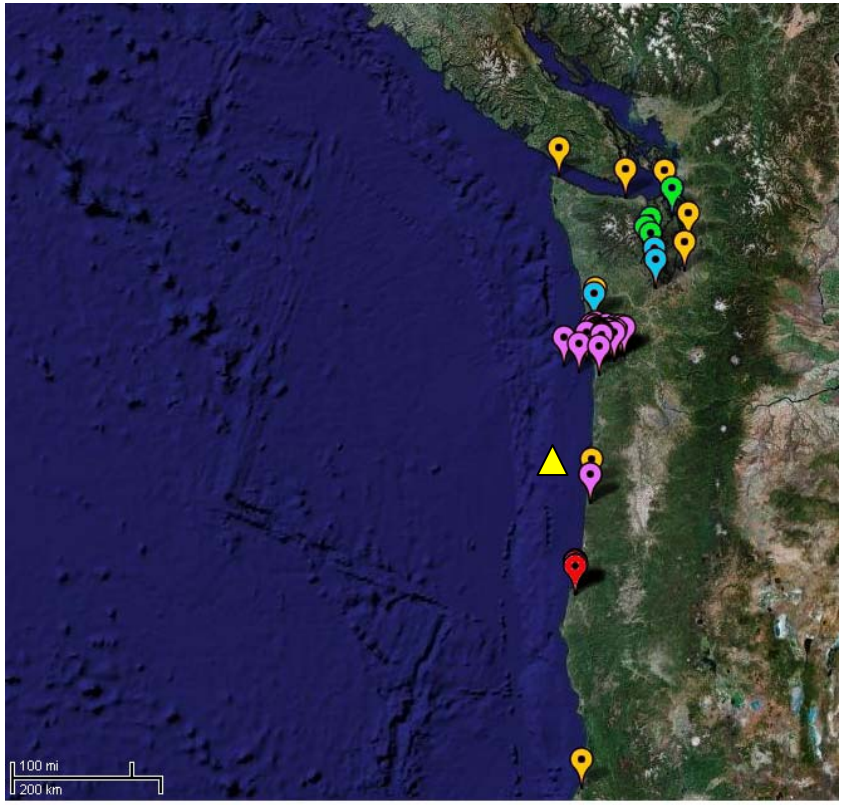
- NOAA: RA Planning and RCOOS grants
- NASA: Joint Center for Remote Sensing (OSU)
- NOAA: JISAO (UW)
- NSF: CMOP STC; Regional Scale Nodes; 2 COSEEs (UO & UW)
- NERRS: NANOOS-NERRS Pilot also supported by PCSGA

Building NANOOS RCOOS: System design strategy

- **Integrate what we have:**
  → Inventory and highlight existing NANOOS assets

- **Strategize to build what we need:**
  → Prioritize the needs for our Regional Coastal Ocean Observing System (RCOOS)

Pre-existing observing assets that the NANOOS Pilot (funded by NOAA CSC) integrated. Data from pictured assets made available via NANOOS website.



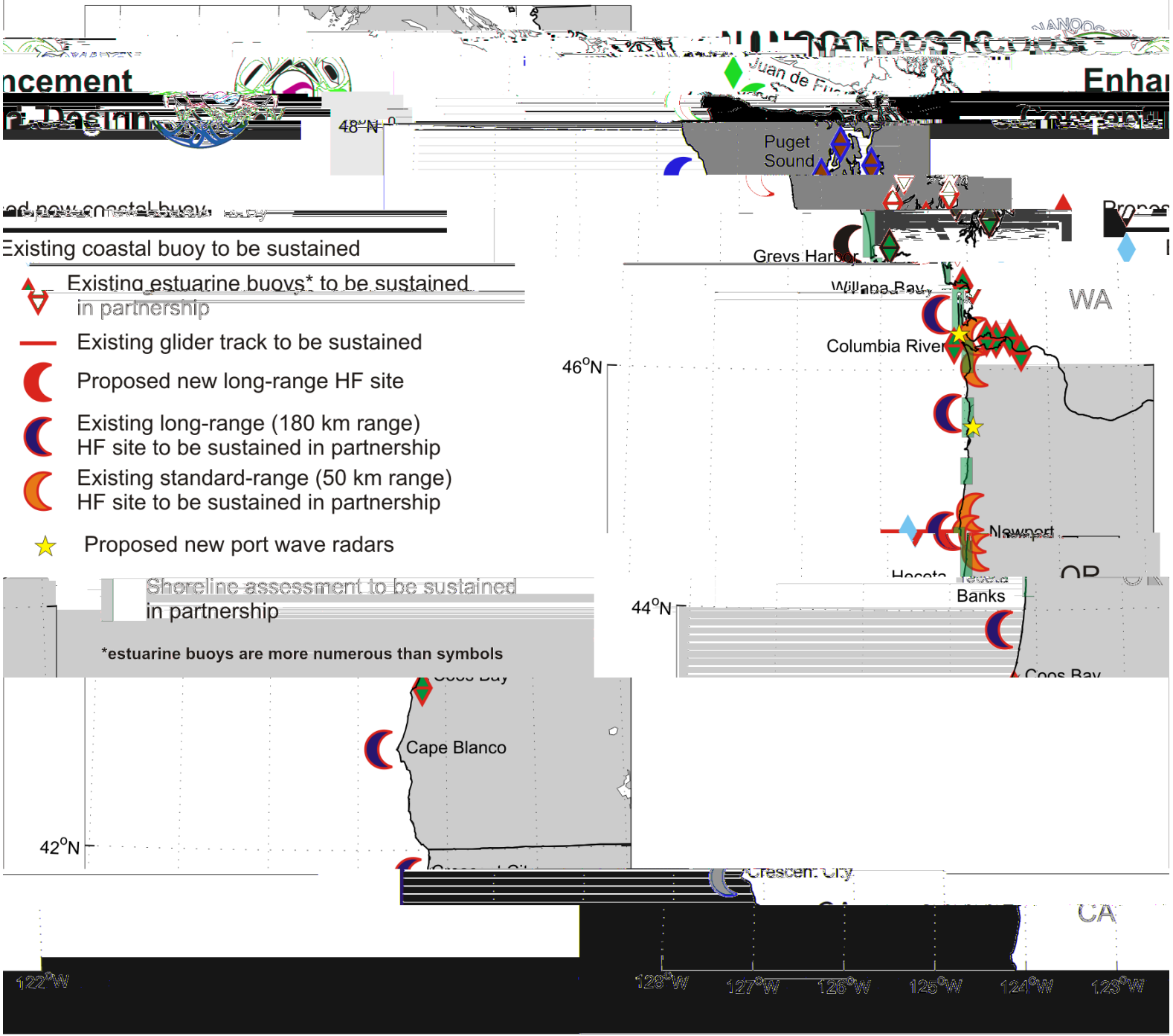
Locations of monitoring buoys in the PNW

Estuarine buoys operated by:

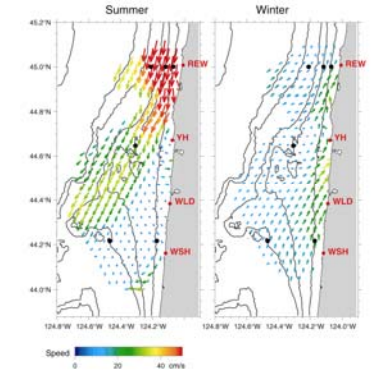
golden (NOAA) purple (OHSU)
green (UW) red (ODSL/NERRS)
blue (WDOE)

Coastal buoys operated by:

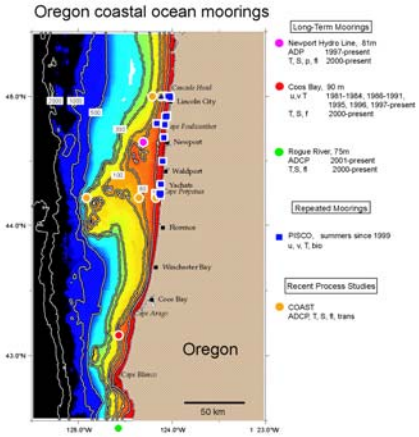
yellow (OSU/OrCOOS)


Existing coastal buoy to be sustained
Existing estuarine buoys* to be sustained in partnership
Existing glider track to be sustained
Proposed new long-range HF site
Existing long-range (180 km range) HF site to be sustained in partnership
Existing standard-range (50 km range) HF site to be sustained in partnership
Proposed new port wave radars
Shoreline assessment to be sustained in partnership
*estuarine buoys are more numerous than symbols
Puget Sound
Grevs Harbor
Willapa Bay
Columbia River
Newport
Banks
Coos Bay
Cape Blanco
Crescent City
WA
OR
CA
48°N
46°N
44°N
42°N
122°W
128°W
127°W
126°W
125°W
124°W
123°W

NANOOS RCOOS Objectives



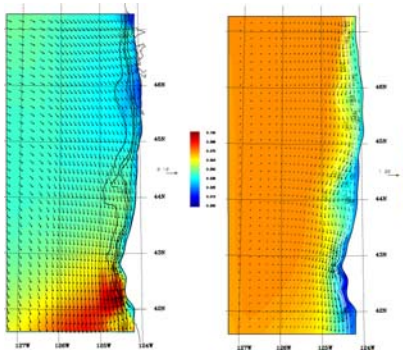
Current mapping



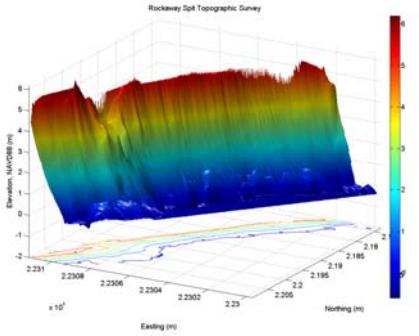
Shelf moorings

Beach/shoreline monitoring

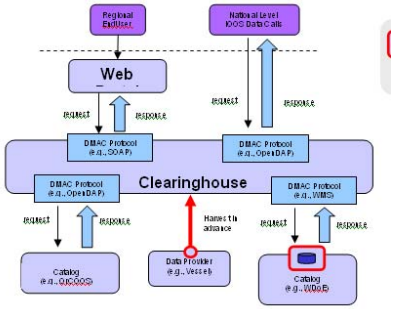
Estuary monitoring



Circulation models



Shoreline change models

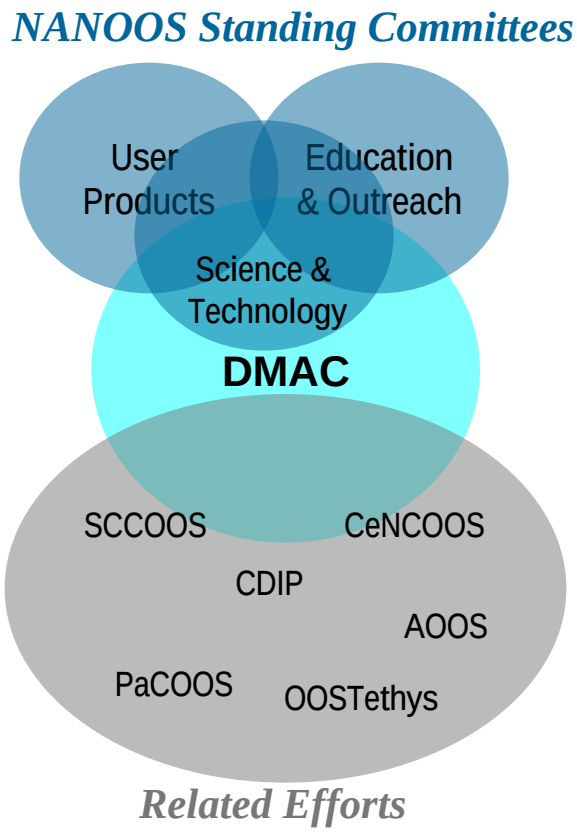


Data Management & Communications

Education/Outreach

NANOOS DMAC Mission

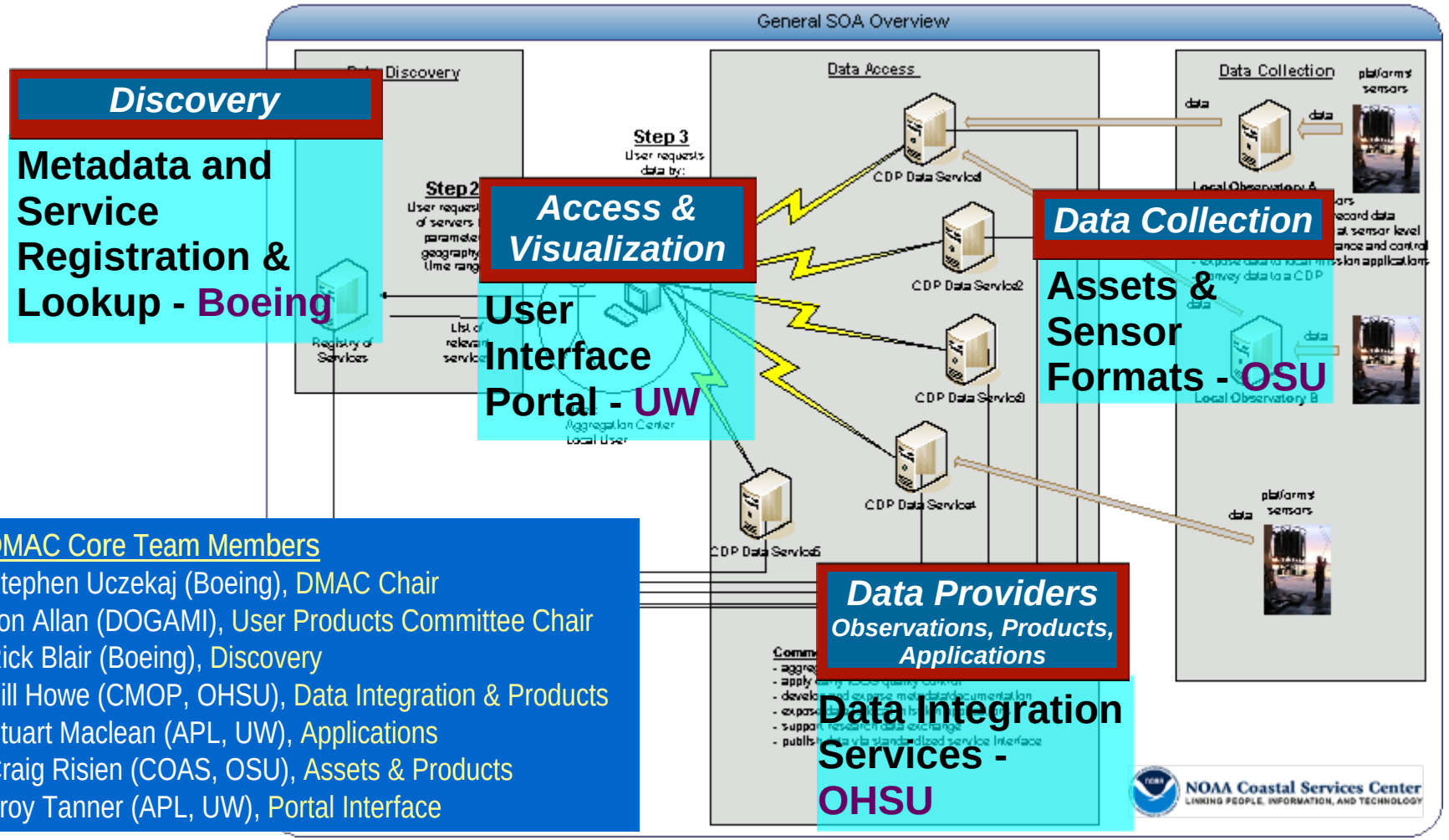
- **Develop and implement a Data Management and Communications architecture and services supporting Pacific Northwest regional coastal ocean observing system (RCOOS), as part of the U.S. Integrated Ocean Observing System (IOOS)**
- **Provide a framework for integrating regional sensor data and modeling services**
- **Support emerging IOOS standards**
- **Work closely with other NANOOS committees**
- **Share results and leverage other regional efforts**



DMAC Goal is focused on delivering Pacific Northwest region ocean observation data services for ingest, search, access, retrieval and viewing

NANOOS DMAC Architecture

Based on SOA and NOAA IOOS Data Integration Framework (DIF)



Discovery

Metadata and Service Registration & Lookup - Boeing

Access & Visualization

User Interface Portal - UW

Data Collection

Assets & Sensor Formats - OSU

Data Providers
Observations, Products, Applications

Data Integration Services - OHSU

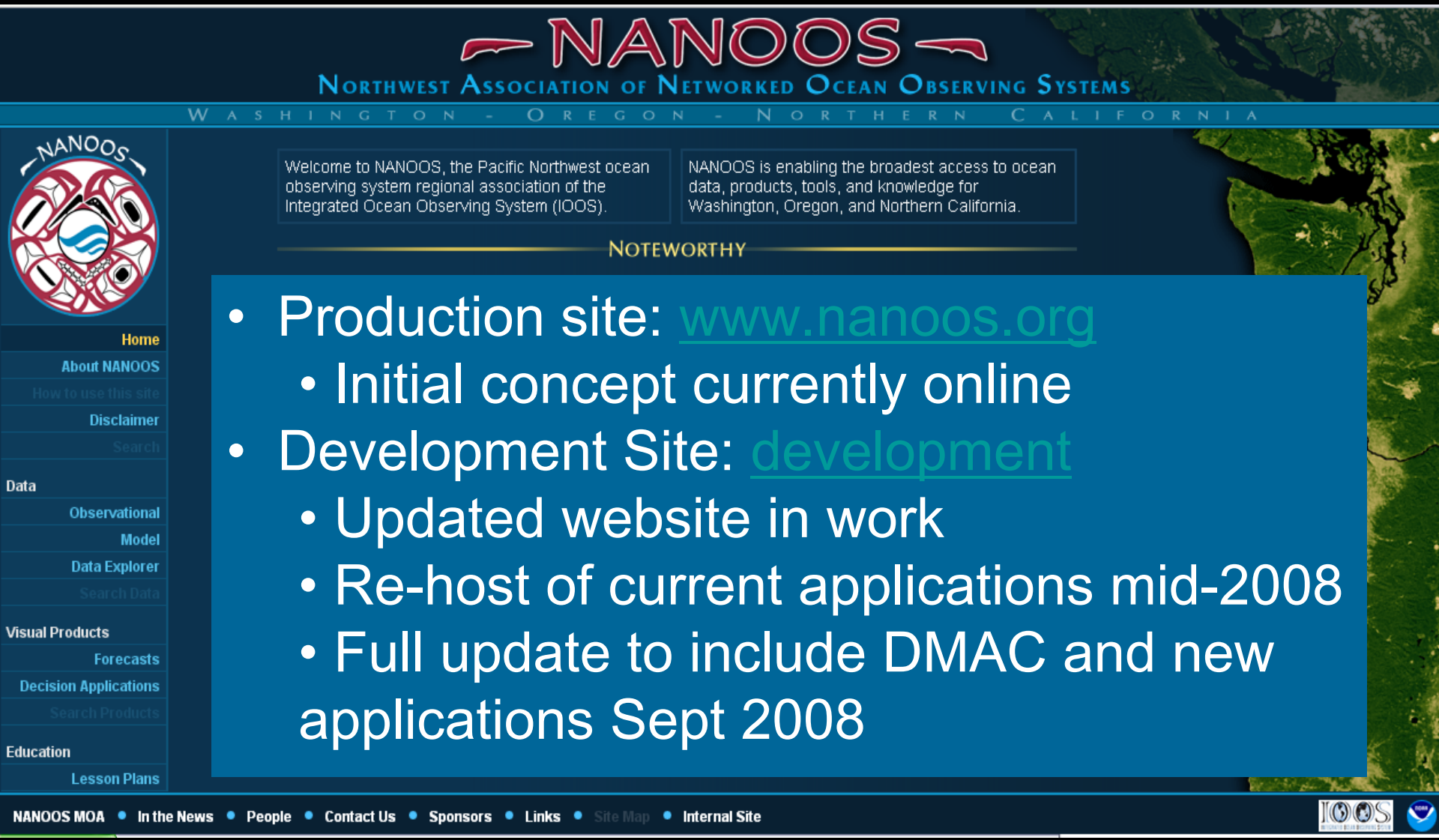
DMAC Core Team Members

Stephen Uczekaj (Boeing), DMAC Chair
Jon Allan (DOGAMI), User Products Committee Chair
Rick Blair (Boeing), Discovery
Bill Howe (CMOP, OHSU), Data Integration & Products
Stuart Maclean (APL, UW), Applications
Craig Risien (COAS, OSU), Assets & Products
Troy Tanner (APL, UW), Portal Interface

NOAA Coastal Services Center
Linking People, Information, and Technology

NANOOS Regional Service Registry

- ***What is it ?***
  - Discovery Service for regional ocean observation services and data
  - Allows regional data providers to advertise services and metadata
  - Allows regional consumers to search and find services using metadata search
- ***Why is it needed ?***
  - Need to have a regional warehouse for registering and looking up NANOOS provided data services and formats
  - Need a service oriented interface to allow easy interfacing and integration
    - Developed initial standard OGC Catalog Service and testing limitations
- ***Does it scale ?***
  - Can be distributed among NANOOS or other sites
  - Database implementation provides fast search and retrieval
  - Can easily be integrated into IOOS national backbone



- Production site: www.nanoos.org
  - Initial concept currently online
- Development Site: development
  - Updated website in work
  - Re-host of current applications mid-2008
  - Full update to include DMAC and new applications Sept 2008

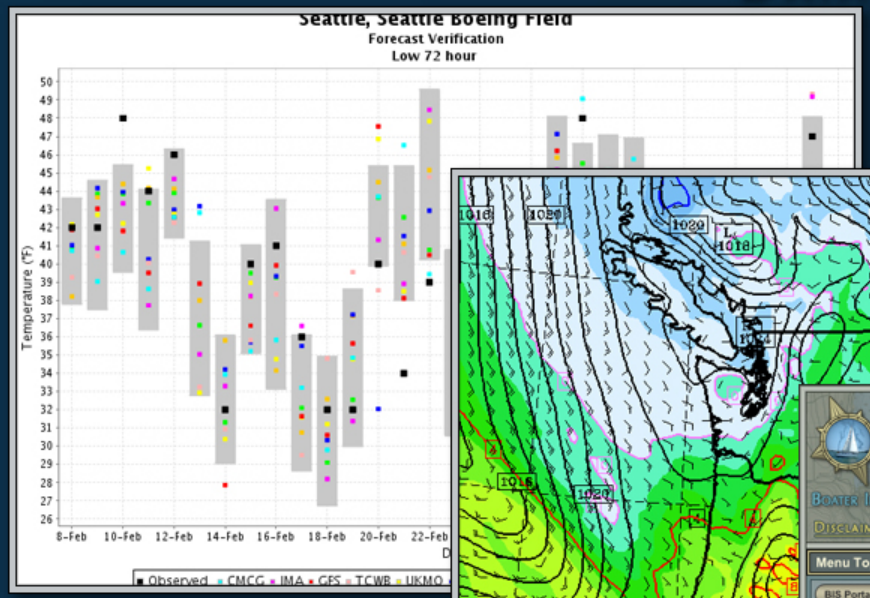
NANOOS

WASHINGTON - OREGON - NORTHERN CALIFORNIA

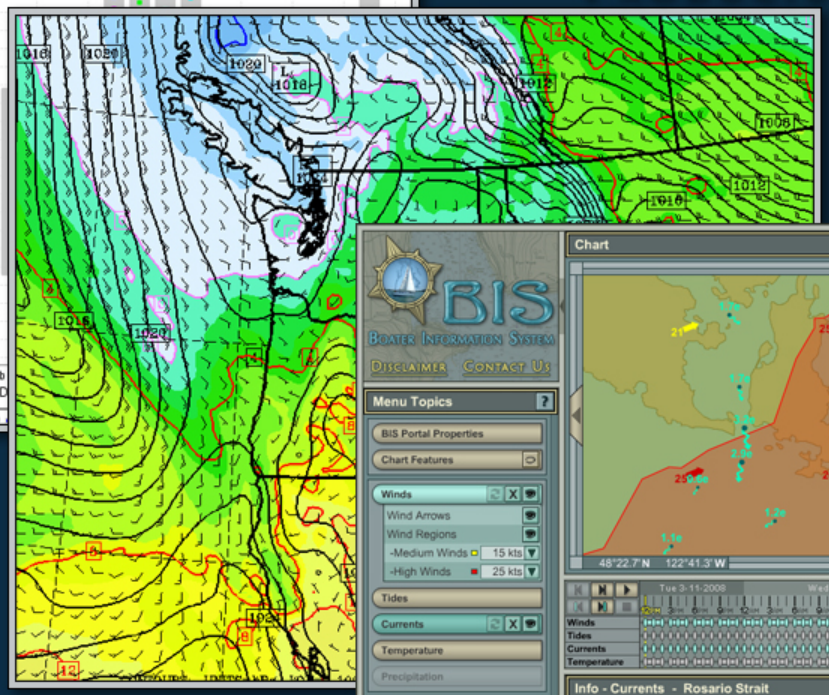
IOOS INTEGRATED OCEAN OBSERVING SYSTEM

PORTAL COMPONENTS:

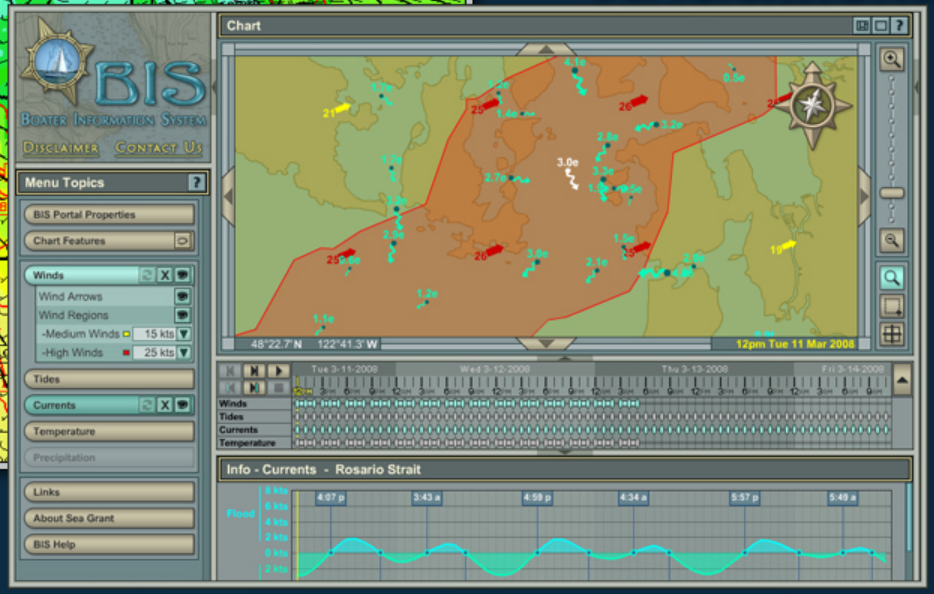
DATA



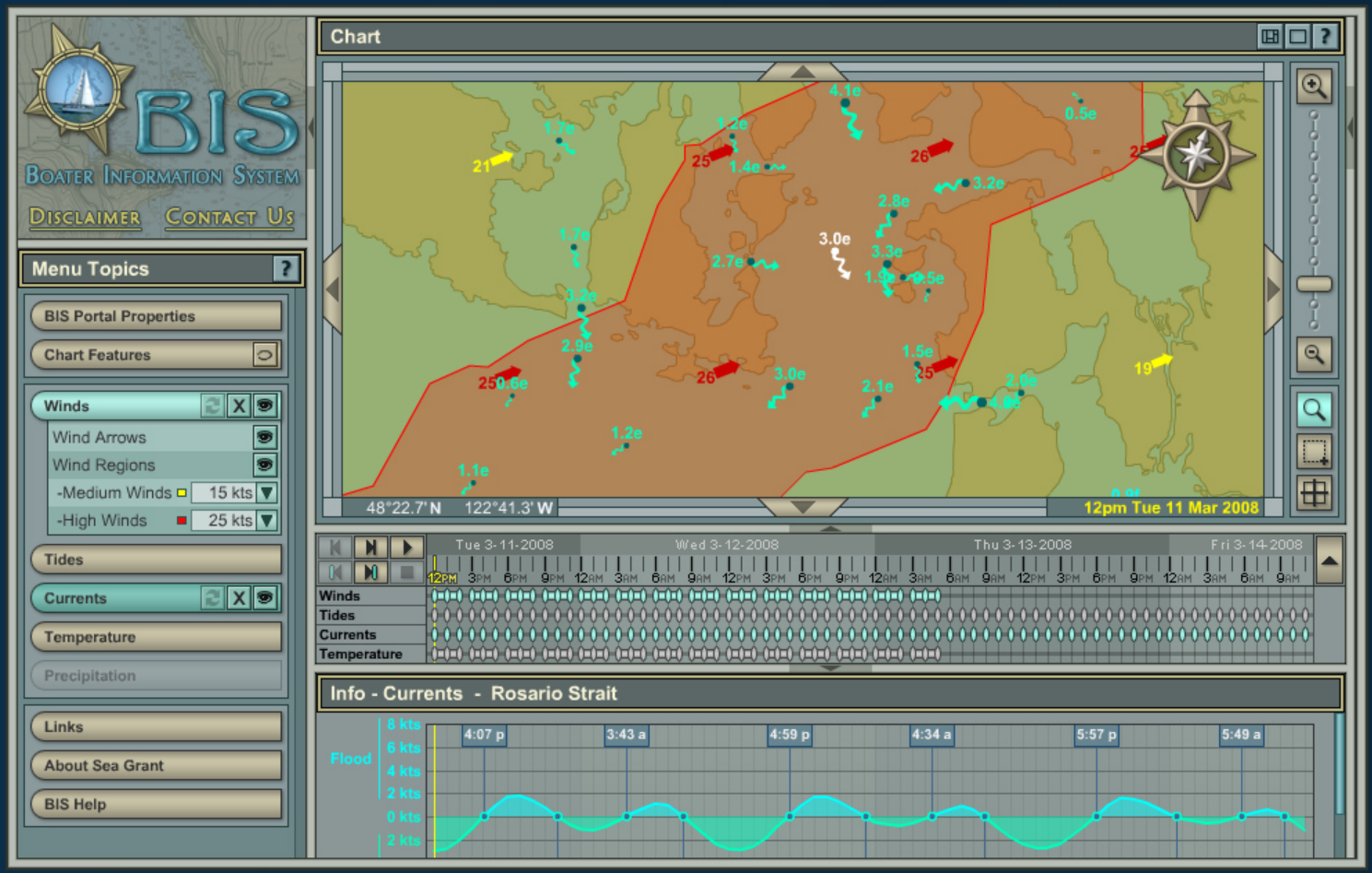
PRODUCTS



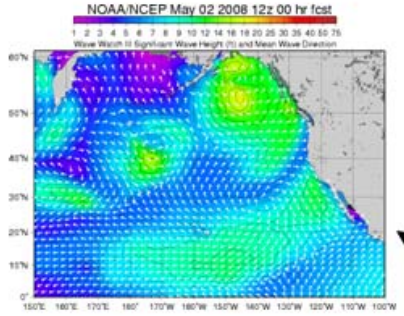
APPLICATIONS

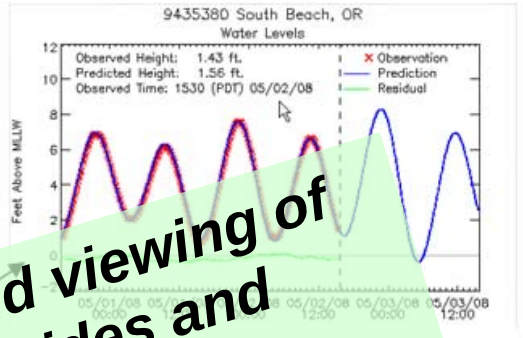


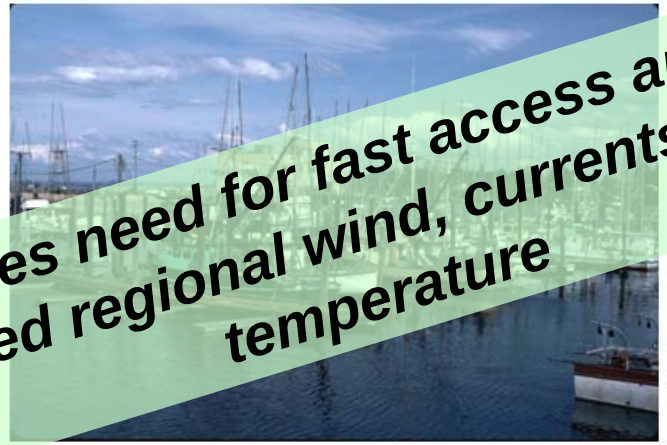
PORTAL - APPLICATIONS - BIS

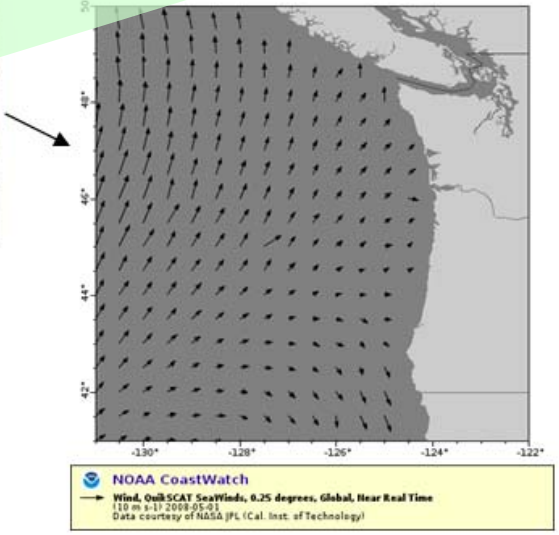


NANOOS: Boater Information System (BIS)
vision is to integrate diverse information into common visual interface









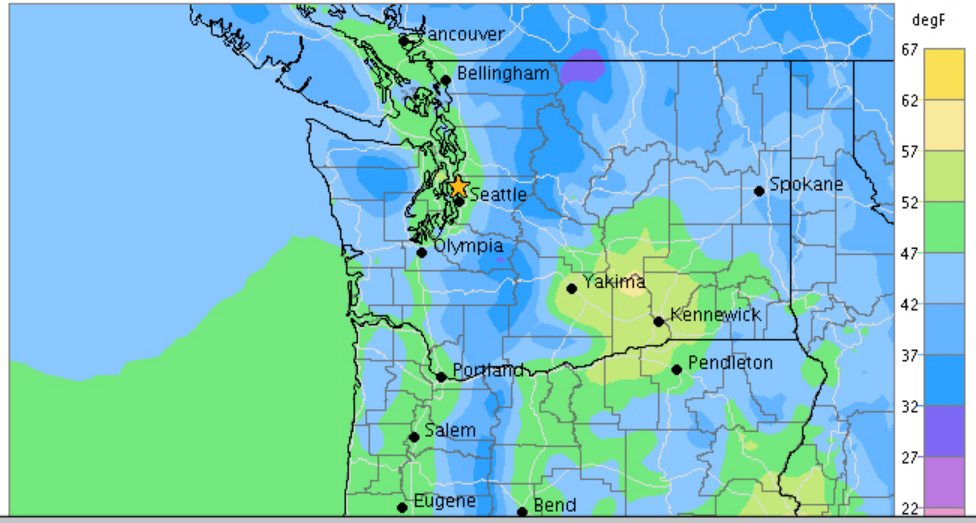
BIS addresses need for fast access and viewing of forecasted regional wind, currents, tides and temperature

Fisherman presently access a variety of websites for nowcast and futurecast information of weather and ocean related products.

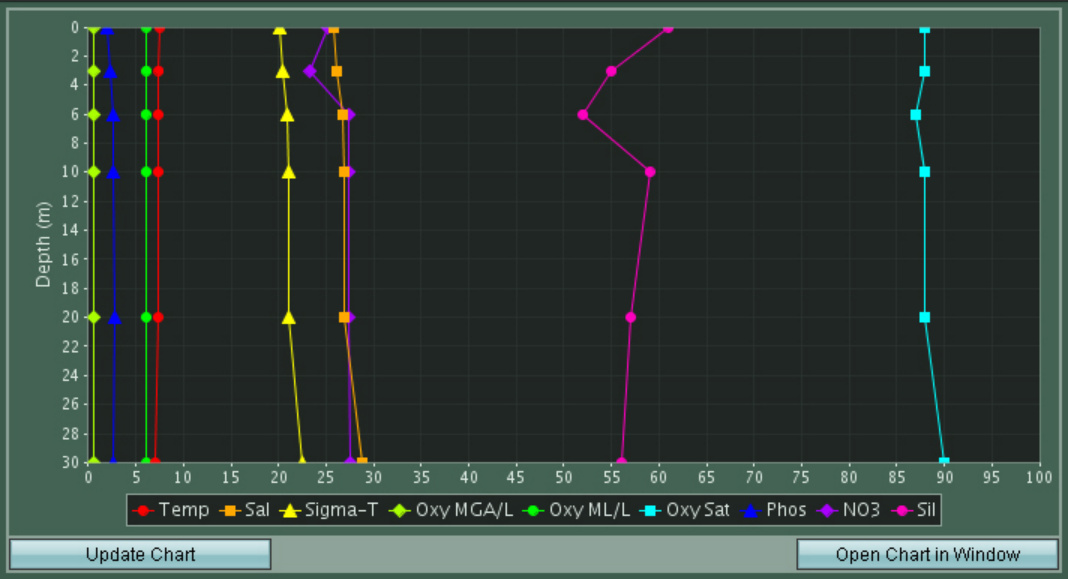
PORTAL - APPLICATIONS - PROBCAST

	Tue Mar 11	Tue Mar 11 Night	Wed Mar 12	Wed Mar 12 Night	Thu Mar 13
TEMP	Daytime High 51°	Nighttime Low 37°	Daytime High 52°	Nighttime Low 41°	Daytime High 50°
	As high as: 54°	Chance freeze: 5%	As high as: 55°	Chance freeze: 5%	As high as: 53°
	As low as: 48°	As high as: 40°	As low as: 49°	As high as: 47°	As low as: 46°
		As low as: 33°		As low as: 34°	
PRECIP	Chance of Precip 45%	Chance of Precip 10%	Chance of Precip 15%	Chance of Precip 30%	Chance of Precip 65%
	Likely Amount: .0"	Likely Amount: .0"	Likely Amount: .0"	Likely Amount: .0"	Likely Amount: .05"
	As Much As: .1"	As Much As: .0"	As Much As: .02"	As Much As: .07"	As Much As: .28"

High temperature for Tue Daytime, Mar 11 2008 -- Select a new weather map --



PORTAL - DATA - HISTORICAL



AMWS Entries

Entries 1-50 of 242 Page 1 2 3 4 5 >>

<< Edit Previous Entry | Edit Next Entry >>

242	EDIT	DELETE	DATE	HOUR	CRUISE	KIK	STATION	LOCATION
1	EDIT	DELETE	23 MAR 71	11.7	OA 345	032	92	MIDDLE SIMILK BAY
2	EDIT	DELETE	23 MAR 71	11.5	OA 345	032	91	WEST SIMILK BAY
3	EDIT	DELETE	23 MAR 71	9.6	OA 345	032	90	YOKEKO POINT
4	EDIT	DELETE	23 MAR 71	8.5	OA 345	032	89	DECEPTION ISLAND
5	EDIT	DELETE	23 MAR 71	7.9	OA 345	032	88	PASS ISLAND
6	EDIT	DELETE	23 MAR 71	7	OA 345	032	87	DEWEY
7	EDIT	DELETE	23 MAR 71	6.4	OA 345	032	86	N OF ALA SPIT
8	EDIT	DELETE	23 MAR 71	5.8	OA 345	032	85	HUNOT HOLE
9	EDIT	DELETE	23 MAR 71	5.2	OA 345	032	84	S OF HOPE ISLAND LITE

Current Activities and Funding

- *Interaction/joint work with other federal agencies*
  - NMFS: Martin (UW) and Newton (NANOOS) on PaCOOS Governing Board
  - NDBC: Martin on NDBC Advisory Board
  - NERRS: NANOOS-NERRS Pilot; Newton on NERRS System-wide Monitoring review team
  - Navy: Newton PI for Puget Sound observing assets that are part of NANOOS
  - Local-scale projects with EPA, USGS, USACE

Current Activities and Funding

- *Sources of funding*
  - *NOAA IOOS and other NOAA funds*
    - RA Planning Grant: $400K/y
    - RCOOS Grant:
      - FY07 request $2M→$1.5M
      - FY08 request $3.5M→$1.5M
      - FY09 request $3.5M→$??M
  - *Other Federal*
    - NANOOS leverages numerous observing assets throughout the region, including those supported by Navy (~$7M over last 4 y), USGS, EPA, USACE, among others.

Current Activities and Funding

- *Sources of funding*
  - *Non-Federal*
    - Boeing has matched NOAA IOOS investment on Y1 and Y2 RCOOS DMAC efforts
    - NANOOS leverages WA and OR state funded monitoring of estuaries and shorelines

Current Activities and Funding

- *RA plans/efforts to match IOOS dollars with funding from other sources*
  - *What sources, and in what areas of work?*
    - Proposal to Murdock Trust; $500K for coastal assets
    - Continue to foster opportunities for industry (e.g., Boeing) matching funds
    - Seek state investment via West Coast Governor's agreement
  - *How can the NOAA Program Office help?*
    - Advise of any opportunities
    - Advocacy for IOOS & RAs to other federal agencies

RA Coordination: Cooperative Agreements

- *As we reach the end of the first set of RA coordination grants, provide a summary of overall progress*
  - *Milestones and status*
    - NANOOS status on meeting its initial RA Planning Grant milestones:
      - Regional workshops: Held 6 both local and system-wide.
      - Governance Structure: Per MOA, we have a fully functional and empowered governance, with elected officers and standing committees. Proven decision-making capability.
      - Business Plan: Version 1.0 approved by GC. NANOOS considers this to be a living document.
      - Accreditation as Regional Association: Awaiting final guidance.

RA Coordination: Cooperative Agreements

– *Updates to the RA progress reports; any new info?*

- 25 March 2008 Governing Council meeting
  - Reports from DMAC, User Products, and Education & Outreach Committees
  - Approval of NANOOS Business Plan 1.0
  - Y2 RCOOS funding reduction decisions
- Outreach
  - Council of American Master Mariners (a NANOOS member) featured Martin as keynote panelist at their national meeting.
  - Washington State Ocean Caucus invited Newton to give a briefing at their meeting in Westport (2 new members resulted)
  - The Quinault Indian Nation (a NANOOS member) hosted space for NANOOS at a PNW Tribal Summit on Nearshore Habitat

RA Coordination: Cooperative Agreements

– *Updates to the RA progress reports; any new info?*

- New members
  - Columbia River Crab Fisherman's Association
  - Quinault Indian Nation

- Ocean acidification congressional field briefing
  - Senator Maria Cantwell, Congressman Jay Inslee held field briefing at Seattle Aquarium. The need for monitoring and ocean observation mentioned explicitly by 3 of the 5 panelists. Newton followed up with both Cantwell and Inslee (and their staffers) re NANOOS, IOOS and the potential for real-time data delivery to public.

RA Coordination: Cooperative Agreements

- *What will change with the new RA grant in FY08?*

Increased synergy with the NANOOS RCOOS effort will allow the RA planning effort to leverage and enhance better regional ocean observing and have more capability to provide targeted and meaningful education and outreach to our members and the public.

RA Coordination: Cooperative Agreements

- *What will change with the new RA grant in FY08?*
- Continue to seek new partners for NANOOS: e.g., two (WDFW and POST) are in works now
- A funded RCOOS proposal eases "expectation management concerns" – will facilitate more vibrant connectivity with users

RA Future Development

- *RA views on function and performance metrics*
  - *How can we best measure outputs and outcomes?*
  - Progress reports are suitable for both quantitative metrics (i.e., success in meeting specific milestones) and qualitative metrics (i.e., stakeholder satisfaction, outreach successes, etc.).

RA Future Development

- *Objectives of the RA and plans for the near-term FY08-12*
  - Strategically position NANOOS to respond to emergent issues and opportunities (e.g., ocean acidification, climate impacts, urbanization influences on PNW waters, e-science initiative, analytical tools and databases (Global Research Alliance for Digital Data))
  - Continue to engage w/ PNW marine stakeholders to ensure we're meeting their needs.
  - Vigorously leverage RA Planning and RCOOS grants to maximize NANOOS utility.

RA Future Development

- *Summary of top five priorities for development of RCOOS capabilities with cost estimates*

1. Enhance and maintain PNW HF radar system ($3M & $1M O&M/yr)
2. Improve in situ observations: ($10M & $2M O&M/yr)
3. Operationalize models: shelf and estuarine ($500K hardware/software; $400K model V&V; $600K O&M/yr)
4. Enhance DMAC capabilities ($1M/yr)
5. Further analysis product development and connection (O&E) with users ($2M/yr)

RA Views on Regional and National IOOS

- *RA needs with regard to the integration of regional and national planning efforts*
  - NANOOS has already integrated with other west coast and Pacific RA planning efforts and has venues in which to continue, although dedicated funds could enhance this.
  - Integration with national planning efforts occurs via NFRA and IOOS meetings, but is more reactive than participatory.

RA Views on Regional and National IOOS

- *RA expectations for development of the "national backbone" of observations*
  - *In situ, remote sensing, and DMAC capabilities*
  - NANOOS expects backbone enhancements to occur in accordance with Airlie House and Ocean Commission funding recommendations.
    - National modeling backbone should be an explicit component of this, and is not now.
    - Remote sensing asset and operational future is dismal…needs national attention now.
    - Build-out of NDBC system has not been regionally sufficient based on input given
  - NANOOS expects that regional input on design/location/etc of in situ assets will occur.

Cross-regional Coordination

- *Discuss existing and potential coordination with other IOOS RAs*
  - *On regional efforts/issues*
    - Satisfactory, as shown before, with Pacific coast RAs
  - *On a national scale*
    - Via NFRA, but limited due to funding constraints

Best Practices and Lessons Learned

- *Describe problems encountered to date and their resolutions*

- Fundamental problem remains level of funding – NANOOS has addressed this to date by reducing scope of effort, but continuation of this strategy risks alienating stakeholder trust.

Best Practices and Lessons Learned

- *Describe problems encountered to date and their resolutions*

- Due to conflict of interest concerns, regional federal agency members cannot be on the NANOOS GC. This has prevented collaborative decisions to be made about NANOOS RCOOS assets.
  - The challenge is that since regional federal agencies cannot be on the GC, it's easy to lose them as a constituency if we're not careful in maintaining separate communication paths – which defeats the collaborative framework we're trying to build.

→ NANOOS awaits legislative solution and has worked with regional feds informally.

Best Practices and Lessons Learned

- *What are some "good ideas" or best practices that you can share with other RAs?*
  - We believe that the diversity of our Governing Council membership (~25% each: NGO, local/tribal govt, industry, academia) and their active involvement in real governance decisions has been central to NANOOS success.

Best Practices and Lessons Learned

- *What are some "good ideas" or best practices that you can share with other RAs?*
  - Direct engagement with industry (e.g., Boeing, maritime operators, and others) has benefited RCOOS development for NANOOS immensely.
  - Pilot partnership with NERRS has expanded real-time data delivery and user base; NERRS available to all RAs.

Parting Thoughts

- *What support or information do you need from NOAA that you are not currently receiving?*
  - PNW is deficient in PORTS systems yet we are the 3rd largest port system in the US.
  - PNW NOAA NDBC buoy system is deficient also. NOAA buoys do not withstand rigorous environment of the PNW. Also, need more ocean measurements on the buoys.

Parting Thoughts

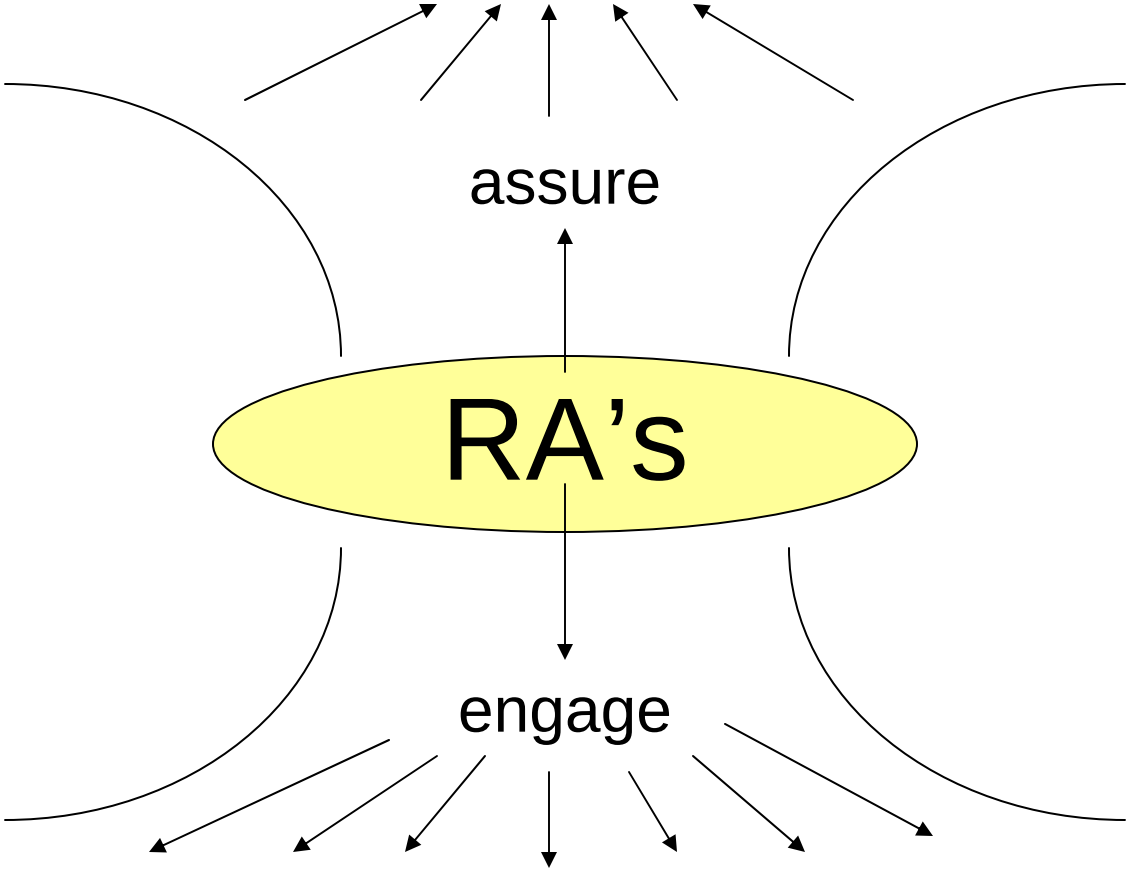
- *What support or information do you need from NOAA that you are not currently receiving?*
  - Advice on liability protection would be helpful in advance of legislative solution
- *Is there input you would like to give to us, but don't have a venue?*
  - Dialog on NOAA investments

Parting Thoughts

- *How can NOAA IOOS best receive regular updates or information from the RAs?*
  - *RA and partner achievements, news items, expressions of stakeholder support, engagement of new stakeholders*
    - Progress Reports, NFRA/IOOS meetings
  - *How can NOAA IOOS best understand (and articulate) how RAs support the national system?*
    - Site visits
    - Invest in marketing strategy (the recent IOOS communication package is good progresses on this)

IOOS
INTEGRATED OCEAN OBSERVING SYSTEM

CONSISTENT NATIONAL CABABILITY



DIVERSE LOCAL STAKEHOLDERS