

Progress Report for Year 3
Enhancing
Northwest Association of Networked Ocean Observing Systems (NANOOS)
#NA05NOS4731124

June 1, 2006 - Nov 30, 2006

This progress report describes activities carried out in support of enhancing the Northwest Association of Networked Ocean Observing Systems (NANOOS). This report was compiled by Jan Newton, NANOOS Executive Director, and David Martin, NANOOS President and PI for this grant.

Project Goal and Description/Methodology

The goal of this project is to foster and enhance Pacific Northwest (PNW) Regional Partnerships to grow constituencies and develop and implement governance structures and business plans that will permit official federal certification of NANOOS as the PNW Regional Association and thus allow for the eventual installation and long-term maintenance of a PNW Regional Coastal Ocean Observing System (RCOOS).

Major activities to date:

During this period we used NANOOS resources for the following activities:

- NANOOS President David Martin held a virtual NANOOS Governing Council (GC) meeting 14 June via conference call attended by 18 Governing Council members and 15 of the 23 NANOOS Governing Council partners. In a now standard procedure, minutes, recorded by NANOOS Secretary Fritz Stahr are provided post-meeting to members of the GC.
- David Martin and NANOOS Executive Director Jan Newton met with Cathy Angel (NERRS) and several others involved in the NANOOS-NERRS Pilot on Real-Time Data for Shellfish Growers Decision Making on 19 June at the Padilla Bay Research Reserve. Other participants included shellfish grower advisors Dan Cheney (Pacific Shellfish Institute) and Bill Dewey (Taylor Shellfish) and a state partner Brian Grantham (Washington State Department of Ecology). The purpose of the meeting was to identify data types, locations, and delivery mechanisms of highest value to shellfish growers to use for the pilot project. A timeline and milestones were identified.
- David Martin and Jan Newton attended the monthly NFRA conference calls on 22 June, 27 July, 28 September, and 26 October and provided NANOOS updates to the collective.
- Jan Newton contributed to at IOOS RA-NERRS Collaboration Teleconference call on 17 July. Jan provided a powerpoint presentation regarding the NANOOS and NERRS collaboration to conduct a needs assessment and develop a web product for shellfish growers in the Pacific Northwest. Cathy Angell of NERRS is contributing her experience and expertise in Coastal Training to this process.

The process and this Pacific Northwest shellfish growers' product can serve as a national model for other IOOS products.

- The NANOOS Education and Outreach Committee had a number of teleconferences to discuss priorities for education and outreach. Calls were organized and led by Christian Sarason. Education and Outreach committee members participating represented OR Sea Grant, Hood Canal Salmon Enhancement Group, the UW, the Ocean Inquiry Project, WetLabs, and OSU.
- David Martin and Jan Newton met with Jonathan Phinney (from NOAA's Southwest Fisheries Science Center) at APL-UW on 28 July to discuss opportunities for enhanced collaboration between NANOOS and the NOAA/NMFS proposed Pacific Coastal Ocean Observing System (PaCOOS). Martin represents the University of Washington on the PaCOOS Board of Governors(BoG) and Newton sits on the BoG as well in her capacity as Executive Director of NANOOS.
- Jan Newton was invited to Bodega Bay Marine Lab by Director Dr. Susan Williams to speak to REU students as an external mentor on 3-4 August. While there, she gave a departmental seminar to the lab community on NANOOS and the value of observing systems. Jan also met with Bodega Bay Ocean Observing Node (BOON) participants (John Largier and others) regarding observations and their CoDar system. BOON is part of CeNCOOS and NANOOS and this RA continue to explicitly enhance inter-RA coordination in a number of areas.
- David met with CSC's Rebecca Smyth on 4 August at APL-UW to discuss IOOS issues in general and NANOOS progress in particular.
- David Martin hosted a Pacific Northwest regional presentation given by Dan Walker of the White House's Office of Science and Technology Policy (OSTP) on the Ocean Research Priorities Plan at UW on 22 August. The presentation on this plan, the creation of which was specifically mandated by the President's Ocean Action Plan, was well attended by many scientists, industry partners, and other marine community stakeholders from the NANOOS region.
- Jan Newton attended the Alliance for Coastal Technologies Board Meeting in Baltimore on 3-4 October. Jan is the Co-Chair of the ACT Stakeholder Committee and represents NANOOS and/or the Regional Association perspective. In this capacity, she participated in various conference calls with either the Board or the Stakeholder Committee over this period. As ACT embraces the regional approach and working with IOOS, a concern Jan has expressed is the lack of Pacific Coast partners (only one for continental Pacific coast (at Moss Landing) in addition to one for both Alaska and Hawaii).
- Jan Newton coordinated the NANOOS contribution to the Remote Sensing Workshop in New Hampshire the first week of October. She, in concert with David Martin, selected two remote sensing experts, Drs. Dana Woodruff (PNNL) and Ted Strub (OSU) to be NANOOS representatives at the workshop and worked with them and Dave Foley (NOAA) to design a survey that was sent out to the NANOOS Governing Council for user input on remote sensing product needs. Jan led a conference call on 21 September with Dana and Ted to discuss the response. Dana and Ted attended the workshop 3-5 October at the University of New Hampshire.

- Many NANOOS Governing Council members attended the Eastern Pacific Ocean Conference at Timberline, OR, 27-30 September and gave scientific talks on parts of NANOOS' observations. Participants included Drs. Antonio Baptista, Jack Barth, Mike Kosro, and Jan Newton (EPOC President). Scientists from CeNCOOS and AOOS were also present and good intellectual as well as organizational exchanges occurred.
- David Martin gave a talk with Cathy Angell (NERRS) to the Pacific Shellfish Growers Annual Meeting in Vancouver, WA on 3 October regarding the NANOOS-NERRS pilot project matching real-time observing data with growers' needs.
- David Martin and Jan Newton attended the NFRA and IOOS workshops in Chicago 6-9 November, representing NANOOS, and participating in numerous formal and informal discussions regarding IOOS, NFRA, NANOOS, collaborations and needs. Martin was elected the NFRA Co-Chair during the NFRA meeting.
- At the invitation of Dr. Elaine Faustman (UW, Public Health), Jan Newton submitted an abstract to give a talk regarding NANOOS/IOOS to Society for Risk Analysis (SRA) at their annual meeting in Baltimore, MD from December 3-6, 2006. The talk will be part of a symposium Dr. Faustman organized entitled "Shoreline Management – on the Interface of Oceans and Human Health".
- Jan Newton is working with Krista Kramer (CeNCOOS), Geno Olmi (NOAA), and Josie Quintrell (NFRA) to organize an IOOS RA session at the next Estuarine Research Federation (ERF) meeting in Rhode Island in fall 2007. ERF 2007 officials have accepted the session. Several conference calls and emails have been made to plan this activity.

Specific Project Objectives:

- 1) **Continue to identify and engage the full and expanding spectrum of stakeholders** having significant interests in the waters of the Pacific Northwest to ensure their views and opinions are fully recognized and taken into account in all aspects of planning, science and governance, and that this partnership building effort takes advantage of their scientific, economic, social, cultural and operational expertise.

Activities to Date:

- Various NANOOS representatives continue to make contacts with stakeholders and potential users of NANOOS products in either individual or group meetings and presentations, as per above.
- Specific activities of note during this period:
 - Outreach was made in a variety of venues by NANOOS President Martin and Executive Director Newton to the shellfish community with respect to the NANOOS-NERRS collaborative pilot project on real-time data for

coastal decision making, working with NERRS, private, and state representatives.

- A census of the NANOOS GC was conducted by the NANOOS Executive Director Newton to assess regional user needs for remote sensing products.
- Two new signatories to the NANOOS MOA were approached by the NANOOS Executive Director Newton who invited discussion of their concerns and interest.... signatures are expected to be forthcoming.
- The NANOOS Education and Outreach Committee met via teleconferences to formulate NANOOS Education and Outreach priorities.

2) **Proactively engage the regional ocean science community** in this partnership-building project to ensure their expertise helps guide the eventual design and evaluation of the system. This approach will ensure the PNW Regional IOOS evolves to take advantage of new knowledge and technology as they are developed.

Activities to Date:

- NANOOS continues to be discussed within the regional ocean science community via formal and informal presentations by many NANOOS members at academic institutions (UW, OSU, and OHSU) and other venues.
- Specific activities of note during this period:
 - Numerous NANOOS scientist representatives actively engaged during the EPOC meeting.
 - NANOOS Executive Director Newton met with CeNCOOS scientists at Bodega Bay to discuss respective observing systems.

3) **Obtain input about sub-regional scale oceanographic concerns** by engaging with local stakeholders to ensure these factors are addressed at the Regional level. The NANOOS Coordinator will work within these smaller groups to build a sense of community and partnerships at the sub-regional scale and then translate this into strong regional partnerships through larger gatherings and workshops.

Activities to Date:

- NANOOS President Martin and Executive Director Newton continue to work to engage user input on sub-regional scale oceanographic concerns but they are also sensitive to expectation management issues in light of the lack of Congressional funding of IOOS to this point.
- Specific activities of note during this period:
 - NANOOS Executive Director Newton, working with NANOOS Remote Sensing representatives (Strub and Woodruff) and NOAA (Foley), designed and implemented a survey to assess user needs for remote sensing products.

- NANOOS Executive Director Newton participated in several Puget Sound Partnership meetings. This is a new partnership convened by the Washington state Governor to address environmental concerns in Puget Sound.

4) Implement the results of the consensus agreement on the overall process to evolve the Governance structure for a Pacific Northwest Regional Association.

Activities to Date:

- NANOOS has a fully functioning Governance structure, including a Governing Council composed of over twenty member entities who have signed the NANOOS MOA, elected Officers, elected Standing Committee Chairs who are forming nascent Standing Committees, a Users Advisory Group Chair, an Executive Director.
- NANOOS continues to receive signed MOA documents.
- Specific activities of note during this period:
 - NANOOS President Martin held a NANOOS Governing Council meeting on 14 June where several governance issues were discussed.

5) Develop and implement a Business Plan in consonance with Ocean.US criteria to guide NANOOS budget formulation, involvement of users, all aspects of linkages between observations and products, research and development decisions, training, and alternate funding opportunities.

Activities to Date:

- As noted below in the progress section, work continues, in support of our anticipated vetting of the NANOOS Business Plan by NANOOS stakeholders via web comment period and final approval at the winter 2007 NANOOS meeting. NANOOS Industry partners who have offered assistance in this area were particularly busy during this period.

6) Strengthen international and inter-Regional partnerships by engaging with Canadian colleagues and other western Regional Association efforts to build bridges to these efforts and ensure seamless integration of these efforts. As part of this effort, we will continue to strongly interact with ongoing or planned federal IOOS Coastal Backbone initiatives such as the NOAA Fisheries sponsored Pacific Coastal Ocean Observatories System (PaCOOS) on whose Governing Board both Martin and Barth sit (<http://www.pacoos.org>).

Activities to Date:

- NANOOS President Martin and Executive Director Newton continue to informally and formally communicate with AOOS, CeNCOOS, SCCOOS and PacIOOS representatives to foster inter-Regional partnerships.
- Specific activities of note during this period:
 - NANOOS President and Executive Director met with inter-Regional representatives at the NFRA-IOOS Chicago workshop, at EPOC, via monthly NFRA conference calls, and by visiting Bodega Bay, CA.
 - NANOOS President and Executive Director met with the PaCOOS Science Coordinator (Phinney) to discuss potential NANOOS – PaCOOS collaboration.

7) **Continue to engage at the national level** to ensure the PNW activities of NANOOS are fully supportive of the national effort to implement and maintain an IOOS. Martin currently serves as the Chair of the new National Federation of Regional Associations (NFRA) Organizing Committee and PNW representation at the national level remains robust.

Activities to Date:

- NANOOS President Martin and Executive Director Newton attend the monthly NFRA conference calls and provide NANOOS updates to the collective, as well as hear the other nascent RA updates.
- NANOOS President Martin, as Co Chair of NFRA, participates in NFRA Ex-Com calls.
- NANOOS Executive Director Newton, as Co Chair of the ACT Stakeholder Committee, participates in ACT Board and Stakeholder Committee calls.
- Specific activities of note during this period:
 - NANOOS President Martin hosted the presentation of the U.S. Ocean Research Priorities Plan at the University of Washington.
 - NANOOS President Martin and Executive Director Newton attended the NFRA and IOOS Workshops.
 - NANOOS is actively participating in a pilot IOOS RA-NERRS collaboration between NANOOS and several PNW NERRS (Padilla Bay, WA; South Slough, OR, and Katchemak, AK). At a national presentation via conference call of this collaboration, the NERRS representative, Beth Ebersole, noted that the process and the Pacific Northwest shellfish growers' product could serve as a national model for other IOOS products.
 - NANOOS sent two regional representatives (Woodruff, PNNL/WA; Strub, OSU/OR) to the National IOOS Remote Sensing workshop.

Status of progress

Governance Plan

NANOOS has fully implemented a Governance system per the NANOOS MOA and election of its officers.

Business Plan

One of our NANOOS partners from industry volunteered to lead the team drafting the NANOOS Business Plan. Candidly, we feel the expertise for crafting such a plan resides much more firmly in industry than in academia and we are pleased the NANOOS industry now leads this necessary effort. We anticipate vetting the Business Plan by NANOOS stakeholders via web comment period and final approval at the winter 2007 NANOOS meeting.

Stakeholder identification and involvement

More MOAs were signed during this period. We now have over twenty NANOOS Partners, representing a broad spectrum of PNW stakeholders. Additionally, we continue to make informal and formal contacts to a host of stakeholders.

DMAC

In two areas, DMAC and Education, NANOOS is resource constrained by the overall size of this grant so we continue to strongly leverage other regional efforts in these areas to the mutual benefit of NANOOS and our partnering programs. In DMAC for instance, we provide NANOOS funding to Oregon Health and Science University (OHSU) to leverage their DMAC efforts begun with the now completed NANOOS Pilot project but which continues with the substantively funded (by NSF) Coastal Margin Observation and Prediction (CMOP) Science and Technology Center (STC). The benefits of these mutually-supportive efforts by NANOOS and the STC in DMAC are articulated in the attached NANOOS DMAC Interoperability Report (Appendix I) which was compiled by members of the NANOOS DMAC Committee and NANOOS Pilot/CMOP STC enterprise; specifically: Bill Howe, Antonio Baptista, and Paul Turner (all of OHSU).

Education and Outreach

Continuing the leveraging discussion begun in the DMAC section above, we follow the same strategy in our NANOOS Education & Outreach efforts. As noted in our previous NANOOS status report, we elected the NANOOS Education and Outreach Standing Committee Chair, Christian Sarason (from the education-focused Ocean Inquiry Project), earlier this year and Christian held a number of teleconference calls with the NANOOS Education and Outreach standing committee. Through these and other NANOOS efforts, contacts with other regional ocean literacy education efforts were strengthened and leveraging opportunities explored. We note in particular the strong partnering and leveraging opportunities NANOOS has with the new NSF-funded Center for Ocean Science Education Excellence (COSEE) at the University of Washington and the exceptionally strong, and mandatory, educational program of the CMOP STC. Another important recommendation that emerged from the Education and Outreach Committee was for NANOOS to hire a part-time Education and Outreach coordinator. Martin discussed this recommendation; unfortunately made more pressing by the recent resignation of Sarason who took a new position and had to relinquish his post as Chair, with NOAA leadership (i.e., Geno Olmi and Rebecca Smyth) at the Chicago IOOS meeting and it was well received.

Given this, NANOOS will press forward vigorously with selecting and hiring a part-time Education and Outreach coordinator as we feel this action is imperative in order to make continue progress in this important aspect of NANOOS.

DMAC Interoperability at NANOOS

The Data Management and Communications (DMAC) committee of the Integrated Ocean Observing System (IOOS) has established a vision for the capabilities of the completed system and made preliminary recommendations for the transport layer with which to support these capabilities. This document describes our interpretation of DMAC recommendations here at NANOOS and the status of their implementation.

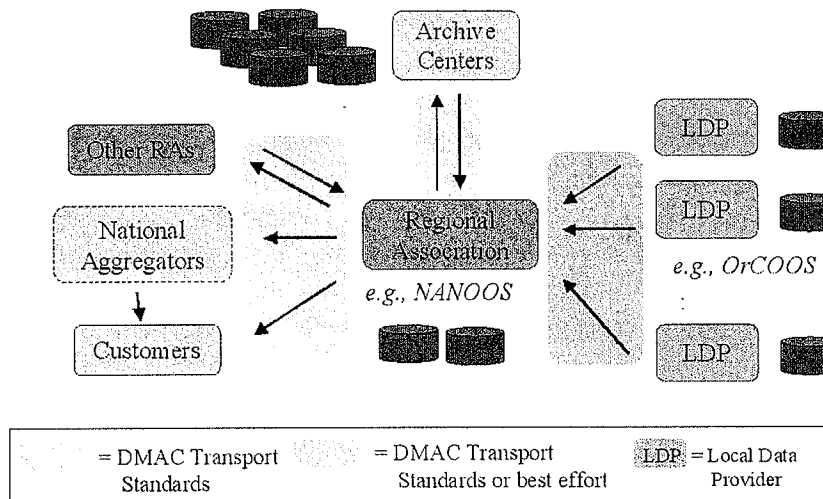


Figure 1: Interpreted IOOS Architecture.

Based on the “Data Management and Communications Plan for Research and Operational Integrated Ocean Observing Systems” (the DMAC Plan) [1], we observe that following capabilities are envisioned for the IOOS system of systems

- **Discovery**
- **Access**, i.e., the ability to *browse* and *query* for *data* and *products*
- **Restructuring**, e.g., provide transparent file format conversions, transparent file merging and splitting
- **Aggregation**, e.g., monthly averages, integrated maps
- **Manipulation**, e.g., coordinate conversions, transparent unit conversion, bounding box selection, arithmetic
- **Archive**

These capabilities suggest a Service Oriented Architecture (SOA), wherein participants provide loosely coupled, “best effort” services commensurate to their developer and computing resources. This architecture minimizes offline coordination between participants by relying on shared standards wherever possible. For example, the term “web service” usually implies the use of the HTTP standard for data exchange, as opposed to, say, CORBA.

Appendix I: NANOOS DMAC Activities, Investigations, and Plans
 Contributed by: Bill Howe, Antonio Baptista, Paul Turner

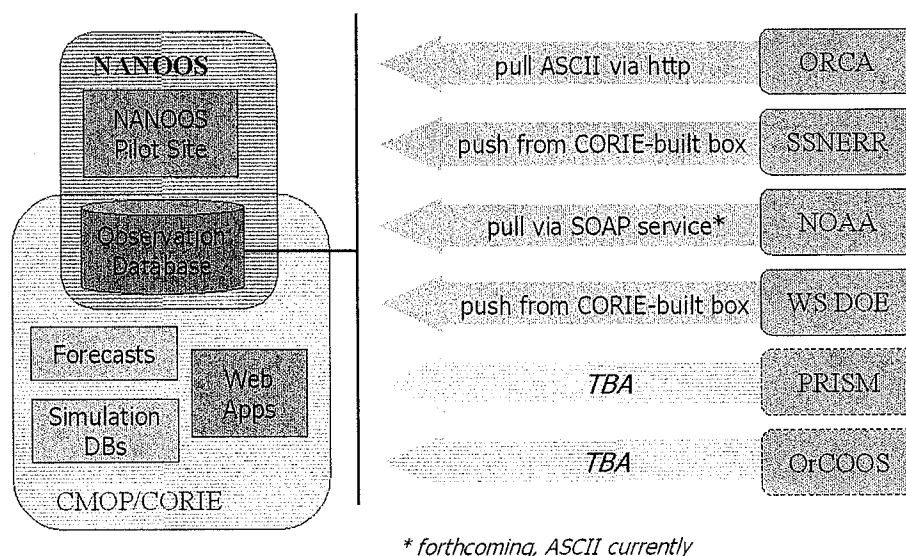


Figure 2: NANOOS interoperability with local data providers in the Pacific Northwest.

Figure 1 illustrates our interpretation of the top-level architecture of IOOS. At the right, Local Data Providers (LDPs) transmit data to Regional Associations through DMAC standards if possible, or otherwise by best effort means. Regional Associations then exchange data with 1) Other RAs and 2) Archive Centers using DMAC standards. National Aggregators, serving as portals, may also exist. Finally, customers themselves will access data through the National Aggregators, or perhaps through the RAs themselves.

NANOOS Status Quo

Figure 2 illustrates the status quo of NANOOS interoperation with its local data providers. The local data providers we work with currently are:

- Oceanic Remote Chemical-optical Analyzer (ORCA) buoys moored in the Hood Canal of Puget Sound
- South Slough National Estuarine Research Reserve (SSNERR)
- NOAA Buoys in the Pacific Northwest
- Washington State Department of Ecology

with other important systems under consideration including:

- Puget Sound Regional Synthesis Model (PRISM)
- Oregon Coastal Ocean Observing System (OrCOOS)
- A joint NERRS/NANOOS project involving shellfish growers

We use a variety of data transmission methods to acquire data from these sources, including downloading ASCII files via http, extracting values from HTML via http, accessing SOAP services erected by the provider (John Ulmer's work at CO-OPS), and even delivering pre-built and pre-configured computers to the LDP to push data to our servers. Although these ad hoc

Appendix I: NANOOS DMAC Activities, Investigations, and Plans

Contributed by: Bill Howe, Antonio Baptista, Paul Turner

solutions may eventually be replaced by DMAC standards (see below), we acknowledge that some LDPs may not have the resources to support advanced protocols. For example, an observatory may have zero budget for developers or additional equipment.

DMAC Standards Distilled

There are three technologies emerging as DMAC recommended standards, in order of *increasing built-in functionality* but *decreasing flexibility*:

1. Simple Object Access Protocol (SOAP)
2. Open Geospatial Consortium standards (OGC)
3. Open source Data Access Protocol (OpenDAP)

SOAP is a protocol for exchanging arbitrary data over the web as XML documents. The protocol can be considered a web-centric reincarnation of Remote Procedure Call protocols such as CORBA. As such, it is very general and very flexible, but requires significant offline coordination between senders and receivers: There are many ways to encode the same logical dataset as physical SOAP messages.

There are many standards put forth by the OGC; here, we focus on the Web Feature Service (WFS) for geo-referenced objects and the Web Mapping Service (WMS) for geo-referenced images. Both are designed for drawing correct maps using remote data. Consequently, both support parameters for specifying bounding box selection and coordinate transformation. OGC standards, and indeed, GIS standards in general were primarily designed with the 2-D Earth's surface in mind. Support for depth and time dimensions are limited, but increasing.

OpenDAP is a very popular protocol among ocean and climate workers. The primary distinction of OpenDAP is the data model, which includes a built-in "grid" type. Non-coincidentally, the data model is closely related to the data models of netCDF files and HDF files, both of which are also popular in the ocean and atmospheric sciences. The benefits of OpenDAP are that 1) netCDF files, HDF files, and others can be served with zero-configuration, 2) many popular clients exist for accessing OpenDAP data (including Ferret and MATLAB), 3) the standard has a great deal of momentum, and new servers, clients, and aggregation capabilities are emerging rapidly.

Which Technology to Use?

The following table summarizes our recommendations of DMAC protocols for specific data formats:

| | |
|---------------------|--|
| netCDF, HDF | OpenDAP |
| Relational Database | Custom SOAP services, WFS, or OpenDAP RDBMS server |
| ArcGIS | WMS, WFS |
| Flat Files | Custom SOAP Services, or OpenDAP FreeForm Server |
| Images | WMS |

Appendix I: NANOOS DMAC Activities, Investigations, and Plans
Contributed by: Bill Howe, Antonio Baptista, Paul Turner

Examples

SOAP

NOAA/CO-OPS (John Ulmer)
<http://opendap.co-ops.nos.noaa.gov/axis/>

OGC

CMOP Model Data
<http://stccmop.org:8000/corie/todaysforecasts>

SeaCOOS

http://nautilus.baruch.sc.edu/portal_obs/

OpenDAP

CenCOOS:
<http://las.pfeg.noaa.gov/CeNCOOS/CeNCOOS.php?dsetinit=AT1&varinit=ssta¤tvarindex=0&compinit=14day®init=C&modeinit=r>

SEACOOS:
<http://seacoos.org/Data Access and Mapping/dodsAccess>