28 September 2017

Mr. David Easter
U.S. Integrated Ocean Observing System
1315 East West Highway
Room 2623
Silver Spring, MD 20910

REF: NA16NOS0120019: "Sustaining NANOOS, the Pacific Northwest component of the US IOOS"

Dear Mr. David Easter,

This Cover Letter accompanies NANOOS' response to your email dated 29 June 2017 stating that NOAA IOOS recommended funding NANOOS at the level of $3,216,463 for FY 2017.

NANOOS greatly appreciates this funding for the continuation of our IOOS Regional Association and Coastal Ocean Observing System for the Pacific Northwest. On behalf of NANOOS' Governing Council and principal investigators, I relay our sincere thanks for the continued support as we together execute this national and regional system.

As noted in the email, this funding level is less than the funding amount requested of $4M in our 30 August 2015 proposal to IOOS for FY17. Per your request, we include documents to detail how NANOOS will de-scope to meet the reduced funding level. In the text appended here, we present how our proposed objectives will or will not be met under the de-scoped budget and our revised Work Plan. Also provided are a revised SF424A, detailed statements of work, a summary budget, budget justifications, subcontractor packages, and rate agreements.

As noted in your email, the FY17 NOAA funding level of $3,216,463 includes 11 line-item amounts with specific tasks:

1. $405,000 for high frequency (HF) radar operations and maintenance.
2. $360,000 for the purchase and deployment of two (2) HF radars.
3. $50,000 to plan and execute an in person training event for biological data management in partnership with the MBON community
4. $55,000 for the Ocean Technology Transition Customer Service Application Project
5. $12,000 for OCS Olympic Coast cruise.

6. $30,000 to enhance the GOA-ON data portal as an OA dashboard to the World
7. $75,000 NANOOS Multi-Scale Prediction of California Current Carbonate System Dynamics
8. $64,181 for NANOOS Ocean Acidification Monitoring and Prediction in Oregon Coastal Waters
9. $33,146 NANOOS UW OA observatories
10. $25,000 to enhance the Cha'ba Mooring Program to Allow Year-Round Deployments
11. $55,000 for UW OA observatories: Replacement System due to loss

The FY17 award, less the amounts allocated for the specified tasks above (but including item 1), equals $2,457,136 toward the operation of NANOOS as proposed in our 5-y proposal for FY17. Compared to our FY15 RCOOS base award, this is $5,000 less, which NANOOS will absorb this decrease through less travel by NANOOS management staff.

Please let us know if you have any questions.

Sincerely,

Dr. Jan Newton
NANOOS Executive Director

Encl.
NANOOS de scope FY17 (revised objectives and de-scoped work plan)
Revised SF424A
SOWs
Summary budget
Budget justifications
Subcontractor packages
UW Rate Agreements

NANOOS Objectives for FY2017

Our specific objectives for the year (FY 2017 = Y2 of the award = Y11 of NANOOS RCOOS) are listed below as originally proposed, and following directly underneath, as revised per our de-scope funding amount:

We retain our first objective without revision:
1) Maintain NANOOS as the U.S. IOOS PNW Regional Association: Sustain our proven role for regional coordination, administrative infrastructure, and stakeholder engagement, engaging federal and non-federal (tribal, academic, state, local, industry, NGO, etc.) partners.

We retain our second objective without revision:
2) Maintain and enhance surface current and wave mapping capability. Maintain existing HF-radar foundational capability and extend it to un-served areas in Washington, northward to the international border, providing a new portion of critical national capacity; continue investment in wave mapping at critical ports.

Our third objective:
Sustain existing buoys and gliders in the PNW coastal ocean, in coordination with national programs. *Maintain and harden these essential assets providing regional observations, with focus on hypoxia, HABs, ocean acidification (OA), climate change detection and invest in biological observations.*
is revised to:
3) Sustain existing buoys and gliders in the PNW coastal ocean, in coordination with national programs. Maintain these essential assets providing regional observations, with focus, to the extent possible, on hypoxia, HABs, ocean acidification (OA), climate change detection.

Our fourth objective:
Maintain and expand observation capabilities in PNW estuaries, in coordination with local and regional programs. *Maintain these to aid sustainable resource management, water quality assessment and sub-regional climate change evaluation. Sustain and enhance observing ability including new in-vestments in hypoxia, OA, and biological observations.*
i*s revised to:*
4) Maintain observation capabilities in PNW estuaries, in coordination with local and regional programs. Maintain these to aid sustainable resource management, water quality assessment and sub-regional climate change evaluation. Sustain observing ability including to the extent possible, hypoxia and OA.

Our fifth objective:
Maintain and enhance core elements of beach and shoreline observing programs. *Contribute to hazard mitigation by providing essential observations and better decision support tools for coastal managers, planners and engineers.*
i*s revised to:*
5) Maintain core elements of beach and shoreline observing programs. Contribute to hazard mitigation by providing, to the extent possible, essential observations and better decision support tools for coastal managers, planners and engineers.

Our sixth objective:

Provide sustained support to a community of complementary regional numerical models. *Contribute to the operation of regional models, and the tools and products they support, covering the head of tide of estuaries to the outer edges of the EEZ in both OR and WA, with strategic improvements to capabilities and scope, including new forecasts for waves, flood and erosion.*

i*s revised to:*

6) Provide sustained support to a community of complementary regional numerical models. Contribute, to the extent possible, to the operation of regional models, and the tools and products they support, covering the head of tide of estuaries to the outer edges of the EEZ in both OR and WA.

Our seventh objective:

Maintain, harden, and enhance NANOOS' Data Management and Communications (DMAC) system for routine operational distribution of data and information. *Sustain and enhance the DMAC system NANOOS has built, including the NANOOS Visualization System (NVS), for dynamic and distributed data access and visualization for IOOS.*

i*s revised to:*

7) Maintain NANOOS' Data Management and Communications (DMAC) system for routine operational distribution of data and information. Sustain, to the extent possible, the DMAC system NANOOS has built, including the NANOOS Visualization System (NVS), for dynamic and distributed data access and visualization for IOOS.

Our eighth objective:

Continue to deliver existing and create innovative and transformative user-defined products and services for PNW stakeholders. *Continue our NVS innovation to succeed in this vital translation: meaningful and informative data products that connect with user applications and serve society.*

i*s revised to:*

8) Continue to deliver existing and, to the extent possible, create innovative and transformative user-defined products and services for PNW stakeholders. Continue our NVS innovation to succeed in this vital translation: meaningful and informative data products that connect with user applications and serve society.

Our ninth objective:

Sustain and strengthen NANOOS outreach, engagement and education. *Foster ocean literacy and facilitate use of NANOOS products for IOOS objectives, the core task for which NANOOS was constructed, via existing and new approaches for engaging users and increasing ocean awareness.*

i*s revised to:*

9) Sustain NANOOS outreach, engagement and education. Foster ocean literacy and facilitate use of NANOOS products for IOOS objectives, the core task for which NANOOS was constructed, via existing approaches for engaging users and increasing ocean awareness.

NANOOS Revised Work Plan for FY2017 de-scope

The work plan described in our proposal for the $2.5M level is similar to our award funding amount. Although the total award amount is $3,216,463, it contains specific line items and the base operation funds are $2,457,136, similar to our current level of effort from the previous (FY16) NANOOS award. NANOOS thus will maintain all efforts to the current level which largely matches that of the $2.5M work effort described in our proposal. Any deviations from that level of work effort are described below.

Governance and Management Subsystem:

1) Maintain NANOOS as the U.S. IOOS PNW Regional Association

Our work plan for this subsystem requires salaries and travel in each year for oversight, coordination, and evaluation. Under this funding level, we will maintain our current effort, though with less travel in order to meet the budget.
Lead PI: Newton, UW

Observing Subsystem:

2) Maintain and enhance surface current and wave mapping capability.

PNW Coast HF Surface Current Mapping: Our work plan for this subsystem element is to continue to operate eight existing SeaSonde HF sites designated as Priority 1 sites by the national HF program (six long-range sites and two standard-range sites) and two of our existing Priority 2 standard-range sites. We will expand the system along the WA Coast to install two new long-range systems, and refit one short-range Priority 2 system from Standard-Range to Long-Range and install on the Washington Coast. Lead PI: Kosro, OSU

Wave Imaging at Critical PNW Ports: Our work plan for this element is to continue X-band radar monitoring of waves and currents at two important navigational inlets, Yaquina Bay and the Mouth of the Columbia River. Effort will be at existing levels, with no new assets or changes in work undertaken. Lead PI: Haller, OSU

3) Sustain existing buoys and gliders in the PNW coastal ocean, in coordination with national programs.

Our work plan for this objective is to sustain the following coastal shelf assets:

WA shelf buoy: Effort will be at existing levels, with no new assets or changes in work undertaken. There is insufficient funding for sustaining the WA glider because the glider was lost and no funds exist to replace the asset. The $50k intended for glider operations will be used for salary for glider data analysis and product development to increase user base and demand for these data. Lead PI: Mickett, UW

OR shelf buoy: Effort will be at existing levels, with no new assets or changes in work undertaken. Lead PI: Kosro, OSU

Columbia River shelf mooring: Effort will be at existing levels, with no new assets or changes in work undertaken. Because of the ramp down of the NSF funding for the 10-year CMOP program, there is insufficient funding to sustain the shelf mooring, estuarine moorings (see objective 4, below), and the shelf glider, thus the glider operations will not be conducted, as planned in the $2.5M budget. Lead PI: Baptista, OHSU

N. CA shelf glider: Effort will be at existing levels, with no new assets or changes in work undertaken. Lead PI: Barth, OSU

4) Maintain observation capabilities in PNW estuaries, in coordination with local and regional programs.

Our work plan for this objective is to sustain the following PNW estuarine assets:

Puget Sound, WA, 6 profiling buoys: Effort will be at existing levels, with no new assets or changes in work undertaken. Lead PI: Mickett, UW

Puget Sound, WA, US-Canada ferry-box: Effort will be at existing levels, with no new assets or changes in work undertaken. Lead PI: Maloy, WDOE

Columbia River, OR and WA: Effort will be at existing levels, with no new assets or changes in work undertaken. Because of lack of leverage NSF funds for these assets, these will be maintained but with impact to the Columbia River shelf glider (see Objective 3, above). Lead PI: Baptista, OHSU

South Slough/Coos Bay, OR: Effort will be at existing levels, with no new assets or changes in work undertaken. Lead PI: Helms, ODSL

5) Maintain core elements of beach and shoreline observing programs.

Our work plan for this objective is to sustain this bi-state network for WA and OR shorelines:

WA and OR beach, shoreline and bathymetry: Effort will be at existing levels, with no new assets or changes in work undertaken. WA beach monitoring, Lead PI: Kaminsky, WDOE; OR beach monitoring, Lead PI: Allan, DOGAMI; WA and OR nearshore bathymetric observations of beach and shoreline morphodynamics, Lead PI: Ruggerio, OSU

Modeling and Analysis Subsystem:

6) Provide sustained support to a community of complementary regional numerical models.

Our work plan for this objective is to support the following existing regional models:

NE Pacific and Salish Sea: The daily forecast model, LiveOcean, simulates ocean circulation and bio-geochemistry in the Salish Sea and in coastal waters of the NE Pacific, including Oregon, Washington, and British Columbia. Effort will be at existing level; an enhancement planned at the $2.5M budget will not occur. Lead PI: MacCready, UW

Columbia River estuary and plume: The OHSU circulation modeling system covers the Columbia River estuary and plume. Effort will be at existing level. Lead PI: Baptista, OHSU

PNW Coastal Waters: The OSU real-time coastal ocean forecast model covers the coastal waters off OR and WA. Effort will be at existing level. Lead PI: Kurapov, OSU

Data Management and Communications (DMAC) Subsystem:

Our strategic DMAC work plan is focused on sustaining the NANOOS DMAC Information System and user-facing Web and Products suite, including the integrated and thematically customized NANOOS Visualization System (NVS) framework.

7) Maintain NANOOS' Data Management and Communications (DMAC) system for routine operational distribution of data and information.

We will sustain our DMAC information system, and the Regional Data Assembly Center (DAC) that supports it. Effort will be at existing level for the following four areas. Lead PI: Mayorga, UW

Mature Regional DAC Operations: NANOOS will continue its regular strategic assessment of current and future needs for DAC operations, to sustain a highly available, robust, distributed hardware and software environment; maintain appropriate staffing and team coordination; and maintain up-to-date operations and system documentation to ensure transparent and clear descriptions of DAC architecture.

IOOS/DMAC Functional Roles: NANOOS will continue to meet IOOS/DMAC Functional Roles (per IOOS/DMAC Guidance) for at least a subset of assets.

NVS Support and Development: NANOOS will maintain its user-friendly NVS data discovery, access and visualization application framework that has served a critical role in NANOOS' service to its stakeholders. The NANOOS DAC will maintain NVS support as one of its central roles, leveraging regional user needs, feedback and data reviews to assure relevance and quality of metadata for observing and modeling data assets integrated and served by NANOOS.

Engagement in National and Cross-regional DMAC Efforts: NANOOS will continue to actively participate in IOOS DMAC community development activities, to the extent possible.

8) Continue to deliver existing and, to the extent possible, create innovative and transformative user-defined products and services for PNW stakeholders.

Our work plan for this objective will be evaluated and prioritized annually by the Tri-Com (= DMAC, User Products, and OEE committees) based on user feedback, NANOOS Governing Council input, and outreach results for regional priorities. Effort will be at existing level and confined to the following two tasks. Lead PI: Tanner, UW

Web Site: Web content relevant to stakeholder issues, especially those related to Maritime Operations, Ecosystem Assessment, Fisheries & Biodiversity, Coastal Hazards, and Climate, will continue to be evaluated and updated as new information/issues become available.

Tailored Products Development: NANOOS will annually evaluate priorities for products at the Tri-Com meeting, based on outreach feedback, regional issues, and GC input, and will implement new tailored products to the extent possible.

9) Sustain NANOOS outreach, engagement and education.

Our OEE efforts will be at existing levels and will continue to focus on four main areas: *Product Development*; *User Engagement*; *Ocean literacy*; *Communications.* OEE will provide the link between users and DMAC, engaging users in product development through focus groups, targeted interviews, or surveys to garner feedback and input on products as they are developed. We will utilize our developed partnerships with key education programs of NANOOS members to foster ocean literacy. And we will continue to use existing methods for communication of NANOOS outputs on local, regional, and national levels, in collaboration with the IOOS Program Office and IOOS Association. Lead PI: Newton, UW

NANOOS assures the stipulations outlined in our award letter as a list of tasks, below, are being funded at the amounts indicated. Pursuant to the President's Budget and congressional appropriations to build a national operational High Frequency Radar (HFR) network and direction to the U.S. IOOS Program Office to develop national system capacity, we have made the following allocations for HFR, as well as the other specified ***Award Letter Tasks*** from our FY17 funding:

1. $405,000 is allocated to fund operations and maintenance of High Frequency Radars. The specific, priority HF Radars that will be supported with these funds, including locations and approximate operating frequencies are as follows: eight (8) existing SeaSonde HF sites which have been designated as Priority 1 sites by the national HF program. These are six (6) long-range sites: LOO1 (46° 26'N, 124° 04'W), MAN1 (45° 38'N, 123° 57'W), YHL1 (44° 41'N, 124° 05'W), WIN1 (43° 40'N, 124° 12'W), CBL1 (42° 50'N, 124° 34'W), and PSG1 (41° 47'N, 124° 15'W), and two standard-range sites: STV2 (46° 11'N, 123° 59'W), and SEA1 (45° 59'N, 123° 57'W). As these resources allow, we hope to also continue operations at two of our Priority 2 standard-range sites, YHS2, and WLD2.
2. An additional $360,000 is allocated for purchase and deployment of two (2) long-range HF radars for the WA Coast. The locations for these additional long-range sites will be refined with site visits and meetings with coastal representatives; our initial aim is to install near Copalis and near La Push. We plan to refit an additional Priority 2 standard-range HFR to become a long-range HFR and install near Cape Flattery.
3. $50,000 to plan and execute an in person training event for biological data management in partnership with the MBON community.
4. $55,000 for the Ocean Technology Transition Customer Service Application Project.
5. $12,000 for OCS Olympic Coast cruise.
6. $30,000 to enhance the GOA-ON data portal as an OA dashboard to the World.
7. $75,000 NANOOS Multi-Scale Prediction of California Current Carbonate System Dynamics.
8. $64,181 for NANOOS Ocean Acidification Monitoring and Prediction in Oregon Coastal Waters.
9. $33,146 NANOOS UW OA observatories.
10. $25,000 to enhance the Cha'ba Mooring Program to Allow Year-Round Deployments.
11. $55,000 for UW OA observatories: Replacement System due to loss.

This completes our NANOOS Work Plan for FY2017.

BUDGET INFORMATION - Non-Construction Programs

OMB Approval No. 0348-0044

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1.		$ 3,216,463.00	$	$	$	$ 3,216,463.00
2.						0.00
3.						0.00
4.						0.00
5. Totals		$ 3,216,463.00	$ 0.00	$ 0.00	$ 0.00	$ 3,216,463.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY (1)	(2)	(3)		Total (5)
a. Personnel	$ 476,954.00	$	$	$	$ 476,954.00
b. Fringe Benefits	238,262.00				238,262.00
c. Travel	42,806.00				42,806.00
d. Equipment	302,331.00				302,331.00
e. Supplies	46,822.00				46,822.00
f. Contractual	1,537,381.00				1,537,381.00
g. Construction	0.00				0.00
h. Other	349,807.00				349,807.00
i. Total Direct Charges *(sum of 6a-6h)*	2,994,363.00	0.00	0.00	0.00	2,994,363.00
j. Indirect Charges	222,100.00				222,100.00
k. TOTALS *(sum of 6i and 6j)*	$ 3,216,463.00	$ 0.00	$ 0.00	$ 0.00	$ 3,216,463.00
7. Program Income	$ 0.00	$	$	$	$ 0.00

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SECTION C - NON-FEDERAL RESOURCES				
(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8.	$	$	$	$ 0.00
9.				0.00
10.				0.00
11.				0.00
12. TOTAL *(sum of lines 8-11)*	$ 0.00	$ 0.00	$ 0.00	$ 0.00

SECTION D - FORECASTED CASH NEEDS					
	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 3,216,463.00	$ 3,216,463.00	$	$	$
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 3,216,463.00	$ 3,216,463.00	$ 0.00	$ 0.00	$ 0.00

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT				
(a) Grant Program	FUTURE FUNDING PERIODS (Years)			
	(b) First	(c) Second	(d) Third	(e) Fourth
16.	$	$	$	$
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 0.00	$ 0.00	$ 0.00	$ 0.00

SECTION F - OTHER BUDGET INFORMATION	
21. Direct Charges: Other: APL prorated direct costs: $242,785 + Services: $107,022	22. Indirect Charges:
23. Remarks:	

Statements of Work for UW-led activities for NANOOS in FY17

The award is for the continued operation of the Northwest Association of Networked Ocean Observing Systems, NANOOS, for FY 17. NANOOS is a complete observing system, composed of observing assets, data management, web display and visualization of data products, and education and outreach. NANOOS is implemented by UW-APL with several regional subcontractors that allow our system to address the diverse needs for coastal information in the Pacific Northwest. As a Regional Association of IOOS, NANOOS delivers data and information that allows the public and a variety of user groups to make decisions that involve the health, economy, and sustenance of uses of the marine coastal environment.

Statement of work for Newton for NANOOS Management

Newton will oversee and direct all elements of NANOOS RA and RCOOS. This includes travel to national and regional meetings, holding NANOOS meetings, assuring NANOOS governance is executed and involving NANOOS membership in the products and decisions of NANOOS. Newton will oversee all US IOOS-NOAA OAP efforts and the OCS Olympic Coast cruise participation (***Award Letter Task 5***). Additionally, Newton will secure the purchase of two HF radars, and working with Kosro, OSU, and the IOOS Program Office, will oversee deployment of these on the WA coast (***Award Letter Task 2***). See OSU subcontract package for Kosro for further details on this task.

Statements of work for Mickett for UW contribution to NANOOS WA coastal buoy Observations

1. *Operation of WA Shelf Buoys:* Available IOOS funds will allow the operation and once-annual servicing of the Cha-Ba coastal buoy and the nearby subsurface profiling mooring, with moorings deployed in spring and recovered in the fall. This funding, combined with NOAA OAP funding to build a second mooring and to sustain year-round operations, will allow for a year-round deployment of a surface mooring. Salary is included for the buoy field engineers (Magness and Parsons), as well as for the project PI (0.75 for Mickett). Funds will cover annual calibration of instrumentation, travel expenses, Iridium/cell telemetry, and consumable items such as mooring hardware and batteries. We have included $13K for one 5-day servicing cruise on the R/V Robertson with the hope that OAP will continue to support our operations through funding for vessel charters.

We will work with DMAC to ensure that real-time and archived data from both the moorings will be accessible online. Additionally, we will continue work on developing a set of standard analyses using these data to enhance the usefulness of the data streams to various users. Mickett will also analyze mooring data and publish and present scientific findings as funds allow.

2. *Maintain a real-time coastal pCO2/ocean acidification mooring:* Provide field support for, maintain, and assist with distributing data for a real-time pCO_2/OA monitoring mooring on the Washington shelf (Cha'ba) at La Push (***Award Letter Task 9***). Leveraging includes 1) Much of the routine servicing, calibration and maintenance of the buoy is supported by NANOOS funding, and 2) NOAA-PMEL is responsible for calibration and maintenance of the OA sensors, which include pCO_2, pH, and temperature, salinity. Specific additional tasks necessary to be performed by APL/UW to support these sensors include 1) PI-level interfacing with NOAA/PMEL to ensure data quality and optimal sensor placement, 2) additional work each mooring servicing mission (2x annually) associated with i) installation, maintenance and operation of mooring infrastructure (sea-lion exclusion fence and wells) necessary for the OA sensors, ii) packing, handling and installation/removal of the OA sensors, and 3) additional OA-specific QA/QC/analysis of the other sensors on the mooring for proper contextualization

of the data from the OA sensors (e.g. velocity and temperature information during observed acidification periods).

3. *Fabrication of a new pCO2/ocean acidification mooring to allow year-round measurements:* This funding will allow the fabrication of a second surface mooring to allow year-round measurements of surface pCO2 and peripheral measurements (CTD with chlorophyll and dissolved oxygen and a pH sensor) at the Washington shelf NANOOS mooring site (***Award Letter Task 11***). This will be a "pared-down" mooring compared to the existing Cha'Ba mooring in that it will not have real-time measurements of water properties over the water column and will not be collecting meteorological and surface wave observations. The mooring will be designed, however, to accommodate these features in the future if funding becomes available. Principal Investigator John Mickett will be responsible for the overall coordination and direction of the work and leading PI-level collaboration with the PMEL Carbon Group. He will also supervise the design, and fabrication of the proposed mooring. Mickett will also directly supervise the supported APL field engineers, who will carry out much of the work, including mooring fabrication/assembly and integration of PMEL instruments.

4. *Fabrication and deployment of a winter pCO2/ocean acidification mooring:* This funding, which is the final 50% ($25k) of the Y3 "Closing the Gap" OAP project, will supplement existing NANOOS/OAP funding to allow year-round deployment of an OA mooring with a PMEL pCO2 system on the Washington Shelf (***Award Letter Task 10***). This funding will largely be used for salary for co-PI Mickett and a technician to carry out mooring servicing cruises, for the purchase of a sensor to allow for water-column measurements in addition to the surface pCO2 measurements, and for validation sample collection and analysis. Co-PI John Mickett will supervise and coordinate mooring servicing cruises, instrument calibrations and maintenance, and data handling. Mickett will also directly supervise the supported APL field engineers, who will carry out much of the work, including mooring fabrication/assembly, instrument integration, all mooring maintenance, instrument care, mooring deployment and recovery operations, and the collection of validation samples.

<u>Statement of work for UW contribution to NANOOS WA coastal glider Observations</u>

Because of the loss of Seaglider 187 and no means to replace it, the proposed budget provides funds to support APL Research Associate Curry to utilize existing data to develop user products that will promote its desirability and need in the PNW. Director Newton will advise this operation.

<u>Statement of work for Mickett and Devol for NANOOS Puget Sound Observations</u>

This effort will focus on status quo maintenance of 6 profiling buoys in Puget Sound that make atmospheric and oceanographic measurements in Puget Sound. APL-UW in collaboration with the UW School of Oceanography via NANOOS co-PIs Mickett and Devol and their teams will continue to operate these profiling buoys in Puget Sound, maintaining and servicing the buoys, sensors, and assuring high quality data streams to the web in near-real time.

This work will include deployment and recovery of mooring systems, maintenance of mooring system and components, maintenance, calibration, and deployment of oceanographic instruments, and collection and laboratory analysis of various water samples for calibration. These duties will involve field work from small boats for trouble-shooting problems and sample collection for sensor calibration, laboratory analyses of calibration samples. We will also continue to provide platform, technical and field support for the pCO_2 sensors that are operational on two of the buoys in collaboration with NOAA- PMEL. The team will continue processing and distributing the ORCA data stream, including

data analysis, database management, and streaming of data to web portals, as well as submitting data for publication, writing reports, and producing other data products to stake holders and collaborators.

Available funds will be used to provide partial support for the maintenance and operation of 6 real-time oceanographic profiling moorings in Puget Sound. This includes partial salary for the PIs (Mickett, Newton, Devol) and technicians (Parsons, Archer, Ruef), travel for meetings and fieldwork, as well as supplies, instrument repairs and calibration and miscellaneous fieldwork expenses including vessel fees. Fieldwork involves roughly monthly to bi-monthly visits to each mooring to service the winch system, power system and swap out instrument packages as needed. Funds will allow for one 2-day mooring recovery/deployment cruise aboard the R/V JACK ROBERTSON.

Statement of work for MacCready for UW contribution to NANOOS Modeling tasks: LiveOcean
We will continue development and application of our daily forecast model, LiveOcean. The model simulates ocean circulation and biogeochemistry in the Salish Sea and in coastal waters of the NE Pacific, including Oregon, Washington, and British Columbia. The model has been used for research on river plumes, phytoplankton growth, Harmful Algal Blooms (HABs), hypoxia, and Ocean Acidification (OA), and has been extensively validated against a wide variety of observational data. More information is available at http://faculty.washington.edu/pmacc/LO/LiveOcean.html.

Previous NANOOS support has allowed rapid development of the forecast system, and daily forecasts of biogeochemical properties, including OA variables, have been available online for the past year, through the NANOOS NVS portal. The model focus is on OA in coastal waters, an issue of great concern to shellfish growers. Over the coming year we will focus on three extensions/improvements to the modeling system that will greatly enhance its utility to stakeholders:

1. High resolution nested sub-model of the Salish Sea and Willapa Bay, with addition of smaller rivers
2. Continued testing of the carbon chemistry simulations against observations
3. Improvement of web access to the model output and data comparisons, developed in collaboration with stakeholders

The Washington shellfish industry lobbied for state funding of OA research. Our forecast model, funded in part by WA State, is designed to deliver information needed by the shellfish growers, specifically giving several days advanced warning of corrosive (low Aragonite saturation state) waters flowing over shellfish beds. The model has good skill in predicting hypoxia, and testing of the carbon chemistry is proceeding with data from many different sources. The daily forecast system is ideally suited to this work because it can make use of new OA observations as soon as they are available.

The modeling system is also directly useful for HAB prediction on the coast. NOAA has continued funding of the model system through the MERHAB program to help predict *Pseudo-nitzschia* blooms on the WA coast. These bring Domoic Acid (which leads to Amnesic Shellfish Poisoning) to the razor clams harvested there.

Extension of the model with higher spatial resolution into Puget Sound and the coastal estuaries will allow it to be used to understand and potentially respond to OA, HAB, and hypoxia events in these heavily utilized regions. A well-validated forecast model would also be useful for oil spill response. In the longer term the model system can be transitioned over to NOAA for operational ecological forecasting, allowing the knowledge gained by over a decade of federal science funding to be most

effectively applied to real problems.

Statement of work for Mass for UW contribution to NANOOS Modeling tasks: Pacific Northwest weather
Continuing work from FY16 year, UW-Atmospheric Science's Pacific Northwest Modeling group (Cliff Mass, PI) will give APL-UW access to high resolution numerical weather forecast data. These data are produced by the UW's Weather Research Forecast (WRF) model. The PNW WRF is run in a 24/7, semi-operational mode, and is available at a variety of resolutions. The WRF data will be used in the NANOOS modeling effort and support several sub-tasks. These include:

- The NANOOS Visualization System (NVS) that will show specific forecast parameters
- where there are observing assets in the water;
- A Boater app on NVS that shows forecasted wind vector at grid points;
- Provision of meteorological boundary conditions to support Parker MacCready's (UW
- School of Oceanography) LiveOcean model which will be served over NVS.

The UW Pacific Northwest Modeling group will allow access to the WRF data at least once every twelve hours. The resolution and data parameters are to be determined by mutual agreement. Access to the data will be for a period of twelve months, upon receipt of funds, and available for yearly renewal.

Statement of work for Tanner for UW NANOOS Website and Products
PI Troy Tanner will lead the implementation of the APL-UW portion of the web portal and products tasks. The web portal will be continuously updated with new content relevant to stakeholder issues, especially Maritime Operations, Ecosystem Assessment, Fisheries & Biodiversity, Coastal Hazards, and Climate. Content will consist of NANOOS generated educational pages, learning tools, lesson plans, and links to appropriate external materials. Prominent and crucial events will be displayed in the slide show on the home page. As information consumption by users continues to change, specifically towards a more mobile world, the portal framework will evolve to support new standards. The portal will also host content and products from related external partners, such as J-SCOPE and Real-time HABs. It is impossible to know in advance what external products will request a presence within the NANOOS portal, but our flexible framework has proven to be andeffective and cost-efficient way to make information available that would otherwise be unavailable to out stakeholders and the general public. To better understand the needs of our users, the content they use the most, and content and products they would like us to provide, we will expand our user tracking to include in-page events. To support a growing user base, we will periodically upgrade hardware.

NVS (NANOOS Visualization System) will continue to evolve, based on the needs of our users. We intend to add real-time and situational overlays to the map, allowing users to compare measurements from various platforms at the same time. We intend to integrate water quality data from Surfrider's Blue Water Task Force. The addition of this information will bring new information into NVS, allowing new comparisons with existing data streams. We have access to climatology data over a long period and users would like to be able to see comparisons of values across all years at once. To accomplish this, we will be developing a new plotting capability to allow data from different time ranges to be plotted together. Initially, this new plotting capability will address the desire for viewing climatological data, but it will also allow similar visulizations of other data. Currently, the evacuation brochures found in the NVS Tsunami Evacuation app are static. We will be developing a new capability that allows users to create dynamic brochures based on the area of the map they have zoomed in on. One feature users have asked for is the option to display graticules on the map. To address their needs, we will work

towards incorporating a graticules overlay on the interactive map. NVS contains many overlays from different providers, and as a result, the same variable can often have different ranges and colorbars for each overlay. We will investigate ways to set consistent ranges and colorbars for each overlay variable. We will continue adding features to the NVS Data Explorer mobile app and start working towards the creation of an updated NVS Tsunami Evacuation mobile app.

Statement of work for Mayorga for UW contribution to NANOOS DMAC

Mayorga will continue to serve as the primary point of contact between the NANOOS DMAC team and the IOOS Program Office DMAC efforts, and will coordinate DMAC activities among core NANOOS DMAC partners. More broadly, APL-UW DMAC efforts will focus on sustaining and enhancing the NANOOS DMAC information system and the Regional Data Assembly Center (DAC) that supports it, in these areas:

1. Mature Regional DAC Operations: We will continue our regular strategic assessment of current and future needs for DAC operations, to sustain, refresh and enhance a highly available, robust, distributed hardware and software environment; maintain appropriate staffing and team communication; and maintain up-to-date operations and system documentation to ensure transparent and clear descriptions of DAC architecture. We will expand our growing suite of tools and procedures to monitor system servers, web services, data flows and processing, and user application status. The DAC will continue to ingest and process all NANOOS supported observing and modeling assets, increasing its IOOS/DMAC Guidance compliance; and will expand the engagement of local providers (not NANOOS funded), integrating their data into NVS and DMAC services, and assisting with their data management & workflows when possible. DAC capabilities and efficiencies will be additionally strengthened through the regional and thematic partnerships with state agencies, municipalities, tribes and industry NANOOS has successfully engaged in.

2. IOOS/DMAC Functional Roles: We will continue to pursue and expand pilots to meet IOOS/DMAC Functional Roles, in some cases starting with a subset of assets while progressively extending compliance to all NANOOS-funded assets and as many non-NANOOS-funded assets as resources and partnerships allow. NANOOS already provides open data sharing, with only limited exceptions; it contributes nearly all its NANOOS-funded data to the WMO GTS; employs a Service-Oriented Architecture; has registered its standards-based data services which offer data in approved common formats and using IOOS semantics and identifiers, and are described using standard-compliant metadata. These capabilities will be incrementally expanded. Recently completed initial NCEI data archiving implementation will be extended to other assets. A QARTOD pilot will be initiated soon (Fall 2017), leading to at least partial operational implementation this year. Service implementation using 52North IOOS SOS, THREDDS, GeoServer WMS, and Web-Accessible Folder metadata will be enhanced and complemented with an operational ERDDAP server on top of some of these services.

3. NVS Support and Development: The user-friendly NVS data discovery, access and visualization application framework has served a central role in NANOOS' service to its stakeholders. The NANOOS DAC will maintain NVS support as one of its central roles, leveraging regional user needs, feedback and data reviews to continually improve the relevance and quality of metadata for observing and modeling data assets integrated and served by NANOOS. DMAC support will include more complex data types, including multi-deployment long time series, depth profilers, drifters and gliders; as well geospatial ("GIS") datasets.

4. Engagement in National and Cross-regional DMAC Efforts: We will continue to actively participate in IOOS DMAC community development activities, particularly OGC WMS/WFS support for geospatial

data; vocabulary management and semantic mapping; and collaborative code development and testing of common tools via github and other channels, specially focusing on Python software. NANOOS DMAC will sustain its collaborations with West Coast RA DMAC teams, particularly via the West Coast Ocean Data Network and IOOS Pacific region Ocean Acidification (IPACOA) activities. Moreover, we will proactively leverage and interact with marine-DMAC relevant efforts, particularly NSF OOI (a successful engagement that is ongoing), the NSF EarthCube cyberinfrastructure initiative (Mayorga is a funded participant in EarthCube), watershed monitoring initiatives, international GOA-ON ocean acidification activities and Canadian collaborations.

5. Supporting NANOOS RICE Certification process: NANOOS DMAC supported the development of the RICE Certification application that NANOOS submitted in July 2017. We will continue to support this process during the review stages and follow-up implementation.

Statement of work for Mayorga for the MBON Workshop

The goal of this project is to plan and carry out a workshop that builds on the successful partnership between IOOS and the Ocean Biogeographic Information System (OBIS-USA) to develop a community of practice around the management and analysis of biological ocean observing data (***Award Letter Task 3***). It will provide hands-on training in a computer lab setting to IOOS Regional Association (RA) Data Management and Communication team members, MBON team members and partners, National Centers for Environmental Information (NCEI) marine ecosystem team, and others that might be interested. The objective of this training workshop is to educate participants in the benefits, goals, technology and process to make biological data resources (and associated physical or chemical data) available in a format that can be ingested by OBIS and the MBON Portal. It will also expose participants to OBIS, IOOS and MBON tools for using those data.

Workshop planning has already been initiated. The workshop will take place in February 2018 at the eScience Institute of the University of Washington, in Seattle. E. Mayorga (the UW project lead) will be responsible for securing the workshop facilities and facilitating participant logistics, including handling of travel reimbursements for participants. He will co-lead the preparation and execution of the workshop together with IOOS Program Office and OBIS-USA staff. In addition, he will bring to hear his experience with IOOS DMAC practices and data science learning to facilitate materials that enhance the learning experience, such as the use of Jupyter Notebooks to share annotated, working Python code, and the adaptation of Software Carpentry tools for tutorial development. He and Don Setiawan (also at UW) will also serve directly as tutors for a subset of topics at the workshop.

Statement of work for Mayorga for the GOA-ON Portal development

The Global Ocean Acidification Observing Network (GOA-ON) data portal was publicly released in September 2016 (***Award Letter Task 6***). In the second year of this project, the following areas will be addressed:

- Integration of international datasets and data synthesis products will continue as these become available via partnerships. Currently data made accessible directly in the portal originate in North America and Australia. A concerted effort will be made to integrate time series station data from other nations.
- Coverage from GLODAP and SOCAT mapped data products will be enhanced to include additional variables, time periods and depths.
- Station data stream from US sites will be integrated more thoroughly, in collaboration with IOOS partners.
- Handling of the GOA-ON asset inventory will continue to be enhanced and strengthened, in collaboration with NOAA PMEL and the GOA-ON data management team.

- Model hindcasts and projections will be integrated.
- Seasonal box and whisker plots of OA parameter variability to show seasonal patterns at individual stations will be incorporated.
- The software application framework and user interface will be improved based on user and leadership feedback.
- We will develop improved visualizations of cruise observation transects and maps.

Statement of work for Newton for NANOOS Outreach, Engagement and Education

Salaries are for OEE staff, Sprenger, Wold and Lebrec for NANOOS Outreach, Engagement and Education activities. E&O staff will conduct networking, outreach, and user engagement to facilitate the use of NANOOS data and products. Their focus will be on keeping the NANOOS portal current and fresh, updating content to reflect NANOOS new products, and using NANOOS home page, social media platforms and regular newsletters to bring traffic to NANOOS portal.

Sprenger, Wold and Lebrec will provide outreach events for targeted groups including recreational boating and maritime operations communities. They will support the web development team's efforts in refining the NANOOS web portal to meet the needs of data users via such activities as gathering feedback from targeted users, coordinating focus groups with targeted user groups, and creating training resources within the NVS Help App, such as FAQs and tutorial videos.

Sprenger will have a specific focus on working with the K-12 education community to use information and data from regional ocean observing systems to support ocean literacy and science, technology, engineering and mathematics (STEM) education in the Pacific Northwest. Both Sprenger and Wold will work with IOOS Association and NOAA IOOS office to support IOOS education efforts on a national scale.

Statement of work for the Ocean Technology Transition Customer Service Application Project, Newton

From Alaska to S California, some shellfish industries along the Pacific Coast have benefited from observing instrumentation (Burke-o-Lators, BoLs) in their hatcheries that provide water quality conditions on aragonite saturation state and pH, enabling decisions on how to adapt hatchery practices to increasing ocean acidification. The successful OTT joint proposal ("Headlights") by AOOS, NANOOS, CeNCOOS and SCCOOS with shellfish grower and sensor industry partners was designed to fill that need by developing, and quality testing along with the BoL, a new pCO2 sensor, ACDC, that can be paired with a pH sensor to deliver the data growers need more economically and reliably. The current OTT proposal to develop new "ACDC" pCO2 sensors and maintain existing Burke-o-lator ocean acidification sensors in five west coast shellfish hatcheries was given a 1-y no-cost extension to allow the successful production and testing of the new sensors by the end of the project. The $55k OTT Customer Service Application Project that NANOOS was awarded, in unison with the other three RAs, will go toward funding the experts for that additional year, per below.

This NANOOS project (***Award Letter Task 4***) will fund technical expertise, continued guidance, and QA/QC testing at two of the project's five hatcheries. This is to be supplied by Dr. Burke Hales, OSU, at the Whiskey Creek hatchery in Oregon via their OSU subcontract, and by Julian Herndon, JISAO, for the Taylor Shellfish hatchery in Washington via the JISAO – UW subaward. The funding ($30k to Hales; $25k to Herndon) will provide technical support to the hatchery operators on the use of the new sensor, to compare the new data with the data from the Burke-o-lators, trouble shoot problems that arise with any new technology, QA/QC, data verification and interpretation, data management and advice.

The deliverables from this support build on the existing OTT award to provide: 1) continued Burke-o-Lator (BoL) and new ACDC data streams live on the IOOS Pacific Region Ocean Acidification (IPACOA, www.ipacoa.org) data portal and on RA portals as appropriate; 2) a QA/QC evaluation/summary of the new ACDC sensor; 3) expert input on a "user guide" for the new sensor, providing regional lessons learned; and 4) a regional assessment of OA condition and variation in the nearshore growing regions. The expert will work with the Dr. Jan Newton, NANOOS Director, and the other OTT Headlights project team members to scope these. It is envisioned that the Pacific Coast-wide compilations of the latter three products would be on the IPACOA site in downloadable format. In addition, the regional assessment may be a stand-alone product that could be prominently displayed on RA websites. We have a golden opportunity to use the data sets to define current conditions and inform stakeholders. The timeline for this work follows the milestones in our NCE of the OTT Headlights award, but with the deliverables due at the end of this FY17 funding year, as per the No Cost Extension.
The milestones for the project are contained in our OTT Headlights No Cost Extension documentation. The milestone for this aspect is for the two experts to continue supporting the two hatcheries throughout the period, as needed, to be concluded by the end of the award.

Statements of Work for the remaining Award Letter Tasks can be found in the packages from our OSU sub-contractors, as follows:

Award Letter Task 1: OSU; Mike Kosro; OSU Project 3
Award Letter Task 2: partial execution by OSU; Mike Kosro; OSU Project 3
Award Letter Task 4: partial execution by OSU; Burke Hales; OSU Project 10
Award Letter Task 7: OSU; Burke Hales; OSU Project 9
Award Letter Task 8: OSU; Burke Hales; OSU Project 8

Statements of Work for subcontractor-led activities for NANOOS in FY17

OSU will be responsible for observing, DMAC, and modeling: Specific tasks include nearshore bathymetric surveying (Ruggerio); harbor wave observations for maritime ops (Haller); HF surface current mapping (Kosro); Oregon shelf mooring (Kosro); N California glider (Barth, Shearman); PNW coastal shelf modeling (Kurapov); Oregon DMAC support (Kosro); OA observations off Oregon (Hales); California Current Predictions (Hales); OTT Customer Service Application (Hales).

OHSU will be responsible for Columbia River shelf and estuary observations, regional DMAC support, and modeling around the Columbia River estuary and plume (Baptista).

DOGAMI will be responsible for Oregon shoreline observing (Allan) and for Allan to participate as User Products Committee Chair.

OR Dept. State Lands will be responsible for estuarine observations in South Slough/Coos Bay (Helms).

WA Dept. Ecology will be responsible for Salish Sea ferry-box observing (Maloy) and for Washington shoreline observing (Kaminsky).

For each subcontract, the detailed SOWs are provided within the subcontractor package, including their budgets, budget justifications, and other supporting documents.

RCOOS YR 10-14 PROPOSAL EFFORT DISTRIBUTION BREAKDOWN SUMMARY

YEAR 11

Indicates new Yr 11 sub budgets

UNIVERSITY OF WASHINGTON:

Title Lead	Mngmt Newton	DMAC Mayorga	Product & Web Dev Tanner	Outreach & Education Jones	WA Shelf Buoys Mickett	Mooring Maintenance Mickett/	Puget Snd Buoy Mickett	WA Shelf Gliders Newton	GOA-ON Mayorga Newton	Chaba loss OA Mickett Newton	year-round Obser Mickett Newton	MBON Staff Mayorga	MBON Student Mayorga	HF Radar Purchase Newton	**APL TOTAL**	Other UW ATMOS Atm Model Mass	Other UW JISAO OTT Herndon	Other UW OCN PS Model MacCready	Other UW OCN PS Buoys Devol	**Combined Yr 11 Grand TOTAL**
Salaries	127,362	39,980	71,023	56,027	17,183	13,303	16,457	24,701	12,570	7,914	3,380	11,094	0	0	**400,994**	4,888	13,706	19,925	37,441	**476,954**
Benefits	69,667	23,308	38,850	30,647	9,399	7,277	9,002	7,263	6,820	4,329	1,848	6,069	0	0	**214,479**	1,584	4,468	5,881	11,850	**238,262**
Equipment	0	0	0	0	0	0	0	0	0	34,068	11,463	0	0	256,800	**302,331**	0	0	0	0	**302,331**
Travel	21,478	4,696	3,338	1,854	6,880	0	2,580	0	0	0	0	0	0	0	**40,826**	0	780	0	1,200	**42,806**
Sub Awards	1,537,381	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	**1,537,381**
Services	26,992	0	0	468	26,300	0	25,094	0	0	0	3,550		23,500	0	**105,904**	0	1,118	0	0	**107,022**
Supplies	365	106	10,000	1,792	11,571	915	11,715	460	65	8,689	0	22	0	0	**45,700**	0	0	0	1,122	**46,822**
Grad Op Fees	0	0	0	0		0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	**0**
Prorated Direct Costs	78,185	21,653	39,181	28,871	22,684	6,835	20,622	10,311	6,186	0	2,792	5,465	0	0	**242,785**	0	0	0	0	**242,785**
Total Direct	324,049	89,743	162,392	119,659	94,017	28,330	85,470	42,735	25,641	55,000	23,033	22,650	23,500	256,800	**1,353,019 0**	6,472	20,072	25,806	51,613	**1,456,982 0**
Indirect Coss	55,087	15,257	27,608	20,341	15,983	4,816	14,530	7,265	4,359	0	1,967	3,850	0	0	**171,063**	3,528	4,928	14,194	28,387	**222,100**
TOTAL	**379,136**	**105,000**	**190,000**	**140,000**	**110,000**	**33,146**	**100,000**	**50,000**	**30,000**	**55,000**	**25,000**	**26,500**	**23,500**	**256,800**	**1,524,082**	**10,000**	**25,000**	**40,000**	**80,000**	**3,216,463**
Target	379,136	105,000	190,000	140,000	110,000	33,146	100,000	50,000	30,000	55,000	25,000	26,500	23,500	256,800	1,524,082	10,000	25,000	40,000	80,000	3,216,463

SUBAWARDS Breakdown Summary:

OREGON STATE UNIVESITY:

Area Lead	CA Shelf Glider Barth	OR Shelf Buoy Kosro	Nearshore Bathymetry Ruggerio	HF Radar Kosro	Port Radar Haller	OR-WA Coast Model Kurapov	OSU DMAC Kosro	OA Hales	Cal curr Hales	OTT Hales	**OSU TOTAL**	**OHSU** Shf Observ Model Baptista	**WA Eco.** WA Shore Obs/PS ferry Kaminsky	**DOGAMI** OR Shore Observ Allan	**OR DOSL** S. Slough Moorings Helms	**Sub Award Total**
Salaries	24,184	28,253	15,067	143,387	21,780	26,695	18,750	23,764	28,773	11,814	**342,467**	133,582	41,627	25,976	0	**543,652**
Benefits	13,342	14,322	5,594	79,132	10,971	14,300	8,344	12,888	15,515	5,766	**180,174**	44,063	16,993	13,767	0	**254,997**
Equipment	0	11,075	0	25,980	0	0	0	5,000	0	0	**42,055**	0	0	0	15,140	**57,195**
Travel	1,300	2,500	5,023	12,000	800	2,000	5,000	1,500	5,000	2,000	**37,123**	3,803	5,800	6,684	0	**53,410**
Sub Awards	0	0	0		0	0	0			0	**0**	0	0	0	0	**0**
Services	0	0	0	26,100	0	2,000	3,722	1,200	1,297	0	**34,319**	0	4,600	1,378	7,372	**47,669**
Supplies	12,194	15,418	3,569	49,422	1,143	1,575	5,000	907	237	828	**90,293**	28,260	3,776	0	7,488	**129,817**
Other	0	0	0	18,000	0	0	0		200	0	**18,200**	0	0	0	0	**18,200**
Grad Op Fees	0	0	0		0	1,543	0			0	**1,543**	0	0	0	0	**1,543**
Total Direct	51,020	71,568	29,253	354,021	34,694	48,113	40,816	45,259	51,022	20,408	**746,174**	209,708	72,796	47,805	30,000	**1,106,483 0**
Indirect Cost	23,980	28,432	13,747	154,179	16,306	21,887	19,184	18,922	23,978	9,592	**330,207**	71,292	17204	12,195	0	**430,898**
TOTAL	**75,000**	**100,000**	**43,000**	**508,200**	**51,000**	**70,000**	**60,000**	**64,181**	**75,000**	**30,000**	**1,076,381**	281,000	90,000	60,000	30,000	**1,537,381**

Budget Justification

Budget will be used to support the NANOOS RA for regional coordination and for NANOOS' essential RCOOS subsystems. Budgets for UW, the fiscal agent of NANOOS, are provided, along with subcontractor sub-budgets. We describe here budget justification and detailed narrative according to budget category.

a. Personnel:

Personnel salaries are for sustaining the following sectors of the NANOOS enterprise:

- Management, for PI Newton to oversee and direct all elements of the NANOOS RA and RCOOS; Newton will oversee the US IOOS, NOAA Ocean Acidification Program (OAP), and Olympic Coast Sanctuary (OCS) efforts, the purchase of the two HF radars, and the OTT Customer Service Application Project.
- Observing Subsystem, for lead PIs and technicians (for UW, this includes salaries for PI Mickett and field engineers to service La Push, WA, buoy, for PIs Mickett/Devol and field engineers to provide periodic servicing of 6 buoys throughout the Puget Sound region), see subcontracts for additional Observing Subsystem PIs. The glider budget is being directed to salary for product development.
- NOAA OAP has added funds to our Observing Subsystem to support sampling for ocean acidification (OA) observations from the La Push, WA buoy (UW salaries for PI Mickett and field engineers) and the Newport, OR buoy (see OSU subcontract for PI Burke). Salaries are needed completion and deployment of an OA buoy to supplement the current La Push WA buoy so year-round coverage is attained.
- Modeling and Analysis Subsystem, for lead modelers and technicians needed to maintain numerical models (UW salaries to PI MacCready for his ocean modeling group and to PI Mass for his atmospheric modeling group, see subcontracts for salaries for additional Modeling Subsystem PIs).
- DMAC Subsystem, for lead PIs and technicians needed to maintain DMAC capabilities (for UW, this includes salaries for PI Mayorga and data engineers), see subcontracts for additional DMAC Subsystem PIs. This work includes the funded DMAC contributions to GOA-ON and MBON, as described earlier in this document.
- Web Development, to maintain the NANOOS website (for UW, this includes salaries for PI Tanner and technicians) and see DOGAMI subcontract for User Products Committee Chair Allan salary to coordinate user product prioritization and execution.
- Outreach, Engagement and Education Subsystem, for OEE staff Sprenger, Wold and Lebrec to execute education and outreach activities.
- OTT Customer Service Application Project, for staff Herndon (UW JISAO) and see OSU subcontract for salary for Hales for hatchery support and data analysis.

b. Fringe Benefits:

The benefit and leave rates included in the budget are in accordance with UW's negotiated rates approved by the Department of Health and Human Services (DHHS) and UW policy on proposal budgets. The negotiated benefit rates differ between APL-UW and other departments

at UW. APL's negotiated benefit rates for Professional Staff is 29.9% while the negotiated rate for UW faculty is 24.9%, professional staff is 32.5%, and for graduate students is 18.4%. In addition to the APL benefit rates, APL charges leave rates of 24.8 % for Professional Staff. A copy of this agreement is attached.

c. Travel:

Regional and national travel is requested for coordination, meetings, and workshops associated with NANOOS (including NANOOS Governing Council meeting; Tri-Committee meeting, All-PI meeting, and regional Observing, DMAC, Modeling, and Outreach meetings), IOOS Association (including bi-annual Board meetings), and IOOS (including bi-annual IOOS meetings and IOOS DMAC meetings). Web development travel is for regional coordination. Outreach, Engagement and Education travel is for focused user group and education meetings. Local travel and ferry costs are associated with buoy support and maintenance of the observing subsystem. Other travel is described in the subcontractor budget justifications.

Funds for domestic and international travel are included in this proposal. Permission for international travel is requested. While not budgeted at this time, it is possible Newton, in her work representing IOOS with the Global Ocean Acidification Observing Network (GOA-ON) will require international travel. Should additional international travel be required, funds from domestic travel may be used after consultation with the NOAA IOOS program manager.

d. Equipment:

Equipment for purchase by UW and its subcontractors is listed in the accompanying table showing task, number, amount, and justification. Equipment purchased will be owned by UW or its subcontractors, but will be used for NANOOS as long as funding is provided. The cost of the equipment listed in the budget is based on quotes from the manufacturer or distributor. Quotes are available upon request.

EQUIPMENT TO BE PURCHASED BY UNIVERSITY OF WASHINGTON:

Task	No	Equipment	Amt per	Justification
WA coast buoy (Mickett)	1	Benthos 865a Acoustic Release	$14,955	Replacement buoy
WA coast buoy rebuild (Mickett)	1	Gilman Buoy Hull	$6,725	Replacement buoy
WA coast buoy rebuild (Mickett)	1	Buoy frame fabrication	$12,388	Replacement buoy
Closing the Gap (Mickett)	1	SBE 37 IMP-ODO	$11,463	Needed for consistency with existing sensors
WA Coast HF Radar (Newton)	2	Codar HF radars	$128,400	Extend NANOOS HF Radar system to the WA Coast, matching those in OR.

EQUIPMENT TO BE PURCHASED BY SUBCONTRACTORS:

Task	No	Equipment	Amt per	Justification
OSU: HF radar (Kosro)	1	Receive Antenna	$9,000	No cost-effective lease
OSU: HF radar (Hales)	1	GPS SHARES	$11,000	No cost-effective lease
OSU: HF radar (Kosro)	1	Rx addition/4.785 MHz	$5,980	No cost-effective lease
OSU: Mooring (Kosro)	1	Microcat CTD w/ DO	$11,075	No cost-effective lease
OSU: OA Monitoring (Hales)	1	pCO2 sensor	$5,000	No cost-effective lease
ODSL: South Slough Estuary (Helms)	1	Estuary mooring	$15,140	Upgrade system

Lease-versus-buy analysis: Lease of the equipment listed above is either not available or not cost-effective for sustained operations. Analysis of lease vs. purchase options for common oceanographic equipment such as current point-measurers or current-profilers, CTDs, wave-tide gauges, sonars, and water quality sensors (temperature, salinity, oxygen, chlorophyll, turbidity, optics) shows leasing rates are generally set to repay instrument purchase costs in 250 to 500 days. Because instruments purchased here will be used in a sustained observing program, beginning with the five-year program funded under this grant, and with the anticipation of future participation, the purchase option is the more cost effective for all of these applications.

e. Supplies:

Supplies costs are required to maintain existing observing subsystem assets for coastal, estuarine and shoreline observations. Supplies are for buoy repair /replacement parts (e.g., shackles, cables) and consumables (e.g. batteries, chemicals). Additional supplies for NANOOS outreach include folders, postcards, decals, pens, etc.

f. Contractual:

The strong academic-industry-government-NGO partnership of NANOOS' RCOOS requires that subcontracts be established for certain sub-element tasks, to:

- OSU for observations, DMAC, and modeling in OR waters: nearshore bathymetric surveying (Ruggerio); harbor wave observations for maritime ops (Haller); HF surface current mapping (Kosro); Oregon shelf mooring (Kosro); N California glider (Barth, Shearman); PNW coastal shelf modeling (Kurapov); Oregon DMAC support (Kosro); OA observations off Oregon (Hales); California Current Predictions (Hales); OTT Customer

Service Application (Hales).

- OHSU for Columbia River shelf and estuary observations, regional DMAC support, and modeling around the Columbia River estuary and plume (Baptista);
- DOGAMI for Oregon shoreline observing (Allan) and for Allan to participate as User Products Committee Chair;
- OR Dept. State Lands for estuarine observations in South Slough/Coos Bay (Helms); and
- WA Dept Ecology for Salish Sea ferry-box estuarine observing (Maloy) and for Washington shoreline observing (Kaminsky).

For each subcontract budget justifications are provided in the subcontractor package, including their detailed budgets, SOWs, and other supporting documents.

g. Construction:
None

h. Other:
APL-UW's purpose is applied and basic research and it is solely funded through Grant and Contract revenue. APL-UW's operating expenses meet the definition of Direct Costs as defined by 2 CFR Part §200.413 and are directly charged to grants and contracts through the application of the Prorated Direct Costs rate (PDC). The PDC rate of 31.8% MTDC was approved by the Office of Naval Research on September 27, 2016 and became effective October 1, 2016. PDC is included within the MTDC cost base for F&A recovery. A copy of the PDC rate approval letter is attached.

The services included in this section include the costs for planned NANOOS and MBON workshops including meals, participant travel support and event costs. Also included for NANOOS management/outreach are conference registration fees; a data plan coverage for an iPad tablet used in field or remote settings to connect users with NANOOS data streams and costs for printing brochures/posters/informational material. Chemical analysis charges (e.g., nutrients, chlorophyll, oxygen); instrument calibration and satellite tracking and iridium telemetry services and cellular internet services to allow communication with and data transmission from moorings Vessel rental/service charges are also included (e.g., R/V Mackinaw and R/V Robertson). Funds are requested for annual IOOS Association dues. Other services are described in the subcontractor budget justifications.

j. Indirect charges:
Facilities and Administrative costs are calculated in accordance with the University's DHHS agreement dated May 26, 2016. A copy of this agreement is attached and a table of the rates can be viewed at:
https://www.washington.edu/research/main.php?page=ospRates&entryTab=0 .

As per current, approve practice, the APL-UW may re-budget within the total estimated costs.

Office for Sponsored Research and Award Administration
Oregon State University, A312 Kerr Administration Building, Corvallis, Oregon 97331-2140
Tel 541-737-4933 | Fax 541-737-3093 | | sponsored.programs@oregonstate.edu

September 20, 2017

To Whom It May Concern:

Oregon State University is pleased to submit the subaward proposal to the University of Washington for NOAA's program FY 2017 Implementation of the U.S. Integrated Ocean Observing System, and OSU's year-2 contribution to NANOOS 2016-2021 (Title: OSU Contribution to NANOOA, 2016-2021).

The appropriate programmatic and administrative officials have reviewed and approved this budget revision in the amount of $1,076,381 for Year 2. The period of performance for this project will be June 1 2017 through May 31, 2021. My signature below, as the authorized institutional official, indicates institution approval for the proposed project.

OSU has a Conflict of Interest policy that is compliant with the PHS Financial Conflict of Interest Regulations (42 CFR Part 50 Subpart F).

Oregon State University is prepared to perform the work as outlined in the proposal, subject to the State of Oregon – Oregon State University regulations. Dr. P. Michael Kosro will serve as Oregon State University's principal investigator on this project.

Legal Name: Oregon State University
Authorized Signing Official: Patricia A. Hawk, Assistant Vice President for Research
DUNS number: 053599908
EIN Number: 61-1730890
Payee Name: Oregon State University
Remittance Address: Office for Sponsored Research and Award Administration, 312 Kerr Administration Building, Corvallis, OR 97331-2140
Financial Representative: Sandy Cobb, osraa.finance@oregonstate.edu
Contractual Representative: Patricia A. Hawk, sponsored.programs@oregonstate.edu

Approved:

Acting for.

Patricia A. Hawk
Institutional Authorizing Official

OSU NANOOS, year 2 of five-year subcontract 1 June 2016-31 May 2021.
Modified statements of work and budget justifications

This document updates year-2 of the statement of work to include budget guidance from NOAA and UW.
Appended below is a Statement of Work, Budget, and Budget Justification for the Oregon State University subcontract contribution to work to be undertaken in pursuit of the goals of year 2 of the 5-year (June 1, 2016-May 31, 2021) NANOOS (Northwest Association of Networked Ocean Observing Systems) subcontract starting June 1, 2017 with an end-date of May 31, 2021, to the University of Washington. Based on year-2 guidance, the budgets shown for year 2 are reduced to a total of $1,033,463 for the period beginning June 1, 2017. The modified statements of work contained here are reduced during year 2 from those proposed originally.

We present several projects, each with its own statement of work and budget justification. Budgets for each project, along with a combined budget, are also included.

Contents:

Statements of work

I. Continuing Projects 1-10. Original statement of work had statements of work for funding at $4M annual level, with notations for anticipated cutbacks if NANOOS is funded at $2.5M annually or $1.5M annually. Our funding for year 2 is near the $2.5M annual budget for year 2, and the text below has been modified to reflect that.

Project 1: OR/WA Nearshore Bathymetry. Peter Ruggiero, Oregon State University

Statement of Work: The objective of this component of the RCOOS will be focused on maintaining the nearshore bathymetric component of both the Washington and Oregon beach and shoreline monitoring efforts in cooperation with Jonathan Allan of DOGAMI and George Kaminsky of WA DOE. The purpose of our efforts is to document the seasonal-interannual-decadal changes in beach and shoreline morphodynamics and for identifying coastal hazards, information that is critical to state and federal coastal resource managers, geotechnical consultants, and the public-at-large.

Since sandbars dissipate wave energy and provide a buffering capacity that protects the shoreline, both the temporal and alongshore variability of nearshore bathymetry create varying regions of exposure to coastal hazards along the coast (Cohn et al. 2014). Quantitative knowledge of nearshore bathymetry is also necessary as the bottom boundary condition for the modeling of nearshore flows, sediment transport, and subsequent morphology change (Di Leonardo and Ruggiero, 2015). Therefore these nearshore bathymetric data provide a critical source of information for improving coastal hazard mitigation along the coastlines of the Pacific Northwest.

In recent years, NANOOS funded nearshore bathymetric data has supported the US Army Corps' Regional Sediment Management at the Mouth of the Columbia River; Oregon Wave Energy Trust's ocean wave energy conversion projects; FEMA flood mapping activities in all Oregon Counties; OSU's PISCO group's habitat characterization work; Washington Department of Ecology's coastal hazards assessments along the southwest Washington coast, and basic research on coastal hazards, morphodynamics, and climate change (resulting in multiple publications and student theses). NANOOS funded nearshore bathymetric data is being explicitly incorporated in a coastal hazards decision support tool (Baron et al., 2015, Mull and Ruggiero, 2014) supported by NOAA's Climate Program Office Coastal and Ocean Climate Applications (COCA) program. Through deep engagement with a Tillamook County (OR) Knowledge-to-Action Network (KTAN), we are co-developing a scenario analysis and modeling tool (*Envision*) to explore strategies for reducing vulnerability to coastal hazards based on a variety of drivers of change - population growth, sea level rise, and possible changes in storminess patterns.

Observations: This task consists of annual nearshore bathymetric surveys, measured using a PWC-based Coastal Profiling System at selected sites in Oregon and Washington. During each summer, Peter Ruggiero's group at Oregon State University proposes to collect nearshore bathymetry data along the four sub-cells of the Columbia River littoral cell (CRLC). Over 220 individual cross-shore profiles will be collected, continuing a

nested sampling scheme that has been ongoing since 1999, in which each profile is approximately 2 km long extending from the lower inter-tidal to ~12 m of water depth. Approximately 400 kilometers of nearshore mapping will take place with approximately 10-12 days of field data collection. In all cases these nearshore bathymetry measurements will be combined with topographic measurement collected by PI Kaminsky's group at Ecology developing complete maps of the nearshore planform. These nearshore bathymetric data will continue to provide a critical source of information for improving coastal hazard mitigation along the coastlines of the CRLC.

During each summer, Ruggiero's group will also collect nearshore bathymetric data along much of the Rockaway littoral cell along the north-central Oregon coast, one of the most rapidly eroding stretches of coast in the state. Approximately 75 individual cross-shore beach profiles will be collected from the lower intertidal to ~25 m of water depth (~1500 m from the shoreline). These data will be combined with topographic data collected synoptically by PI Allan's group at DOGAMI developing complete maps of the nearshore planform.

Deliverables: The data will be processed from their raw format into deliverable text files after having passed a rigorous quality assurance process. Specific deliverables include digital data, first in simple ascii tables associated with each nearshore bathymetric map, and ultimately in a gridded form representing the full nearshore planform.

Budget justification: This work, the collection of nearshore bathymetry data along 3 (sub) littoral cells in Washington (North Beach, Grayland Plains, and Long Beach Peninsula) and 1 littoral cells in Oregon (Clatsop Plains), requires part time support of a a technical person (Jeff Wood), two hourly graduate student workers, and an undergraduate student to perform the majority of the field work. The proposed budget provides for survey preparation and data collection (domestic travel), processing, archiving, and initial change analyses. Domestic travel of $5023 in year 2 is requested based on 13 days along the Oregon and Washington coast for the team. Support ($3569) is also requested for minor equipment and supplies (batteries, cables, pelican cases, etc.) required to maintain and operate a 4th generation PWC-based Coastal Profiling System (designed and built by OSU). The PWC based nearshore surveying system used by Ruggiero's group is now over 8 years old and the equipment is showing wear and tear. In particular, the PWCs themselves have been driven for several hundreds of hours in very demanding conditions and need to be carefully maintained to be able to safely collect this data.

References:

Baron, H.M., Ruggiero, P., Wood, N.J., Harris, E.L., Allan, J., Komar, P.D., and Corcoran, P., 2015. Incorporating climate change and morphological uncertainty into coastal change hazard assessments, Natural Hazards, 75:2081-2102, DOI: 10.1007/s11069-014-1417-8.

Cohn, N., Ruggiero, P., Ortiz, J., D.J. Walstra, 2014. Investigating the role of complex sandbar morphology on nearshore hydrodynamics. In: Green, A.N. and Cooper, J.A.G. (eds.), Proceedings 13th International Coastal Symposium (Durban, South

Africa), Journal of Coastal Research, Special Issue No. 70, pp. 053-058, ISSN 0749-0208.
Di Leonardo, D. and Ruggiero, P., 2015. Regional scale sandbar variability: Observations from the U.S. Pacific Northwest, Continental Shelf Research, 95,74-88, http://dx.doi.org/10.1016/j.csr.2014.12.012i
Mull, J. and Ruggiero, P., 2014. Estimating storm-induced dune erosion and overtopping along U.S. West Coast beaches, Journal of Coastal Research, 30(6), 1173-1187, DOI: 10.2112/JCOASTRES-D-13-00178.1.

Project 2: X-band radar monitoring at navigational inlets, Merrick Haller (OSU)

Background

Our marine radar wave observing station began regular observations at the mouth of Yaquina Bay (Newport, OR) on May 1st 2009 and data is available in real-time through the NANOOS Visualization System. The system collects regular image sequences each hour and uploads all data and products to our database server on the OSU campus.

In April of 2013 we installed an additional station on Cape Disappointment to monitor the Mouth of the Columbia River. This effort was originally supported by the Office of Naval Research (Coastal Geosciences) for the DARLA series of field experiments. The MCR radar installation has proven to be extremely valuable. Data quality at the site is exceptional, primarily due to the substantial increase in elevation of the radar station on Cape Disappointment (CapeD Coast Guard Station). We remain excited about the new radar installation at the Mouth of the Columbia River. We would like to add this station as a real-time station under the NANOOS observational system, as there is significant stakeholder interest in the Columbia River site. We have also been working with the Columbia River Bar Pilots (Captain Dan Jordan) to develop a better understanding of frontal dynamics at the MCR and their impact on navigation. This includes development of a new "front-imaging" data product. These fronts indicate where there are sharp surface current gradients that can affect navigation.

On the science front, the recent PhD Thesis (David Honegger, OSU; "Depth Estimation and Frontal Imaging via X-band Marine Radar") identified two previously unobserved phenomena at the MCR. The first being the presence of oblique internal hydraulic jumps on ebbing tides. The second being a negative backscatter anomaly indicating the leading edge of salt water intrusion as the tide switches from ebb to flood. Both of these phenomena are presently the subject of further study and upcoming paper submissions.

Proposed Effort

Our proposed effort is to continue X-band radar monitoring of waves and currents at two important navigational inlets, Yaquina Bay and the Mouth of the Columbia River. In addition to data collection, this effort will continue software and product development. Real-time data products include wave directional spectra, both the latest observations and one-week historical records, as well as a wave-averaged product for viewing current fronts from the most recent tidal cycle.

Another data product we have been working on extensively is radar-derived bathymetry. Bathymetry is of leading order importance in determining the dynamics of the coastal zone, yet it often remains unknown or poorly constrained. Wave-imaging remote sensors

can be exploited for estimating nearshore hydrography. Observational time series of wave speeds and directions can be utilized to estimate hydrography using the linear wave dispersion relation. Reliable around the clock detection of the wave field makes X-band marine radar an attractive sensor choice. In addition, the large wave resolving footprint allows full coverage of important coastal regions such as the ebb shoals of tidal and engineered inlets.

We have already demonstrated success at bathymetric retrievals at the MCR (Benson Beach and the navigational channel area between the jetties. Tests of the algorithm at Newport are still ongoing. These bathymetric retrievals are complementary to the traditional jet ski surveys at these sites, as the radar estimates provide bathymetry information in the seasons between any summer in-situ collections, albeit less accurately than traditional acoustic surveying. Our radar-derived bathymetry effort has also caught the attention of the Office of the Coast Survey (NOAA, Silver Spring, MD). At their request we delivered a Technical Training Course entitled "Wave-Imaging Remote Sensing for Hydrographic Applications" (May 27-28, 2015) and we hope to continue to develop this relationship.

Budget Justification

Support for this effort is primarily for technician time (Faculty Research Assistant, Randy Pittman), with minor amounts of materials and supplies (hard drives, radar parts, routine radar servicing) and travel costs to field sites for service and maintenance. This effort is heavily leveraged with other funds (Office of Naval Research, Coastal Geosciences), which we have secured through 2019. The interest of ONR is primarily with the MCR site, which is what has allowed us to expand our radar monitoring efforts to this as a second site.

Fringe and indirect costs are calculated according to OSU guidance. Travel costs are for both in-state (Newport) and out-of-state (Ilwaco, Washington) field work.

Project 3: HF Surface Current Mapping. P. Michael Kosro, Oregon State University

We propose to continue to operate a suite of current measurement sites using HF radar in a continuous mapping array from southern Washington to northern California. One-dimensional currents ("radials") are collected from each site and, where radials overlap, full 2D "total" currents are measured by combining radials. Each year this system produces approximately 50 million individual hourly-averaged radial current measurements. The vector currents are made available to, and used by, a wide array of stakeholders, including the US Coast Guard for search-and-rescue, NOAA's Office of Response and Restoration for oil spill and pollution response, ecosystem analysts for tracing transport of HABS, fishermen and other ocean users for route planning, the US Weather Service through AWIPS, field scientists for operational planning, and ocean modelers for data assimilation to improve their model fidelity, and for assessment of ocean interannual variability thanks to their long history.

Also for year 2, we will expand the system along the Washington state coast, using additional funding from the "Closing the Gaps" campaign to install two new long-range systems, and refitting one Priority 2 system from Standard-Range to Long-Range and installing it on the Washington coast.

We will continue to operate eight (8) existing SeaSonde HF sites which have been designated as Priority 1 sites by the national HF program. These are six (6) long-range sites: : LOO1 (46° 26'N, 124° 04'W), MAN1 (45° 38'N, 123° 57'W), YHL1 (44° 41'N, 124° 05'W), WIN1 (43° 40'N, 124° 12'W), CBL1 (42° 50'N, 124° 34'W), and PSG1 (41° 47'N, 124° 15'W), and two standard-range sites: STV2 (46° 11'N, 123° 59'W), and SEA1 (45° 59'N, 123° 57'W). As these resources allow, we hope to also continue operations at two of our Priority 2 standard-range sites, YHS2, and WLD2. The locations for the three additional long-range sites will be refined with site visits and meetings with coastal representatives; our initial aim is to install near Copalis, near La Push, and near Cape Flattery/Tatoosh.

We will continue to provide data and products. We will continue our collaboration with the modeling community to assist in facilitating the assimilation of HF data into regional circulation models. These measurements will contribute to the improvement of maritime operations (search and rescue, vessel routing), to ecosystem assessment, including analysis and modeling of HAB transport. They also contribute to the assessment of interannual variability, based on histories extending back to 1997 in the longest occupied locations.

These data are part of the national HF surface-current mapping system, which is a coordinated program to provide surface current information in near real-time to the public. In addition to local data collection, processing, and product generation, the radial data are reported in near realtime to the national system, which uses duplicate centers to provide emergency operational backup. The data are combined nationally into eastward and northward currents ("totals") and the results provided via ftp, via a THREDDS server which can provide subsetted data, and via graphical output.

These results are also provided in GNOME format for oil spill/pollution work by NOAA, in netcdf, in AWIPS for the national weather service forecasting offices, and to the US Coast Guard for use in search and rescue.

These data provide high-resolution maps of surface currents on an hourly basis. They have been used in a wide variety of scientific analyses, including examination of topographic effects on coastal flows (Kosro, 2005; Kim et al., 2011), development of interannual variability such as El Nino (Kosro, 2002; Durski et al., 2015), recognition of and mapping alongshore propagating signals in the currents (Kim et al., 2013), unexpected flows such as the subarctic invasion of 2002 (Kosro, 2003) or the delayed spring transition of 2005 (Kosro et al., 2006), the tracking of Harmful Algal Blooms (Hickey et al., 2013), the variability of coastal tidal systems (Erofeeva et al., 2003; Kurapov et al., 2003; Osborne et al., 2011; Osborne et al., 2014). Their combined fine spatial and temporal resolution have allowed the mapping of spatial scales of the fast inertial currents in the Pacific Northwest, an important contributor to mixing (Kim and Kosro, 2013; Kim et al., 2014). They have proven especially valuable in combination with ocean circulation models – by providing ground truth for model comparison (e.g. Liu et al, 2009; Yu et al., 2012; Durski et al., 2015) and (separately!) through assimilation of the HF data, the models are able to do a considerably better job in estimating the ocean flows not only near to, but also distant from the data, both horizontally and vertically (Oke et al., 2002a, 2002b; Kurapov et al., 2003; Paduan et al., 2004; Yu et al., 2012). They provide long time-series of coastal flows which often vary strongly in space,

complementing the time series data available from fixed moorings (e.g. Kim et al., 2011). Near the coast, they delineate the flows associated with rotationally trapped buoyancy currents from river outflow (Mazzini et al., 2015).
The data are also used by the glider community, to improve steering of their gliders. In the same way, fishermen use the data to avoid stemming large currents (on introduction to the measurements at a meeting of "Scientists and Fishermen Exchange" in Newport, one said "this will save me a lot of money").

Budget Justification
Salary is proposed for scientific and management participation (Kosro), field repairs and calibration (Arnesen) and data processing, networking, archiving, and quality control (Dorkins).
Travel is budgeted for visits to experimental sites for data archiving (6/yr/site), equipment repairs, and instrument calibration; funds to attend two program or scientific meetings per year are requested. Costs are also included for travel to candidate sites for the new WA radars; we also budget funds for installation of new sites, including provision of shelter, electricity, and communications. Funds to upgrade an existing Standard Range site to Long Range, including permanent equipment (GPS SHARES [to allow frequency sharing among multiple long-range radars, patented technology of Codar Ocean Sensors], Long Range Antenna [replaces Std. Range Antenna], outfitting Receiver for long-range operation at 4.785MHz) and software are budgeted. Partial costs for connection of required computers to the CEOAS network (Research Computing System) have been budgeted. Funds to defray the costs of publication (journal articles, meeting abstracts, etc) have been budgeted. Funds for on-site (far from OSU campus) electricity, internet connectivity (e.g. cell phone/modem/ISP service) are requested under Other Direct Costs/Other, as are costs to construct, secure, and electrify equipment shelters at each of the proposed new sites, and funds for repair or replacement of on-site electronics. Materials for antenna cables, computer data storage, project-related data acquisition, site air-conditioners and de-humidifiers, processing computers, and expendables are also included in Materials & Supplies.

Project 4: Oregon Shelf Mooring System, P. Michael Kosro, Oregon State Univ.

The goal of this project is to maintain a mooring system on the Oregon shelf. The intent is to sustain a mooring similar to the one that is currently transferring real-time data to the NANOOS and NDBC websites.
Moored observations are an important component of an ocean observing system, providing continuous time series information. Time series data observed at a fixed point compliment spatial data, such as observations from gliders and satellites.
The mooring observations can be useful for:
* providing weather information—wind, temperature of air and water, barometric pressure, etc.
* looking at the currents, from near surface to deep,
* obtaining real-time data that will help improve model predictions, and
* continuing time series at CB-06 to help resolve interannual variability.

A shelf mooring will be maintained during the program to collect time-series of ocean parameters at subsurface depths, and to obtain meteorological measurements. This program will operate in cooperation with Burke Hales' biogeochemistry measurement program, which focuses on CO2 and ocean pH.
Since the start of NANOOS, a physical-meteorological mooring has been maintained on the Oregon shelf, measuring water temperature at about 10 depths, water salinity at 3-4 depths, dissolved oxygen in the lower water column, and vertical profiles of horizontal currents using an Acoustic Doppler Current Profiler. On the surface float, meteorological data are collected. There is cell-phone communication between the buoy and shore, with real-time reporting of ocean data (T, S, currents) and meteorological data (wind speed and direction, insolation, air temperature, etc) and buoy diagnostics (GPS location, battery voltage, etc). An Argos satellite-based monitoring system provides alerts should the buoy's location (determined independently of the GPS) depart from its expected location by more than a fixed amount. In addition, the mooring serves as a potential platform of opportunity for other investigators who wish to collect timeseries data from their own sensors.

As it has been historically, the preferred plan will be to recover the mooring and re-deploy it twice per year, to balance costs vs. risk of data loss.

As anticipated, we relocated the NANOOS Oregon shelf mooring in June 2017 to a new site, CB06, south of Cape Arago (43°17.6′ N, 124° 32.2′ W). This site was selected after consultation with the US Coast Guard, the Trawling Commission, and representatives of the regional fishing community, to be comparable to the historical site used in SuperCODE and GLOBEC, on the same isobath, but in an area which is not fished or trawled. We intend to continue operation at this location. This has extended the geographic coverage of NANOOS, putting more sensors closer to its southern boundary. This location is also near the southern-most glider transect planned for operation by the OOI, providing opportunities for synergy yielding high-temporal resolution data from the mooring at the mid-shelf location, and high spatial resolution but weekly or lower time resolution from the glider. In addition, the mooring will be offshore from the South Slough National Estuarine Research Reserve, a NANOOS member, and near the home waters of the Oregon Institute of Marine Biology (OIMB) in Charleston, Oregon, providing support from offshore measurements for both institutions.
The mooring measurements will be downloaded and post-processed at the completion of each 6-month deployment. In addition, a subset of these data are being reported by cell-phone and provided in near-realtime via NVS.

Budget Justification
Funding is requested for support as follows:
Salary plus Benefits: PI for management and NANOOS participation; Mooring Technician for engineering, preparation, deployment, recovery of mooring twice/year.
Partial costs for connection of required computers to the CEOAS network (Research Computing System) have been budgeted.
Travel for mooring cruises are included for each year.

Materials and Supplies: Funds are requested for instrument calibrations, mooring rigging, cell phone charges, ARGOS satellite beacon charges, batteries, replacing worn and damaged sensors, anchors, etc.
Permanent Equipment: In year 2, funds are included to purchase an SBE37 Microcat with dissolved oxygen sensor ($11075), to replace an instrument lost during a mooring breakaway the previous winter. Most of the equipment currently in use has been purchased by other projects, and is aging. Equipment will be retained by Oregon State University after the project ends for use on other research initiatives.
Ship time for this work has been budgeted under the Hales project for Ocean Acidification.

Project 5: Underwater Glider Observations off Trinidad Head, CA
John (Jack) Barth and R. Kipp Shearman, Oregon State University

We will continue year-round sampling along the Trinidad Head (TH), CA, line (41 3.5'N) using an autonomous underwater glider. Beginning in November 2014, we started glider sampling along the TH line, with financial assistance from NANOOS, CeNCOOS and the NOAA SWFSC. In consultation with NANOOS leadership, we moved our IOOS-supported glider sampling to the TH line after the NSF-supported Ocean Observatories Initiative began glider sampling along the Newport Hydrographic Line where we have been conducting glider sampling since the inception of NANOOS.
The TH line fills an important gap in continuous subsurface oceanographic observations between Newport, OR, and Monterey Bay, CA, and has been identified in many California Current plans as a key sampling location (e.g., the PaCOOS Science Plan). Running a glider on the TH line with support from both NANOOS and CeNCOOS is a perfect opportunity for collaboration between these two northern California Current IOOS regional associations. For the surface-intensified, equatorward-flowing California Current, the TH line forms an important "upstream" boundary condition for central and southern California. For the subsurface, poleward-flowing California Undercurrent, the TH line forms an important "upstream" boundary condition for the Pacific Northwest, with water properties brought north by the California Undercurrent (salinity, temperature, dissolved oxygen, nutrients) setting the source water values for upwelled waters off the Pacific Northwest. Thus, the TH line subsurface observations are critical to keeping ocean models on track.
We are using a 1000-m capable Seaglider equipped with the following sensors: CTD, dissolved oxygen (Aanderaa 4831 optode), light backscatter (700 nm), chlorophyll fluorescence and Colored Dissolved Organic Matter (CDOM) fluorescence (WET Labs Ecopuck). The gliders also measure depth-averaged velocity which can be combined with geostrophic estimates of relative velocity to get absolute velocity and hence transport. We presently own 3 of these Seagliders, valued at approximately $133K each, so that we can "hot swap" them to maintain continuous coverage along the TH line. The glider will fly from approximately the 100-m isobath (~10km offshore) to at least 130W (~400 km offshore), repeating the line every

~30 days. Data are returned to shore after every dive and submitted in real-time to the IOOS glider data center and to NOAA's NODC. The data are also automatically sent to both NANOOS and CeNCOOS for use by other PIs, for plotting and for creation of value-added products.

In addition to the OSU glider group members, Jack Barth (PI), Kipp Shearman (co-PI), Anatoli Erofeev (lead glider associate) and Steve Pierce (glider research associate), we work with CeNCOOS's Dr. Eric Bjorkstedt (NOAA SWFSC, Humboldt State University) and his colleagues who are presently making CTD and zooplankton measurements along the TH line. We work with Eric to make use of the R/V Coral Sea to conduct glider fieldwork. We will also collaborate with NANOOS and CeNCOOS modelers to make sure our glider data is readily available for their data-assimilating circulation models of the California Current.

To utilize the glider data to create products to inform policy and decision-making, we intend to supply not only value-added plots of subsurface data, but a derived, simple "El Niño Index" comparable to that being computed by Dan Rudnick (Scripps, SCCOOS, http://www.sccoos.org/data/elnino/). This index can be displayed on both the NANOOS and CeNCOOS web pages, and we'll collaborate with other west-coast glider operators to track changing ocean conditions. We expect the data, plots and index to be useful to fellow researchers, ocean modelers, ocean users (fishers) and policy makers.

Budget

With $75K/year, and a contribution from CeNCOOS, we will continue year-round sampling on the TH line from June 2017 through May 2018. The costs cover glider batteries, satellite cell phone charges, deployment and recovery costs (to be leveraged with CeNCOOS colleagues as much as possible), glider refurbishment (sensor calibration, compass calibration), and, most importantly and the largest expense, salary and benefits for experienced glider research associates. The $75K/year budget will also allow us to do some minor repair of our aging gliders and the sensors they carry.

Reduced Budgets: With this activity funded at $75K budget in year 2, we propose to forgo any glider refurbishment and do the best we can to continue year-round operations. Should we need to pay for any major repairs, this will result in less than year-round coverage.

Budget justification: Salary is to support a research associate (3.0 months per year) to perform the glider work. The co-PIs Barth and Shearman (0.25 months per year each) will participate in and supervise the operations. Both the co-PIs and the research associate are responsible for data quality and delivery. The OSU gliders (valued at $133K each, so for two, total of $266K) will be made available for this project at no purchase cost. We request modest funds to maintain the gliders in good working order. Travel funds support OSU personnel costs for traveling to Trinidad Head, CA, to join research cruises and for the NANOOS annual PI meeting. Materials and supplies include computer supplies and batteries for the gliders. The "Other" category includes shipping the glider to the manufacturer in Seattle for servicing, sensor calibration, glider repair, and Iridium cell phone charges for glider operations and data return to shore. Computing services are for partial support of the PI's connection of their computers to the CEOAS network.

Project 6: OSU Coastal Circulation Modeling. Alexander Kurapov, OSU

As part of the NANOOS effort, a real-time coastal ocean forecast model has been developed and run routinely by the OSU modeling group. The model assimilates satellite and land-based observations (altimetry, SST, HF radar surface currents) and provides everyday updates of oceanic forecasts (including surface currents, SST, and other variables) along the Oregon coast (the model domain extent is 41-47N). A new model has been developed, and is currently at the testing stage. Compared to the present, "official" real-time OR model, the new system features the extended domain (41-50N, including the entire OR and WA coasts), improved model resolution (2 km in horizontal), and the Columbia River discharge. This new OR-WA predictor for ocean circulation has been run in near-real time, with data assimilation. In 2017-18, we will plan to make it the main ocean data assimilation system, providing outputs to NANOOS NVS and the old model will be phased out.

In 2017-18, we propose to continue supporting and advancing the OR-WA data assimilation system. Improvements will include:

A. Adding temperature and salinity vertical sections from gliders (NANOOS, OOI) to the set of routinely assimilated data
B. Adding fresh water inputs in British Columbia (Fraser River) and Puget Sound (although the 2-km resolution of this model does not make it a competitor in Puget Sound, we need to model the salinity balance in JdF Strait correctly).
C. Develop tools for crab industry (such as conditions for recovering crab pots, depending on three-dimensional velocity information).
D. In collaboration with U. Washington (Dr. Parker MacCready), make steps toward coupled physical/biochemical forecasts constrained by assimilation of physical variables. Research in this direction will be supported by the NOAA MERHAB project and NANOOS will provide support for sustainable 24/7 operational implementation.

Budget justification

Salary support is requested at the rate of 0.5 month/year in year 2 (PI Kurapov) and 3 mo/year in year 2 for the research associate Dr. S. Erofeeva, who has been in charge of everyday model forecast operation and updates. One month in year 1 is requested for the PhD student (Ivo Pasmans) to enable transfer of new data assimilation modules, developed as part of his thesis research, into NANOOS operations. (Note: College of Earth, Oceanic, and Atmospheric Sciences faculty of Associate Professor ranks hold 12-month academic appointment and receive only 4.2 months salary from the College budget. Faculty are expected to raise from research grants the balance of their annual, 12-month salary. Research associate ranks obtain 100% of their salary from research grants.) Fringe benefits are calculated based on the estimated future Oregon State University rates.

In year 2, funds are requested to support 1 national, to attend regular coastal ocean research meetings (such as the annual NANOOS PI meeting). The estimated rate is $2,000 (per trip within the US).

Materials and Supplies include funds for expendable project supplies, including data storage media and computer software required for the project.
Computer services costs are estimated based on the rate of $2000/PI accepted at CEAOS.
Tuition is included for 1 month in year 2. The amount is based on the OSU guidelines.
Indirect cost base is equal to the total direct minus equipment expenses and tuition. The OSU facilities and Administrative fee is 47% of the direct costs in year 2.

Project 7: OSU DMAC (Data Management and Communication)

PI: P. Michael Kosro, OSU

This project will provide OSU expertise to the NANOOS team on data management and communication, and contribute to the transformation of NANOOS, and especially OSU, data into user products.
OSU has a strong concentration of ocean observing and modeling activities for NANOOS. To facilitate the transition of those observations and model outputs into data products conforming to national standards in an efficient and responsive way, NANOOS invests in DMAC expertise local to OSU.
The OSU DMAC specialist, a faculty research assistant, will continue to serve as the interface between information generators, product developers, and data standards requirements. He will be a member of the distributed DMAC team (with members from University of Washington and OHSU) to provide local expertise which assists scientists in making their data ready for the NANOOS Visualization System, and other outlets. He will continue to participate in the weekly phone conferences to share progress and plan development of NVS. He will advise on presentation and delivery of model-based results. He will continue to be a member of the NANOOS User Products committee, helping to define and implement products for NVS, including for measurements such as the surface current maps, NANOOS gliders, the OSU shelf mooring, X-band wave radar, satellite remote sensing fields, coastal sea level, and for model results, including the OSU circulation model, "tuna plots".
As funded in year 2 with an allocation of $60,000/yr, this effort will result in reduced attention available from the DMAC specialist to OSU data needs.

Budget Justification:
Salary is requested to support a research assistant part-time for participation in the DMAC activities for OSU. Travel funds are budgeted to allow attendance at meetings of NANOOS, of user groups and professional meetings. Funds are budgeted for project-related data acquisition, storage, analysis and presentation. Costs for connection of required computers to the CEOAS network (Reserch Computing System) have been budgeted. Communications charges (long distance, ISP costs for data transmission from remote sites to OSU, etc) are also requested.

Project 8: Ocean Acidification Monitoring in US Pacific Coastal Waters (Burke Hales; OSU-CEOAS)

Objective

The goal of this year-2 component of the project is to continue the mooring monitoring of the Ocean Acidification-impacted carbonate chemistry of US Pacific coastal waters.

This objective will be accomplished by continued operation of the Oregon Ocean Acidification Mooring Program, including deployment and maintenance of the surface moorings at the established Ocean Acidification (OA) node south of Coos Bay at CB06 with surface MAPCO2 systems, including deployment of the NOAA-OAP moored assets off Coos Bay at CB-06, as well as continued opportunistic sample collection for archiving and analyses in Hales lab at OSU.

Rationale

Ocean acidification (OA) is an undeniably increasing effect in the global ocean, but it has only recently been recognized that the natural processes of upwelling and de-oxygenation (Feely et al., 2008) are contributing to accelerate the effects of OA in coastal waters of the Pacific Northwest. These natural processes can expose the coastal ocean to waters nearly corrosive to $CaCO_3$ minerals; anthropogenic effects have contributed to intensify these natural effects to drive instances of undersaturation in nearshore surface waters (Feely et al., 2008; Harris et al. 2013). Recent hatchery failures beginning in 2006 were originally attributed to hypoxia or biological pathogens (Elston et al., 2011), but were ultimately linked to the CO2 chemistry of hatchery waters in which larvae were spawned (Barton et al. 2012). Recent work at OSU (Waldbusser et al., 2014) has clearly demonstrated the exclusive sensitivity of larval calcifiers to reductions in aragonite mineral saturation state (Ω ; $\Omega = [Ca^{2+}][CO_3]/K_{sp,a}$, where $K_{sp,a}$ is the seawater solubility product of aragonite), and provided a linkage to bio-energetic requirements to accelerate precipitation rates over those driven purely by physical chemistry (Waldbusser et al., 2013). The Ω_a effect is already being felt during the variable conditions of the upwelling environment of the US Pacific coast (Barton et al., 2012; Harris et al., 2013) and will define the average condition of these waters within a decade or so (Hauri et al., 2012), far before any likely effects related to pH (Waldbusser et al., 2014). The immediacy of the looming effects demands that the observational network previously supported OAP efforts continue. Further, the fact that Ω_a, which cannot be directly measured, has been definitively determined to be the most impactive component of the effects of OA requires that the carbonate system be observed comprehensively and with abundant validation efforts such that this critically important parameter can be sufficiently constrained.

Proposed Project

Operation of the Oregon OA mooring program

This effort consists of the continued operation and maintenance of an OA-relevant mooring like those that have been deployed off the Oregon coast in various capacity since 2008, leading to Hales' advisee-authored publications (Evans et al., 2011; Harris et al., 2013; Evans et al., 2014). This effort has until recently centered around the deployment of SAMI-CO2 and SAMI-pH instruments, augmented with CTD sensors, at the NH10 hydrographic station at a mid-shelf depth on the Newport Hydrographic (NH) line, with surface and near-bottom instrument packages, and a near-bottom instrument package at the shelf break on the NH10 line. This deployment pattern allowed constraint of the seasonal evolution of the carbonate chemistry in surface waters at NH10. The deep moorings allowed quantification of the development of carbonate chemistry in the upwelled source waters at the shelf break, and their

modification after transiting the shelf to NH10, both of which determine the signature of and productivity response to upwelling in surface waters at NH10. In early 2014, we incorporated a MAPCO2 system into the NH10 surface expression, and subsequently developed and deployed a winter-worthy MAPCO2-capable mooring deployed in October 2014, with which we merged the classical capabilities of the traditional NH10 hydrographic mooring (Figure 1).

Following cross-validation, we moved the OAP-supported assets to the south, to a site off Cape Arago, CB-06. This location is logistically justified by the proximity to the deep-water port of Coos Bay, where a fleet of charterable vessels exists, including some that have been used by OSU researchers in the past. The shelfbreak mooring may continue to be deployed on the NH line, as that cross-shelf flow pattern at the southern site is not as well understood.

Part of the OAP-supported mooring work has been to merge the OA moored capabilities with the historical NH10 hydrographic measurement program (meteorology, ADCP, water-column thermistor arrays; work by OSU PI Mike Kosro, supported through NANOOS). This was accomplished with the construction of the new MAP-capable mooring currently at NH10 site.
This merged mooring was deployed off NH10, but has now been relocated to the CB06 site south of Coos Bay.

Budget Justification:
Salary is proposed for Hales (1 month/yr2) to oversee the project. He will participate in the mooring turnaround efforts, and guide the sampling programs. Salary is requested for Hubbard for 2 months in year 2. Hubbard is the lead field engineer in Hales' group, and has directed the field mooring work for the last few years.

Fringe benefits are included at University-specified rates.

Travel is requested at $1500 in Year 2, for domestic travel for project meetings, and travel of CEOAS personnel to and from port calls in support of mooring deployment. Permanent equipment ($5000) is budgeted for a sensor.

Miscellaneous supplies are budgeted at $507 associated with mooring operations. These might include electronic testing and fabrication tools (volt meters, power supplies, soldering stations), mechanical fabrication supplies (welding supplies, stainless materials and hardware, machine shop charges) that frequently crop up in projects like this; standard gases and solutions for testing and validation discrete sample analyses; hand and power tools; drill bits, taps, adhesives, cleaning and labeling supplies, and instrument interface and personal computers and associated software. These estimates are approximate, but our previous experience suggests this estimate to be appropriate.

$200 is budgeted in year 2 to support shipping and mail costs, and $400 to support

partially the PIs' contribution to the college computer network. The college and university do not provide computer network support, and subscription to the network and IT support is billed on a per-PI basis. This estimate is appropriate for the amount of PI and Tech time allotted for this project.

Funds for fishing-boat chartering for mooring work are requested at $1000.

Overhead is included at the University-specified on-campus rate of 47% of direct costs in Yr 2, less equipment.

Project 9, Multiscale prediction of California Current Carbonate System Dynamics, Burke Hales, CEOAS/OSU

The California Current is a dynamic eastern boundary system that spans the Northeast Pacific from Canada to Baja California, Mexico. Upwelling of cold, nutrient rich water drives multi trophic level productivity throughout much of the domain, but also results in naturally acidic on-shelf waters on regional scales. In addition, anthropogenic CO_2 on basin to global scales, and local inputs by eutrophication, fresh water inputs, and local respiration or carbon assimilation result in multiscale and context-specific perturbations to the carbonate system. Thus, to understand, manage, or mitigate the effect of ocean acidification on ocean ecosystems, we need to quantify a suite of carbonate system parameters along the Pacific Coast in a mechanistic, spatially explicit, and temporally dynamic fashion.

We propose to embed an improved semi-analytical carbonate-chemistry prediction model within a dynamic classification of pelagic seascapes derived from satellite remotely sensed variables, including, but not limited to, phytoplankton standing stock (chl-a), SST, and wind stress. We will produce synoptic time series and nowcasts of surface TCO_2, TALK, pH and Ω that will facilitate regional comparisons of interannual trends in OA parameters. We will include metrics of model and spatiotemporal uncertainty to better inform management decisions. These maps will be validated with the wealth of multi-parameter OA data generated from recent NOAA-supported field-observational efforts, from coastal moorings, West-coast OA cruises, and shore-based Burke-o-Lators. Statistical analyses will quantify spatially explicit trends across OA parameters, and local deviations from seascape-based predictions will disentangle basin-scale oceanic vs. local drivers of the carbonate system. Maps will be served in near real time on IOOS data portals. Time series and maps will inform marine ecosystem management and provide metrics of ocean health for National Marine Sanctuary condition reports.

Statement of Work, year 2

In year 2, we will continue our modeling effort, write papers to describe the results, and present our results at a national science meeting such as AGU or Ocean Sciences.

During June through September, we will work on completing manuscript #1 on algorithm description and the development of linkage functions. In the following three months, we

refine the linkage functions, and produce descriptions of local variability. We will also work on manuscript #2, a description of spatiotemporal variability of carbonate system parameters in the California Current. During the final six months (Dec 2017-May 2018), we will disseminate our findings at a national meeting (AGU or Ocean Sciences), revise and submit manuscripts 1 and 2. We will also automate map uploads to the IOOS server.

Budget Justification

Funds are budgeted for salary and benefits for Hales to lead the CO2 semi-mechanistic model improvement; in-water data collection, QA/QC, and model ingestion; and optimization of the intra-seascape model parameterization.

Travel funds are budgeted in year 2 to allow Hales to attend a national or international meeting to present results.

Funds for materials and supplies (computer hardware and/or software) and networking charges are included in Other Direct Costs, as are funds for shipping and mailing, and funds for publication of results.

Indirect costs are included at 47% of modified total direct costs.

Project 10: Ocean Technology Transition (OTT) Customer Service Application Project Statement of Work, Burke Hales, OSU/CEOAS

From Alaska to S California, some shellfish industries along the Pacific Coast have benefited from observing instrumentation (Burke-o-Lators, BoLs) in their hatcheries that provide water quality conditions on aragonite saturation state and pH, enabling decisions on how to adapt hatchery practices to increasing ocean acidification. The successful OTT joint proposal ("Headlights") by AOOS, NANOOS, CeNCOOS and SCCOOS with shellfish grower and sensor industry partners was designed to fill that need by developing, and quality testing along with the BoL, a new pCO2 sensor, ACDC, that can be paired with a pH sensor to deliver the data growers need more economically and reliably. The current OTT proposal to develop new "ACDC" pCO2 sensors and maintain existing Burke-o-lator ocean acidification sensors in five west coast shellfish hatcheries was given a 1-y no-cost extension to allow the successful production and testing of the new sensors by the end of the project.

This NANOOS project will fund the technical expertise, to be supplied by Dr. Burke Hales, OSU, continued guidance and QA/QC testing at the Whiskey Creek hatchery. The funding will provide technical support to the hatchery operators on the use of the new sensor, to compare the new data with the data from the Burke-o-lators, trouble shoot problems that arise with any new technology, QA/QC, data verification and interpretation, data management and advice.

The deliverables from this support build on the existing OTT award to provide: 1) continued Burke-o-Lator (BoL) and new ACDC data streams live on the IOOS Pacific Region Ocean Acidification (IPACOA, www.ipacoa.org) data portal and on RA portals as appropriate; 2) a QA/QC evaluation/summary of the new ACDC sensor; 3) expert input on a "user guide" for the new sensor, providing regional lessons learned; and 4) a regional assessment of OA condition and variation in the nearshore growing regions. The expert will work with the Dr. Jan Newton, NANOOS Director, and the other OTT Headlights project team members to scope these. It is envisioned that the Pacific Coast-wide compilations of the latter three products would be on the IPACOA site in downloadable format. In addition, the regional assessment may be a stand-alone product that could be prominently displayed on RA websites. We have a golden opportunity to use the data sets to define current conditions and inform stakeholders. The timeline for this work follows the milestones in our NCE of the OTT Headlights award, but with all deliverables due at the end of this FY17 funding year.

Budget Justification: Salary is requested for Hales to participate in the program. Travel funds are included for visits to industry partners, sites, and conferences. Materials and supplies are included for demonstrations, reports, and data storage.

Budget Justification Notes, subcontract wide:

Permanent Equipment/Leveraging, Lease-Purchase and Ownership, Salaries: In many of these projects, existing equipment purchased, but no longer being used under, non-IOOS grants are being used for NANOOS, at no cost to NOAA/IOOS. This represents a large leveraging element. As an example, the existing HF array consists of 11 SeaSondes, purchased at a cost of over $1M, using no IOOS funds. However, some new equipment is needed expressly for these projects, and these instruments are described under the individual budget justifications. An analysis of lease vs. purchase options is possible for common oceanographic equipment such as current point-measurers or current-profilers, CTDs, wave-tidge gauges, sonars, and water quality sensors (temperature, salinity, oxygen, chlorophyll, tubidity, optics) and shows leasing rates are generally set to repay instrument purchase costs in 250 to 500 days. Because instruments purchased here will be used in a sustained observing program, beginning with the five year program funded under this grant, and with the anticipation of future participation, the purchase option is the more cost effective for all of these applications. (e.g. http://www.aslenv.com/Doc/Equipment%20Leasing%20Rates%20March%202010.pdf). If lease options were available for the less common, more expensive instruments (e.g. HF and X-band radars) the economic factors are expected to be the same. Equipment purchased under this subcontract will be owned by Oregon State University, and highest priority for its use will be given to NANOOS investigators to perform their funded NANOOS work.

For all projects, OSU Facilities & Administration fees (Indirect Costs) are 46.5% of modified total direct costs in year 1, and 47.0% for years 2 through 5, by federal agreement dated October 3, 2014. Benefits (OPE) are based on Oregon State University guidelines.

Lease of the equipment listed below is either not available or not cost-effective for sustained operations.

EQUIPMENT TO BE PURCHASED in YR1 BY Oregon State University:

Task	No	Equipment	Amt per	Justification
3. HF	1	Receive Antenna	$9,000	No cost-effective lease
3. HF	1	GPS SHARES	$11,000	No cost-effective lease
3. HF	1	Rx addition/4.785 MHz	$5,980	No cost-effective lease
4. Mooring	1	Microcat CTD w/ DO	$11,075	No cost-effective lease
8. OA Mon	1	pCO2 sensor	$5,000	No cost effective lease

Salaries: Assistant, Associate, and Full Professors in CEOAS receive 30%, 35%, and 40% salary directly from the University. Thus, full Professors must raise 60%, or 7.2 months/year, of their salary from external funding. Faculty in the Senior Research category must earn an even larger percent of their salary through external funding.

Form rev 2/2/2015

College of Earth, Ocean, and Atmospheric Sciences, Oregon State University

Enter data in Yellow Boxes Only **ESTIMATED BUDGET FOR DURATION OF RESEARCH PROJECT**

Agency	**University of Washington**	Start Date:	**7/1/2017**
Principal Investigator:		End Date:	**6/30/2018**
Proposal Title:	**OSU NANOOS YR 2**		

		YEAR 2		
BUDGET CATEGORIES				
Senior Personnel	**Base Salary (monthly)**	FTE	Months	Cost
Peter Ruggiero	10,852	-	-	-
	-	-	-	-
Kosro	11,123	0.50	6.00	66,738
Kosro	11,123	0.08	1.00	11,123
John (Jack) A. Barth	12,024	0.02	0.25	3,006
R. Kipp Shearman	9,305	0.02	0.25	2,326
Kurapov	9,686	0.04	0.50	4,843
	-	-	-	-
Burke Hales	11,814	0.08	1.00	11,814
Burke Hales		0.08	1.00	11,814
Maria Kavanaugh	6,959	0.08	1.00	6,959
Burke Hales		0.08	1.00	11,814
	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-
Total Senior Personnel				**130,437**
Other Personnel				
Research Associates (Post Doc)			-	-
Faculty Res Assistants			37.50	201,032
Grad Research Assistants			1.00	2,511
Summer GRAs (no tuition)			2.00	4,974
Undergrads (hourly rate)			1.00	2,013
Sea Pay (daily rate)			20.00	1,500
TOTAL SAL & WAGES				**342,467**
OTHER PAYROLL EXPENSES		Rate		
Peter Ruggiero		35.53%		-
		0.00%		-
Kosro		49.73%		33,189
Kosro		49.73%		5,531
John (Jack) A. Barth		46.25%		1,390
R. Kipp Shearman		37.46%		871
Kurapov		51.40%		2,489
		0.00%		-
Burke Hales		48.81%		5,766
Burke Hales		48.81%		5,766
Maria Kavanaugh		51.00%		3,549
Burke Hales		48.81%		5,766
		0.00%		-
		0.00%		-
		0.00%		-
		0.00%		-
		0.00%		-
Faculty Res Assistant				114,179
Grad Research Assistants				527
Summer GRAs (no tuition)				498
Undergrads (hourly rate)				167
Sea Pay (daily rate)				486
TOTAL OPE				**180,174**

TOTAL SALARIES, WAGES AND OPE COSTS			**522,641**
TOTAL EQUIPMENT			**42,055**
TRAVEL			
Domestic			38,473
Foreign			-
TOTAL TRAVEL			**38,473**
PARTICIPANT SUPPORT			
Stipends			-
Travel			-
Subsistence			-
Other			-
TOTAL PARTICIPANT SUPPORT			**-**
OTHER DIRECT COSTS			
Materials & Supplies			86,393
Publication Costs			2,000
Consultant Services			-
Computer Services (RCS)			12,872
Communications (Telecom, Network Charges)			12,297
Utilities			7,000
Other			20,900
TOTAL OTHER DIRECT COSTS			**141,462**
TOTAL TUITION			**1,543**
SUBCONTRACTS	included	excluded	
TOTAL SUBCONTRACTS	-	-	**-**
TOTAL DIRECT COSTS			**746,174**
MTDC Method			
MTDC BASE	702,576		
Total Exemptions	43,598		
INDIRECT COSTS	**47.0%**		**330,207**
TOTAL COSTS TO SPONSOR			**1,076,381**

Research
Development &
Administration

Office of Proposal & Award Management

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August 31, 2017

Jan A. Newton, Ph.D.
NANOOS Executive Director
Principle Oceanographer
Applied Physics Laboratory
University of Washington
1013 NE 40th St.
Seattle WA 98105-6698

Re: Letter of Intent to Collaborate

Dear Dr. Newton:

Oregon Health & Science University (OHSU) submits this letter of intent to collaborate for the following sponsored project.

Title:	Sustaining NANOOS, the Pacific Northwest component of the US IOOS
Principal Investigator:	Dr. Jan A. Newton, Applied Physics Laboratory
Subaward P.I.	Dr. Antonio Baptista, OHSU
Sponsor:	NOAA/NOS Coastal Services Center
Period of Performance:	6/1/2017 – 5/31/2018

OHSU is willing to establish a Subaward for this project. OHSU is aware of the Sponsor's grant and contract policies and agrees to administer the subaward in accordance with them.

OHSU's proposed Statement of Work is attached. OHSU's requested funding is $281,000; a detailed budget is also attached.

Please contact the following individuals for additional information regarding this proposal.

Technical Contact:
António M. Baptista, Ph.D.
Phone: 503-346-3418
Fax: 503-346-3427
Email: baptista@ohsu.edu

Administrative Contact:
Valerie Mansur
Grants/Contracts Admin, OPAM
Phone: 503-494-4854
Fax: 503-494-7787
Email: orserv@ohsu.edu
mansurv@ohsu.edu

Sincerely,

Valerie Mansur
Grants & Contracts Administrator

STATEMENT OF WORK

PI: António M. Baptista, Oregon Health & Science University
June 1, 2017-May 31, 2018

Proposed effort: We propose to maintain an established observation and prediction infrastructure for science and societal applications in the Columbia River estuary (SATURN [*Baptista et al.*, 2015]). Support is requested for observations, modeling, data management, and product maintenance, as follows:

Rationale and Justification for continuation of effort

SATURN (including predecessor CORIE) is among the earliest and most comprehensive estuarine observation and prediction systems in the world, and one of the pioneer subsystems of NANOOS and IOOS. Focused on the Columbia River estuary (broadly defined to include riverine and ocean interactions), SATURN has been developed as a "collaboratory" to support both science and science translation to society. Sample accomplishments include:

- Physical observations extending back to 1996 and biogeochemical observations to 2008. These long-term time series are powerful and distinctive witnesses to PNW processes and their variability and change.
- SATURN observations, simulations and products have directly supported multiple multi-institutional science projects, including but not limited to NSF-LMER, NSF-RISE, NSF-CMOP, NOAA-Plume and NOAA-Estuary. NSF-CMOP alone produced over 150 peer-reviewed publications and theses.
- SATURN has helped bridge across stakeholder communities (federal and state agencies, tribes, others) and has provided direct support to major regional decisions, including the Columbia River Channel Improvement Project (CRCIP), the Columbia River Treaty Review, and the Bradwood Landing LNG terminal application. CRCIP exemplifies the multiple ways SATURN serves the region: simulations were used to generate topic-specific consensus among stakeholders during the Re-consultation phase of CRCIP (2001); observations were used to monitor post-construction impacts for almost a decade; and a new generation of simulations were eventually used to generate post-construction consensus about the extent of the impact.

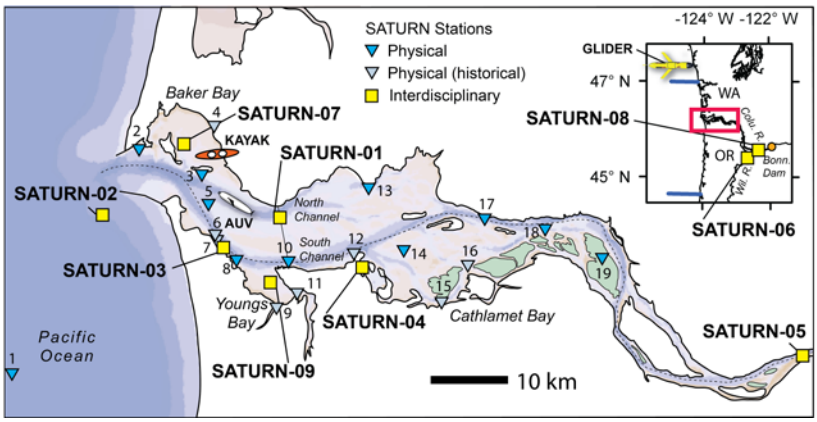
Scope

<u>Task 1a: Observations in the lower estuary and shelf source waters</u> (PI: A.M. Baptista)

- Maintain the network of interdisciplinary endurance stations in the lower estuary and near-plume (SATURN-01, 02, 03, 04, 07 and 09). A seasonal station (SATURN-10) may also be deployed in support of joint NOAA-Corps studies.

Task 1c: Modeling (PI: A.M. Baptista)

- Maintain the daily forecasts of river-to-shelf circulation in the Columbia River
- Maintain the multi-year climatology of river-to-shelf circulation in the Columbia River (aka Climatological Atlas)



Task 1d: Data management and products (PI: A.M. Baptista)

- Maintain the SATURN observational database
- Maintain existing web products for Columbia River stakeholders
- Export sensor and model data to NANOOS
- Contribute to the central NANOOS DMAC cyber-team

De-scoping note

Since 2006, SATURN has been partially funded by NSF through a Science and Technology Center cooperative agreement, which by the nature of STCs is non-renewable beyond June 2017, and began tapering down in July 2014. CMOP, the center created through this agreement, will remain active and multi-institutional beyond July 2017, and will continue to manage SATURN. However, without the core NSF support, SATURN efforts will be de-scoped to remain consistent with available NANOOS and other regional funding. In particular, de-scoping will apply to parts of the proposed Task 1a:

- A network of historical physical endurance stations in the lower estuary will be maintained only on an "as time permits" basis. Interruptions will break a set of long time series approaching climate scale, that offer distinctive insights into the variability and change in the Columbia River estuary and its source waters, and that support model skill assessment for anchoring operational products (e.g., daily forecasts and climatology of circulation).
- No glider deployments will be conducted. This will limit the ability to characterize the sources of shelf water (with implications for modeling and data interpretation), and will eliminate the collaboration with the Quinault Indian Nation to characterize shelf hypoxia.

In addition, the efforts proposed by OHSU investigators Joseph Needoba [Task 1b: Observations in the river source waters], Tawnya Peterson [Task 2: Monitoring phytoplankton assemblages in Oregon estuaries to assess trends in coastal productivity] and Jon Waterhouse [Task 3: Tribal Outreach] will not be funded—as they all required an increase in the NANOOS budget assigned to OHSU.

Reference

Baptista, A. M., C. Seaton, M. Wilkin, S. Riseman, J. A. Needoba, D. Maier, P. J. Turner, T. Kärnä, J. E. Lopez, L. Herfort, V. M. Megler, C. McNeil, B. C. Crump, T. D. Peterson, Y. Spitz & H. M. Simon (2015). Infrastructure for collaborative science and societal applications in the Columbia River estuary. *Frontiers of Earth Science*, 9(4), 659-682.

Oregon Health & Science University
Congressional district OR-001

Antonio Baptista: "Sustaining NANOOS, the Pacific Northwest component of the US IOOS"

Budget Justification

A. PERSONNEL. Salary support is requested for PI Antonio Baptista (0.72 calendar months). Salary support is also requested for two field team specialists (total 16.8 calendar months), one modeling team specialist (1.4 calendar months) and one cyber team specialist (1.9 calendar months).

Salary projections reflect actual, 12-month salary for the year ending June 30, 2017.

B. BENEFITS. Benefit rate for Antonio Baptista, 21%; Michael Wilkin, 34%; Jo Goodman, 35%; Paul Turner, 37% and Charles Seaton, 37%.

C. CAPITAL EQUIPMENT. No funds are requested.

D. OTHER DIRECT COSTS.

1. *Materials and supplies:* The budget includes a total of $28,260 for materials and supplies. These Materials and Supplies are primarily for operating and maintaining the Center's observation network on the Oregon coast, including fabrication, instrument calibration and vessel operation, and secondarily for operating and maintaining computer resources, including maintenance services for hardware and software. We have estimated these expenses based on recent experience in the Center for Coastal Margin Observation & Prediction.
2. *Contracted Services:* No funds are requested.
3. *Domestic Travel:* The budget includes a total of $3,803 for domestic travel. These funds will allow OHSU staff, based in Astoria, OR and in Portland, OR, to attend NANOOS and IOOS meetings in the Pacific Northwest, as well as other regional meetings.
4. *Foreign Travel:* No funds are requested.
5. *Publications:* No funds are requested.
6. *Tuition:* No funds are requested.
7. *Other:* No funds are requested.
8. *Participant Support:* No funds are requested.

9. *Subcontracts:* No funds are requested.

E. INDIRECT COSTS. The Department of Health and Human Services, acting as the cognizant agency of the federal government, approved a facilities and administration (F&A) cost rate agreement for Oregon Health & Science University (OHSU) on March 19, 2015. The Department of Health and Human Services Representative to this agreement is Arif M. Karim, phone 415-437-7820. The Modified Total Direct Costs (MTDC) used for calculating F&A recovery include all project expenditures except capital equipment (>$3,000), subcontract amounts after the first $25,000 and tuition. The F&A rate approved for off-campus research is 26%.

Oregon Health & Science University (OHSU) is a public corporation chartered by the State of Oregon pursuant to Section 353.020 of the Oregon Revised Statutes. OHSU operates under the OMB's Uniform Guidance.

Baptista
NANOOS Year 1
6/1/2017 to 5/31/2018

A. PERSONNEL

SALARIES	
PI Antonio Baptista	15,420
Research Associate Michael Wilkin	58,258
Research Associate Jo Goodman	38,350
Research Associate Charles Seaton	8,930
Research Associate Paul Turner	12,624
TOTAL SALARIES	133,582
BENEFITS	
PI Antonio Baptista	3,186
Research Associate Michael Wilkin	19,644
Research Associate Jo Goodman	13,254
Research Associate Charles Seaton	3,340
Research Associate Paul Turner	4,639
TOTAL BENEFITS	44,063
TOTAL PERSONNEL	177,645

B. CAPITAL EQUIPMENT (> $3000)

Computing infrastructure	0
Laboratory infrastructure	0
TOTAL CAPITAL EQUIPMENT (> $3000)	0

C. OTHER DIRECT COSTS

1. Materials and supplies (incl software)	28,260
2. Contracted services	0
3. Domestic travel	3,803
4. Foreign travel	0
5. Publications	0
6. Tuition	0
7. Other	0
8. Participant Support	0
9. Subcontracts	0
TOTAL OTHER DIRECT COSTS	32,063

TOTAL DIRECT COSTS	209,708

D. INDIRECT COSTS

On-Campus	Modified total direct costs (MTDC)	59,892
	F&A COSTS	32,342
Off-Campus	Modified total direct costs (MTDC)	149,816
	F&A COSTS	38,951

TOTAL COSTS	**281,001**

Oregon
Kate Brown, Governor

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September 12, 2017

Drs. David Martin and Jan Newton
Applied Physics Laboratory
University of Washington
1013 NE 40th St
Seattle, WA 98105-6698

Dear Drs. Martin and Newton:

This is to confirm that for FY2017/18 the Oregon Department of Geology and Mineral Industries (DOGAMI) will continue to participate in the project titled "Enhancing the Regional Coastal Ocean Observing Systems (RCOOS) of the Northwest Association of Networked Ocean Observing Systems (NANOOS)". Specifically, DOGAMI will assist with the following:

1. Undertake late summer (~Aug/Sep), winter (~Dec/Jan), and spring (~Mar/Apr/May) surveys of the Neskowin (15 sites), Rockaway (25 sites) and Clatsop (6 sites) beach monitoring network. Undertake an annual survey, late summer (~Aug/Sep) of the Beverly Beach (15 sites), and Newport (58 sites) beach monitoring network. Undertake Mean Higher High Water (MHHW) tidal based shoreline surveys on the same days as the beach profile measurements are carried out. Budget estimate of $45,000;
2. Disseminate beach state/change data and products among coastal managers and regulatory authorities in appropriate formats through the NANOOS Beaches and Shorelines portal (http://nvs.nanoos.org/BeachMapping); and,
3. Coordinate, organize and chair meetings of the NANOOS User Products Committee (UPC). Work with core Data Management and Communications (DMAC) committee members to facilitate the development and implementation of products identified by coastal and ocean stakeholders (e.g., continued development of Pacific Northwest climatology products, enhancements to the maritime operations and boater web applications, etc.). Participate in NANOOS Governing Council, Principal Investigator, and stakeholder meetings. Budget estimate of $15,000.

Sincerely,

Brad J. Avy
Director and State Geologist

cc: Jonathan Allan, PhD, Coastal Geomorphologist, DOGAMI – Newport Coastal Field Office

Oregon Beach Shoreline Mapping and Analysis Program: Quantifying the short and long-term response of Oregon beaches for Coastal Managers

PI: J.C. Allan

The Oregon Department of Geology and Mineral Industries (DOGAMI), remains a committed partner in the ongoing development of the regional NANOOS RCOOS. The primary objective of our component of the RCOOS will remain focused on maintaining an Oregon beach and shoreline monitoring program (Allan and Hart, 2007a, 2008, Allan and Stimely, 2013), the purpose of which is to document variability in beach and shoreline morphodynamics, information that is important to coastal resource managers. The specific objectives of our study include:

- To provide quantitative information on the morphological response of Oregon beaches at various time scales, including seasonal (due to changes in waves and tides), interannual (e.g. storm-induced, El Niños), and long-term changes (e.g. sea level rise, changes in storm frequency/magnitude, and interdecadal climate shifts such as the Pacific Decadal Oscillation);
- To provide improved knowledge of coastal hazards, particularly the effects of such processes on the patterns and trends of coastal erosion, as well as flooding and inundation effects to properties and infrastructure located adjacent to the coast (e.g. Barnard et al., 2017).
- To contribute to an overall improved understanding of the role of climate variability in controlling the morphodynamics response of beaches along the Oregon coast, to assist coastal resource managers with important decisions related to management of the coast (e.g. Barnard et al., 2017).

Established in 2004, the Oregon Beach Shoreline Mapping and Analysis Program (OBSMAP) presently consists of 674 beach and shoreline monitoring sites established along the length of the Oregon coast. Of these, 178 sites are supported through NANOOS, while the remaining sites were established for the purposes of the Federal Emergency Management Association (FEMA) coastal flood hazard inundation mapping (e.g. Allan et al., 2015), Snowy Plover dune restoration (USFWS), landslide changes (ODOT/FHWA), erosion control and engineering design at the mouth of the Columbia River (USACE) and at the Hatfield Marine Science Center in Newport (OSU). None of these monitoring sites would have been made possible without the initial implementation of an RCOOS in the NANOOS region. Monitoring of the beach sites is accomplished using Real-Time Kinematic Differential Global Positioning System (RTK-DGPS), with a precision of ~±2 cm and survey mapping accuracies of ~±4-6 cm (Allan and Stimely, 2013). RTK-DGPS allows DOGAMI scientists to mount the GPS on a backpack worn by a mapper, locate it atop of an ATV vehicle in order to undertake detailed topographic measurements, or on a personal watercraft to collect bathymetric data offshore the coast. These data, served through the NANOOS Visualization System beach mapping portal (http://nvs.nanoos.org/BeachMapping), are of considerable interest to state and federal agencies to assist with coastal resource management (e.g. the Oregon Department of Land Conservation and Development (planning), the Oregon Parks and Recreation Department (permitting of coastal engineering structures)), the City of Cannon Beach (dune management), coastal geotechnical consultants (e.g. Ashcreek & Associates, HG Schlicker for site-specific geologic investigations), federal agencies such as FEMA for coastal flood inundation and erosion mapping, and the public at large (e.g. erosion responses in the communities of Neskowin and Rockaway have led to a greater demand for information about what is happening).

With support from NANOOS, DOGAMI has been tasked with three roles:

1. Undertake late summer (~Aug/Sep), winter (~Dec/Jan), and spring (~Mar/Apr/May) surveys of the Neskowin (15 sites), Rockaway (25 sites) and Clatsop (6 sites) beach monitoring network. Undertake an annual survey, late summer (~Aug/Sep) of the Beverly Beach (15 sites), and Newport (58 sites) beach monitoring network. Undertake Mean Higher High Water (MHHW) tidal based shoreline surveys on the same days as the beach profile measurements are carried out. Budget estimate of $45,000;

2. Disseminate beach state/change data and products among coastal managers and regulatory authorities in appropriate formats through the NANOOS Beaches and Shorelines portal (http://nvs.nanoos.org/BeachMapping); and,
3. Coordinate, organize and chair meetings of the NANOOS User Products Committee (UPC). Work with core Data Management and Communications (DMAC) committee members to facilitate the development and implementation of products identified by coastal and ocean stakeholders (e.g., continued development of Pacific Northwest climatology products, enhancements to the maritime operations and boater web applications, etc.). Participate in NANOOS Governing Council, Principal Investigator, and stakeholder meetings. Budget estimate of $15,000.

References

Allan, J.C. and Hart, R., 2007. Assessing the temporal and spatial variability of coastal change in the Neskowin littoral cell: Developing a comprehensive monitoring program for Oregon beaches Portland, Oregon: Oregon Department of Geology and Mineral Industries Open-file-report O-07-01, 27p.

Allan, J.C. and Hart, R., 2008. Oregon beach and shoreline mapping and analysis program: 2007-2008 beach monitoring report. Portland: Oregon Department of Geology and Mineral Industries Open file report O-08-15, 60p.

Allan, J.C. and Stimely, L., 2013. Oregon Beach Shoreline Mapping and Analysis Program: Quantifying Short to Long-term Beach and Shoreline Changes in the Gold Beach, Nesika, and Netarts Littoral Cells. Portland, Oregon: Oregon Department of Geology and Mineral Industries O-13-07, 46p.

Allan, J. C., Ruggiero, P., Garcia, G., O'Brien, F., Stimely, L., and Roberts, J. T., 2015. Coastal Flood Hazard Study, Tillamook County, Oregon. Oregon Department of Geology and Mineral Industries, Portland, Oregon. Special Paper 47, 283 pp.

Barnard, P. L., Hoover, D., Hubbard, D. M., Snyder, A., Ludka, B. C., Allan, J., Kaminsky, G. M., Ruggiero, P., Gallien, T. W., Gabel, L., McCandless, D., Weiner, H. M., Cohn, N., Anderson, D. L., and Serafin, K. A.: Extreme oceanographic forcing and coastal response due to the 2015-16 El Niño, Nature Communications, 8, 2017.

Oregon Beach Shoreline Mapping and Analysis Program: Quantifying the short and long-term response of Oregon beaches for Coastal Managers

PI: J.C. Allan

Budget:

Core Budget	**Amount**
Includes all core activities required to maintain the OBSMAP program.	
PERSONNEL	
J. Allan – Coordinate & undertake field surveys, data reduction & analysis, and reporting (9 weeks).	$ 14,395
L. Stimely - Field assistant (2 weeks)	$ 2,622
F. O'Brien - Field assistant (2 weeks)	$ 2,334
J. Allan – NANOOS UPC Chair. (4 weeks)	$6,625
Personnel sub-total	**$ 25,976**
Other Payroll Expenses (53% of salary)	**$13,767**
Total Personnel	**$39,743**
TRAVEL	
- Per diem, fieldwork (2 people, $91/night lodging & $51 M&IE, 16 days)	$ 4,544
- Per diem, PI meeting ($169/night lodging & $64 M&IE, 2 days)	$ 466
- Per diem, UPC & GC meetings ($205/night lodging & $74 M&IE, 6 days)	$ 1,674
Total Travel	**$ 6,684**
MISCELLANEOUS COSTS	
- GPS equipment/ ATV maintenance.	$ 1,236.5
- NANOOS UPC supplies	$ 141
Total Miscellaneous	**$ 1,378**
TOTAL DIRECT COSTS	**$ 47,805**
INDIRECT COSTS (25.51%)	**$ 12,195**
TOTAL	**$ 60,000**

Budget Justification:

Personnel / Salaries: For Task 1, PI Allan requests 8.8 weeks/yr salary to undertake project management, GPS surveys of the beach monitoring sites, data reduction and analyses, and reporting. PI Allan also requests 2 weeks/yr salary support for a Geol-2 and NRS-2 DOGAMI staff member to assist with field surveys. For Task 2, PI Allan requests 4.1 weeks/yr salary support as NANOOS User Products chair in order to facilitate UPC/DMAC/E&O meetings, data analyses (e.g. climatology products) and product development and testing. Fringe benefits are calculated at 53% of the base salary. The rate includes components for employee benefits, provisions for applicable cost of living increases and range adjustments in accordance with Oregon Department of Geology policy.

Travel: Considerable time will be spent in the field travelling to coastal field sites. For Task 1, the budget request includes in-state travel support for 2 people for a total of 16 days each. Travel costs are based on the following costs: $91/night lodging, $51/day food. Additional travel support is requested for PI Allan to attend NANOOS meetings, which is calculated at $169/night lodging, $64/day food for two days. The total travel budget request for Task 1 is $5,010. For Task 2, the budget request includes travel support to enable PI Allan to participate in NANOOS

DMAC/UPC/E&O, Governing Council and PI meetings. The travel budget request for Task 2 is $1,674, with a combined total for travel of $6,684.

Equipment and Supplies: DOGAMI is requesting funding to support field operations. This includes general field supplies, Matlab software maintenance and ATV maintenance ($1237) for Task 1, and general supplies ($141) for Task 2. The total funding requested to support field operations is $1378.

Indirect Costs: A fixed carry forward rate is negotiated with the United States Department of the Interior annually. The current rate is currently under negotiations in the amount of 25.51% and is applied to all direct costs. Indirect charges requested for this project amount to $12,195.

DOGAMI is requesting $60,000 in funding support for Tasks 1 and 2.

Oregon
John A. Kitzhaber, MD, Governor

Department of State Lands
South Slough National Estuarine
Research Reserve
P.O. Box 5417
61907 Seven Devils Road
Charleston, Oregon 97420
(541) 888-5558
FAX (541) 888-5559
www.southsloughestuary.org

September 6, 2017

Dr. Jan Newton, NANOOS Executive Director
Applied Physics Laboratory
University of Washington
1013 NE 40th St
Seattle, WA 98105-6698

Dear Dr. Newton:

The South Slough National Estuarine Research Reserve (SSNERR) is pleased to participate in the collaborative work generated by the Northwest Association of Networked Ocean Observing Systems (NANOOS) to contribute to estuarine observing activities.

The Oregon Department of State Lands (ODSL)/SSNERR propose to continue to maintain and operate a network of four water quality monitoring stations along with one meteorological station located within the South Slough estuary, and collaborate with the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians (CTCLUSI) to co-manage a water quality station in the Coos estuary.

Four of the water quality stations (Charleston Bridge, Valino Island, Winchester Creek, Elliot Creek) and the meteorological station (Tom's Creek Marsh) are operated in cooperation between NANOOS and the NERR System-Wide Monitoring Program (NERR SWMP), and the North Spit station is collaboratively managed by CTCLUSI/SSNERR/NANOOS. The water quality stations are equipped with YSI multi-parameter data loggers that record measurements every 15 minutes of water temperature, conductivity/salinity, dissolved oxygen, pH, turbidity, and water depth. Currently, all stations are equipped with telemetry systems, data are routed through the Geostationary Observational Environmental Satellite System (GOES), and data streams are available through the NANOOS Visualization System and the NERRS Centralized Data Management Office. The data telemetry capabilities of GOES are available to the SSNERR as part of their partnership with NOAA.

New funds provided by NANOOS ($30,000) in 2017 will enable the Reserve to repair, maintain, install, and operate the network of estuarine monitoring stations.

We look forward to the opportunity to continue to participate as a member of the NANOOS team and to provide relevant information and deliver data products to our coastal stakeholders.

With best regards,

Bree Yednock, Acting Manager South Slough NERR

NANOOS FY2017 Subcontract ODSL/SSNERR
Oregon Department of State Lands/ South Slough National Estuarine Research Reserve
09/06/2017

Statement of Work**:**

As a participant in the collaborative Northwest Association of Networked Ocean Observing Systems (NANOOS) program, the Oregon Department of State Lands / South Slough National Estuarine Research Reserve (ODSL/SSNERR) shall operate and maintain a network of five water quality monitoring stations and one meteorological station. This network currently includes five South Slough SWMP stations and one Coos estuary water quality station. We cooperate with one of our local tribes to install and maintain telemetry equipment on one of their established water quality stations in the Coos estuary.

Four water quality stations and one meteorological station are located within the South Slough estuary (Charleston Bridge, soschwq; Valino Island, sosvawq; Winchester Creek, soswiwq, Elliot Creek, sosecwq, and Tom's Creek marsh, sostcmet), the fifth water quality station (North Spit, sosnswq) is located in the lower Coos estuary. Each moored station is equipped with a Yellow Springs Instrument multi parameter EXO data logger, and there are telemetry systems at all six of these stations. Measurements are recorded every 15 minutes for the following parameters: water temperature, conductivity, salinity, dissolved oxygen, pH, turbidity, and water depth; three stations will also collect chlorophyll by the end of the five year award. The stations are located near oyster growing areas in the South Slough estuary (Charleston Bridge, Valino, Elliot Creek).

New funds provided by NANOOS ($30,000) will enable the South Slough NERR to 1) maintain operation of the existing network of estuarine water quality monitoring stations and one meteorological station over the period of the project, 2) partner with the Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians (CTCLUSI) to maintain telemetry equipment on their existing North Spit BLM water quality station.

Specific expenses associated with operation of the monitoring stations include purchase of replacement and new water quality sensors, telemetry system components, and calibration solutions for the sensors. Funding provided by NANOOS will enable the South Slough NERR to continue to provide near real-time measurements of the ambient estuarine water parameters to several web-based data access portals including the NANOOS Visualization System (NVS), the NERRS Centralized Data Management Office (CDMO), and the NOAA Hydrometeorological Automated Data System (HADS).

Subcontract Budget:

South Slough Estuary Observations	Maintain South Slough moorings; Collaborate with tribes to maintain lower Coos estuary station	
Equipment	**Item Description**	**2017**
Sondes/ Sensors	Replacement pH module	(13) $2,210.00
	Replacement DO caps	(13) $2,015.00
	Turbidity Sensor	$1800.00
	Chlorophyll Sensor	(2) $6,760.00
	Replacement wiper brushes	(13) $715.00
	Sonde guard	$880.00
	Copper Tape	(4) $280.00
	Batteries, D cell	$480.00
Subtotal		$15,140.00
Telemetry	Satlink Transmitter	$2,800.00
	SDI12 Signal Adapter	$295.00
	Sonde to DCP Cable	$470.00
	V2th Satellite Antenna	$325.00
	V2th Antenna Mount	$135.00
	Fiberglass Enclosure	$205.50
	Aluminum backpanel	$33.15
	Lightning Protection Kit	$399.00
	Solar panel	$100.00
	Charge Controller	$50.00
	12 V battery	$100.00
	Platform hardware/supplies	$2,459.35
Subtotal		$7,372.00
Calibration Solutions	Conductivity standard	(12)$1,488.00
	pH 7 standard	(12) $960.00
	pH 10 standard	(12) $960.00
	Turbidity standard	(12)$4,080.00
Subtotal		$7,488.00
Totals		**$30,000.00**

Budget Justification:

The Yellow Springs Instruments, Inc. (YSI) EXO2 data logger is the new version of the water quality sonde instrument that is approved for the National Estuarine Research Reserve System as a component of their participation in the System-Wide Monitoring Program (SWMP). YSI supplies the existing water quality instruments used by SWMP to ensure program-wide uniformity in equipment, data parameter specifications, and data file format. YSI, and thus the NERRS, have transitioned to the EXO series instruments.

The YSI EXO series data loggers will be equipped with an array of water quality sensors to measure water temperature, specific conductivity/salinity, dissolved oxygen, pH, turbidity, water depth, and chlorophyll at a subset of stations. Each instrument also has a centrally located anti-fouling wiper/brush sensor. Funds requested here will allow the Reserve to use equipment that accommodates optical sensor arrays (dissolved oxygen, turbidity), purchase calibration standard solutions for each of the sensors for monthly calibrations, directly interchange equipment during monthly deployment and retrievals, complete field verification quality assurance/quality control protocols with an EXO sonde instrument, and replace malfunctioning equipment. The dissolved oxygen, pH, and wiper sensors have replaceable modules, caps, or brushes that are exchanged approximately annually or during malfunction of the sensor, instead of replacing the entire sensor body itself. Additional items include sonde guards that protect the sensors during field deployment, copper tape for anti-fouling protection of the sensors, and internal D-cell batteries that power the sonde instruments.

The telemetry system components allow seamless and cost-free data stream telemetry via the GOES satellite system. Telemetry system components specifically requested here are for replacing aging equipment at one station (Valino Island;l sosvawq). Communication components that will be installed include the Satlink Transmitter and antenna/mount for data transmission, SDI-12 Signal Output Adapter (SOA) to convert the EXO RS-485 to SDI-12, and the sonde to Data Collection Platform (DCP) cable to connect the instrument to the transmitter. The remaining equipment are associated with powering and protecting the real-time mooring platforms, including solar panels, charge regulator, batteries, lightning protection system, waterproof enclosures/panel, and mooring hardware and supplies for securing the equipment and platform for long-term data collection. The platform hardware and supplies include Acrylonitrile Butadiene Styrene (ABS) pipe, stainless steel fittings, locks, mounts, nylon straps, and strapping related tools.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

September 12, 2017

David Martin, NANOOS President
Jan Newton, Executive Director Applied Physics Laboratory
University of Washington
1013 NE 40th Street
Seattle, WA 98105-6698

Dear David and Jan:

This letter is to provide our statement of work and corresponding budget for participation during the period June 1, 2017 to May 31, 2018 of the Northwest Association of Networked Ocean Observing Systems (NANOOS) Regional Coastal Ocean Observing Systems (RCOOS).

The Washington State Department of Ecology (Ecology) has made estuarine observations directed by Ecology's Environmental Assessment Program (EAP) and conducted shoreline and beach monitoring by Ecology's Shorelands and Environmental Assistance (SEA) Program under the NANOOS Pilot and the past eight years of grants. Work under this grant will be conducted separately by these two programs and they are combined in this letter of commitment related to Fiscal Year 2017 of NANOOS funding. The scope of work, budget, and budget justification follows.

Scope of Work

Estuarine Observations (Environmental Assessment Program)

EAP will focus our NANOOS support on helping to maintain our collaborative ferry monitoring project with Clipper Navigations, Inc.

Ecology currently has several sensors and a data logging system installed on the Victoria Clipper IV ferry. Funding for the upcoming period ($30,000) will support 25% of one environmental specialist position, critically important for servicing the water quality sensors on the ferry. Funding will also partially cover IT support for data flow.

This public-private partnership has been very successful and is extremely cost-effective, saving the cost of expensive ship time. We collect continuous surface data as the ferry makes its twice daily runs between Seattle, WA and Victoria, BC, Canada. This data has been valuable in looking at the timing and spatial extent of blooms in Puget Sound, and the movement of water masses and river plumes, which we report on in our monthly surface condition report, Eyes Over Puget Sound. Recently, the Victoria Clipper ferry data has been useful for tracking the unusually warm water in Puget Sound.

By leveraging some one-time support from EPA's National Estuary Program (NEP) grant program, we improved data flow and telemetry and defined a data calibration/Quality Assurance strategy. EAP is currently providing the majority of funds for monthly data flow and trouble-shooting. Additional funding would allow us to create daily products to report near real-time surface features in Puget Sound as well as use the data to calibrate satellite images. However, current funding does not allow us to develop these products, nor can we respond promptly to technical problems with data acquisition or telemetry. Our ferry monitoring program is at risk, due to the fact that the agency currently does not have plans to support a the full-time ferry monitoring technician position; only 0.25 FTE is supported with NANOOS funds.

Shoreline and Beach Monitoring (Shorelands and Environmental Assistance Program)

With funding of $60,000, Ecology will maintain a reduced-level beach and shoreline monitoring effort in the Columbia River littoral cell. The beach monitoring program requires the support of a two field project scientists/technicians. NANOOS funds only support approximately 30% of specialist and 15% of a scientist plus a portion of operations and expenses. Thus, other project grants are required to fund the remainder of the salaries and indirect costs plus additional operating expenses in order to implement the monitoring program. With leveraging of additional funds, the NANOOS budget enables implementation of data collection, processing, and archiving.

With base-level NANOOS funding, we have reduced our beach surface mapping from 16 sites during both summer and winter and three sites during fall and spring, to only 15 sites during summer and five sites during winter. This allows us to maintain an annual time series, but does not provide the previous capability to assess regional gradients in beach response to winter conditions, particularly El Niño signatures that have accentuated asymmetric seasonal forcing. Products to be developed and delivered include: digital data, time-series of cross-shore beach profiles, beach surface and contour change, and operational support of the Coastal Profiling System (CPS) through collaboration with Oregon State University.

Although NANOOS funding has remained essentially flat since over the past nine years while operating costs have increased, we have been fortunate to leverage support from other organizations that benefit from our beach monitoring program. We have been able to monitor in Puget Sound (e.g., Elwha River mouth), and have been able to increase our surveying capabilities using our 28' twin-hull vessel (beach-landing craft) designed for hydrographic and topographic surveying. We previously collaborated with Washington Sea Grant, National Park Service, Quinault Indian Nation, and the Quileute Tribe on establishing monuments and collecting initial beach profiles along the Olympic Peninsula. These efforts demonstrate the potential to expand the beach monitoring program beyond the southwest Washington coast to serve the needs of more communities throughout the state. Unfortunately, opportunities to acquire funds for sustained monitoring from other sources are extremely limited.

We look forward to working with the entire NANOOS team over the next year building a broader support for our collective efforts. We appreciate the continued collaboration with NANOOS.

Thank you,

Carol Smith
Environmental Assessment Program Manager

Enclosures

cc: Gary Koshi, EAP Budget Planner, Ecology
Dale Norton, Western Operations Section Manager, Ecology
Carol Maloy, EAP Marine Monitoring Unit Supervisor, Ecology
George M. Kaminsky, SEA Senior Coastal Engineer, Ecology

Fiscal Year 17 Budget

Washington State Department of Ecology

	WA Beach Monitoring	WA Estuarine Observations
Staff		
FTE Staff	6.0 months	3.0 months
Salaries and Wages	$27,757	$13,870
Employee Benefits	$11,226	$5,767
Indirect (29.35%)	$11,441	$5,763
Staff Sub-Total	***$50,424***	***$25,400***
Operating Expenses		
G&S	$0	$4,600
Travel	$5,800	$0
Supplies	$3,776	$0
Equipment	$0	$0
O&M Sub-Total	***$9,576***	***$4,600***
Total Annual Cost	***$60,000***	***$30,000***

TOTAL Combined Cost = $90,000

Fiscal Year 17 Budget Justification

Washington State Department of Ecology

A total of $90,000 is requested for the Washington State Department of Ecology for the period June 1, 2017 to May 31, 2018. This includes $60,000 for WA Beach Monitoring [Shorelands and Environmental Assistance (SEA) Program] and the Coastal Monitoring & Analysis Program (CMAP) for Shoreline and Beach Monitoring, as well as $30,000 for WA Estuarine Observations [Environmental Assessment Program (EAP)].

Costs include:

Section A: Salaries
Senior Personnel
Carol Maloy (Marine Monitoring Unit Supervisor, EAP), PI, will provide overall leadership on the Estuarine Observation components of this project as in-kind service, overseeing all phases of the project. Carol Maloy will also lead coordination and collaboration with other NANOOS partners and beneficiaries.

George Kaminsky (Coastal Engineer, SEA), Principal Investigator (PI), will provide overall leadership on Shoreline and Beach Monitoring components of this project. Dr. Kaminsky will contribute approximately five months to this project as in-kind service, overseeing all phases of the project and assisting with field-data collection, analysis, data assimilation, product generation, incorporation into local decision-making. Dr. Kaminsky will also coordinate and collaborate with other NANOOS partners and beneficiaries.

Other Personnel
Other EAP staff will provide field-data collection, processing, analysis, and product generation support. Suzan Pool (Environmental Specialist 3) will charge approximately 3.0 months to the project.

Other SEA Program staff will provide field data collection, processing, analysis, and product generation support. Diana McCandless (Environmental Specialist 3) and Heather Weiner (Natural Resource Scientist 3) will charge approximately 4.0 and 2.0 months, respectively to the project associated with collecting and processing topographic and bathymetric data.

Salaries are paid in accordance with Washington State Employee Salary Schedule (McCandless- $4,623/month, Weiner- $5,001/month, intern-$11.00/hour, Pool- $4,623/month), plus 2% anticipated increases each year.

Section B: Employee Benefits
The Washington State Department of Ecology benefit rate is dependent on salary level and is approximately 33-45% for the above positions.

Section C: Equipment
None.

Section D. Travel
Travel Requested includes approximately 25 days for two staff at an average per diem rate of approximately $116.00 per day.

Sections E and F: Other Direct Costs
Costs include $4,600 for IT support, and annual maintenance and troubleshooting related to data flow from the Victoria Clipper ferry. This will be conducted via a contract with UW Applied Physics Laboratory.

Materials and Supplies:
Costs for consumables and replacement field surveying supplies are estimated at $3,776 based on prior experience.

Section H: Indirect costs
Washington Department of Ecology negotiated indirect rate is set for each fiscal year. The rate for Fiscal Year 17 is 29.35% of Salaries and Benefits (28.6% for June 2017 only, 29.35% starting July 1, 2017).

COLLEGES AND UNIVERSITIES RATE AGREEMENT

EIN: 916001537

DATE:07/21/2017

ORGANIZATION:

University of Washington
Management Accounting and Analysis
4300 Roosevelt Way NE, Suite 300
Box 354966
Seattle, WA 98195-4966

FILING REF.: The preceding agreement was dated 05/26/2016

The rates approved in this agreement are for use on grants, contracts and other agreements with the Federal Government, subject to the conditions in Section III.

SECTION I: INDIRECT COST RATES

RATE TYPES: FIXED FINAL PROV. (PROVISIONAL) PRED. (PREDETERMINED)

	EFFECTIVE PERIOD				
TYPE	FROM	TO	RATE(%)	LOCATION	APPLICABLE TO
FINAL	07/01/2014	06/30/2015	54.50	(1) & (A)	Organized Research
PRED.	07/01/2015	06/30/2017	54.50	(1) & (A)	Organized Research
PRED.	07/01/2017	06/30/2018	55.00	(1) & (A)	Organized Research
PRED.	07/01/2018	06/30/2020	55.50	(1) & (A)	Organized Research
FINAL	07/01/2014	06/30/2015	26.00	(1) & (B)	Organized Research
PRED.	07/01/2015	06/30/2020	26.00	(1) & (B)	Organized Research
FINAL	07/01/2014	06/30/2015	53.00	(1) & (A)	Instruction
PRED.	07/01/2015	06/30/2020	53.00	(1) & (A)	Instruction
FINAL	07/01/2014	06/30/2015	26.00	(1) & (B)	Instruction
PRED.	07/01/2015	06/30/2020	26.00	(1) & (B)	Instruction
FINAL	07/01/2014	06/30/2015	33.80	(1) & (A)	Other Sponsored Activities
PRED.	07/01/2015	06/30/2016	33.80	(1) & (A)	Other Spon Act

ORGANIZATION: University of Washington Management Accounting and Analysis

AGREEMENT DATE: 7/21/2017

TYPE	FROM	TO	RATE(%)	LOCATION	APPLICABLE TO
PRED.	07/01/2016	06/30/2020	37.00	(1) & (A)	Other Sponsored Activities
FINAL	07/01/2014	06/30/2015	26.00	(1) & (B)	Other Spon Act
PRED.	07/01/2015	06/30/2016	26.00	(1) & (B)	Other Sponsored Activities
PRED.	07/01/2016	06/30/2020	25.00	(1) & (B)	Other Spon Act
FINAL	07/01/2014	06/30/2015	42.00	(1) & (C)	Core Grant
PRED.	07/01/2015	06/30/2016	42.00	(1) & (C)	Core Grant
PRED.	07/01/2016	06/30/2020	38.10	(1) & (C)	Core Grant
FINAL	07/01/2014	06/30/2015	78.00	(1) & (C)	Non-Core Fed
PRED.	07/01/2015	06/30/2016	78.00	(1) & (C)	Non-Core Fed
PRED.	07/01/2016	06/30/2020	83.10	(1) & (C)	Non-Core Fed
FINAL	07/01/2014	06/30/2015	17.00	(1) & (D)	
PRED.	07/01/2015	06/30/2016	17.00	(1) & (D)	
PRED.	07/01/2016	06/30/2020	19.00	(1) & (D)	
FINAL	07/01/2014	06/30/2015	25.00	(2) & (E)	
PRED.	07/01/2015	06/30/2020	25.00	(2) & (E)	
FINAL	07/01/2014	06/30/2015	74.00	(1) & (F)	Organized Research
PRED.	07/01/2015	06/30/2016	74.00	(1) & (F)	Organized Research
PRED.	07/01/2016	06/30/2017	75.00	(1) & (F)	Organized Research
PRED.	07/01/2017	06/30/2019	76.00	(1) & (F)	Organized Research
PRED.	07/01/2019	06/30/2020	76.50	(1) & (F)	Organized Research
PROV.	07/01/2020	Until Amended		(G)	

*BASE

(1) Modified total direct costs, consisting of all direct salaries and wages, applicable fringe benefits, materials and supplies, services, travel and up to the first $25,000 of each subaward (regardless of the period of performance of the subawards under the award). Modified total direct costs shall exclude equipment, capital expenditures, charges for patient care, rental costs, tuition remission, scholarships and fellowships, and the portion of each subaward in excess of $25,000.

(2) Direct salaries and wages including vacation, holiday and sick pay and other paid absences but excluding other fringe benefits.

(A) On-Campus
(B) Off-Campus
(C) Washington National Primate Research Center - see Section II Special Remarks.
(D) Applied Physics Laboratory
(E) Vessel Operations
(F) Lake Union Campus

(G) Use same rates and conditions as those cited for fiscal year ending June 30, 2020.

ORGANIZATION: University of Washington Management Accounting and Analysis

AGREEMENT DATE: 7/21/2017

SECTION I: FRINGE BENEFIT RATES**

TYPE	FROM	TO	RATE(%)	LOCATION	APPLICABLE TO
FIXED	7/1/2016	6/30/2017	25.30	(1) & (B)	Faculty & Res. Assoc.
FIXED	7/1/2016	6/30/2017	30.00	(1) & (A)	Medical Residents & Senior Fellows
FIXED	7/1/2016	6/30/2017	17.00	(1) & (A)	Grad. Students
FIXED	7/1/2016	6/30/2017	17.00	(1) & (A)	Post Doc. Trainees
FIXED	7/1/2016	6/30/2017	37.90	(1) & (B)	Class. Staff
FIXED	7/1/2016	6/30/2017	32.40	(1) & (B)	Prof. Staff
FIXED	7/1/2016	6/30/2017	19.60	(1) & (B)	(D)
FIXED	7/1/2016	6/30/2017	21.60	(1) & (B)	(E)
FIXED	7/1/2016	6/30/2017	8.80	(1) & (B)	(F)
FIXED	7/1/2016	6/30/2017	17.90	(1) & (A)	Hourly
FIXED	7/1/2016	6/30/2017	26.40	(1) & (A)	Pre-Doctoral Trainees & Fellows
FIXED	7/1/2016	6/30/2017	76.70	(2) & (C)	Class. Staff
FIXED	7/1/2016	6/30/2017	61.30	(2) & (C)	Prof. Staff
FIXED	7/1/2016	6/30/2017	46.10	(2) & (C)	Faculty & Research Associates
FIXED	7/1/2017	6/30/2018	24.90	(1) & (B)	Faculty & Res. Assoc.
FIXED	7/1/2017	6/30/2018	30.50	(1) & (A)	Medical Residents & Senior Fellows
FIXED	7/1/2017	6/30/2018	18.40	(1) & (A)	Grad. Students
FIXED	7/1/2017	6/30/2018	15.20	(1) & (A)	Post Doc. Trainees
FIXED	7/1/2017	6/30/2018	40.10	(1) & (B)	Class. Staff
FIXED	7/1/2017	6/30/2018	32.50	(1) & (B)	Prof. Staff
FIXED	7/1/2017	6/30/2018	19.40	(1) & (B)	(D)
FIXED	7/1/2017	6/30/2018	21.70	(1) & (B)	(E)
FIXED	7/1/2017	6/30/2018	8.60	(1) & (B)	(F)

ORGANIZATION: University of Washington Management Accounting and Analysis

AGREEMENT DATE: 7/21/2017

FIXED	7/1/2017	6/30/2018	20.70 (1) & (A)	Hourly
FIXED	7/1/2017	6/30/2018	27.60 (1) & (A)	Pre-Doctoral Trainees & Fellows
FIXED	7/1/2017	6/30/2018	68.20 (2) & (C)	Class. Staff
FIXED	7/1/2017	6/30/2018	54.70 (2) & (C)	Prof. Staff
FIXED	7/1/2017	6/30/2018	29.40 (2) & (C)	Faculty & Research Associates

** DESCRIPTION OF FRINGE BENEFITS RATE BASE:

(1) Direct salaries and wages including vacation, holiday, and sick pay but excluding other fringe benefits.

(2) Direct salaries and wages excluding vacation, sick leave, holidays, other paid absences and all other fringe benefits.

(A) Entire University
(B) All except Applied Physics Laboratory
(C) Applied Physics Laboratory
(D) Professional Staff - Global (No Health)
(E) Professional Staff - Global (No Retirement)
(F) Professional Staff - Global (No Health or Retirement)

SECTION II: SPECIAL REMARKS

TREATMENT OF FRINGE BENEFITS:

The fringe benefits are charged using the rate(s) listed in the Fringe Benefits Section of this Agreement. The following fringe benefits are included in the fringe benefit rate(s):
HEALTH INSURANCE, SOCIAL SECURITY & MEDICARE TAXES, WORKERS COMPENSATION, MEDICAL AID & INDUSTRIAL INSURANCE, UWRP, STATE RETIREMENT, UNEMPLOYMENT COMPENSATION, AND SEPARATION LEAVE PAYMENTS FOR CLASSIFIED & PROFESSIONAL STAFF.

TREATMENT OF PAID ABSENCES

Vacation, holiday, sick leave pay and other paid absences are included in salaries and wages and are claimed on grants, contracts and other agreements as part of the normal cost for salaries and wages. Separate claims are not made for the cost of these paid absences. Beginning July 1, 2011, unused leave payments made upon separation of Classified and Professional Staff are included in the fringe benefit rates.

Beginning October 1, 1996 the Applied Physics Laboratory (APL) has separate fringe benefit rates from the remainder of the University of Washington. These rates include paid absences. Therefore, charges for direct salaries and wages from APL must exclude charges for paid absences, including vacation, sick leave, holidays, and other paid absences.

DEFINITION OF EQUIPMENT
Prior to 07/01/2016, equipment is defined as tangible nonexpendable personal property having a useful life of more than one year, and an acquisition cost of $2,000 or more per unit. Effective 07/01/2016, equipment is defined as tangible nonexpendable personal property having a useful life of more than one year, and an acquisition cost of $5,000 or more per unit.

DEFINITION OF ON-CAMPUS, OFF-CAMPUS AND SPECIAL RATES:
DEFINITION OF OFF-CAMPUS RATE
a. An off-campus program is one that is conducted (1) in leased facilities where space related costs (e.g. rent, utilities and maintenance) are charged directly to the program, or (2) in facilities made available (at no cost) to the program by a non-University organization, or (3) away from the University over an uninterrupted period of time in excess of 30 days for field work. The Off-Campus rate is not to be used as a substitute for the Vessel Operations rate or the Applied Physics Laboratory rate. Even though Pack Forest, Big Beef Creek, and Olympic Natural Resource Center are owned and operated by the University, these facilities are considered to be off campus.

b. Projects conducted at two or more locations:
There are instances where a project supported by a single grant or contract is conducted at two or more locations, thus requiring special consideration

in determining the appropriate indirect cost provision. The following should be observed in such circumstances:

(1) Where the total annual amount of the grant or contract direct costs is less than $250,000, a single indirect cost rate will be applied. This rate will be the one currently applicable to the location where the preponderance of project salaries is located.

(2) Where the total annual amount of the grant or contract direct costs is $250,000 or more, the appropriate rate for each location will be applied to the modified total direct costs specifically assigned to the respective location. In the absence of the institution's ability to specifically identify and assign costs to each location, the appropriate rate for each location will be applied to total project costs in the same ratio as direct salary costs incurred at each location during the period covered by the project billing or accounting.

PRIMATE CENTER RATES:
The Washington National Primate Research Center (WNPRC) has two Federally recognized rates for each time period. The NIH Office of the Director Primate Research Center (P51) Core Grant rate is 42.0% for 07/01/14 - 06/30/16. The NIH Office of the Director Primate Research Center (P51) Core Grant rate is 38.1% for 07/01/16 - 06/30/20. The Non-Core Federal Rate of 78.0% for 07/01/14 - 06/30/16 is the sum of the Core Grant (42.0%) and the WNPRC specific F&A expenditures (36.0%). The Non-Core Federal Rate of 83.1% for 07/01/16 - 06/30/20 is the sum of the Core Grant (38.1%) and the WNPRC specific F&A expenditures (45.0%).

This rate agreement updates the fringe benefits only.

NEXT PROPOSAL DUE DATE
A fringe benefit rates proposal based on actual costs for fiscal year ending June 30, 2017 will be due no later than December 31, 2017.

SECTION III: GENERAL

A. LIMITATIONS:

The rates in this Agreement are subject to any statutory or administrative limitations and apply to a given grant, contract or other agreement only to the extent that funds are available. Acceptance of the rates is subject to the following conditions: (1) Only costs incurred by the organization were included in its facilities and administrative cost pools as finally accepted: such costs are legal obligations of the organization and are allowable under the governing cost principles; (2) The same costs that have been treated as facilities and administrative costs are not claimed as direct costs; (3) Similar types of costs have been accorded consistent accounting treatment; and (4) The information provided by the organization which was used to establish the rates is not later found to be materially incomplete or inaccurate by the Federal Government. In such situations the rate(s) would be subject to renegotiation at the discretion of the Federal Government.

B. ACCOUNTING CHANGES:

This Agreement is based on the accounting system purported by the organization to be in effect during the Agreement period. Changes to the method of accounting for costs which affect the amount of reimbursement resulting from the use of this Agreement require prior approval of the authorized representative of the cognizant agency. Such changes include, but are not limited to, changes in the charging of a particular type of cost from facilities and administrative to direct. Failure to obtain approval may result in cost disallowances.

C. FIXED RATES:

If a fixed rate is in this Agreement, it is based on an estimate of the costs for the period covered by the rate. When the actual costs for this period are determined, an adjustment will be made to a rate of a future year(s) to compensate for the difference between the costs used to establish the fixed rate and actual costs.

D. USE BY OTHER FEDERAL AGENCIES:

The rates in this Agreement were approved in accordance with the authority in Title 2 of the Code of Federal Regulations, Part 200 (2 CFR 200), and should be applied to grants, contracts and other agreements covered by 2 CFR 200, subject to any limitations in A above. The organization may provide copies of the Agreement to other Federal Agencies to give them early notification of the Agreement.

E. OTHER:

If any Federal contract, grant or other agreement is reimbursing facilities and administrative costs by a means other than the approved rate(s) in this Agreement, the organization should (1) credit such costs to the affected programs, and (2) apply the approved rate(s) to the appropriate base to identify the proper amount of facilities and administrative costs allocable to these programs.

BY THE INSTITUTION:

University of Washington Management Accounting and Analysis

(INSTITUTION)

(SIGNATURE)

Jeffrey F. Scott

(NAME)

Executive Vice President for Finance & Administration

(TITLE)

08/22/2017

(DATE)

ON BEHALF OF THE FEDERAL GOVERNMENT:

DEPARTMENT OF HEALTH AND HUMAN SERVICES

(AGENCY)

Arif M. Karim -A

Digitally signed by Arif M. Karim -A
DN: c=US, o=U.S. Government, ou=HHS, ou=PSC, ou=People, cn=Arif M. Karim -A, 0.9.2342.19200300.100.1.1=2000212895
Date: 2017.07.31 11:19:54 -05'00'

(SIGNATURE)

Arif Karim

(NAME)

Director, Cost Allocation Services

(TITLE)

7/21/2017

(DATE) 7194

HHS REPRESENTATIVE: Janet Turner

Telephone: (415) 437-7820

DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH
SEATTLE REGIONAL OFFICE
300 FIFTH AVENUE, SUITE 710
SEATTLE, WA 98104

IN REPLY REFER TO

ONR 247
September 27, 2016

Dr. Jeffrey A. Simmen
Director, Applied Physics Laboratory
University of Washington
909 NE Boat Street
Seattle, WA 98105

Reference: Applied Physics Laboratory Prorated Direct Cost Rate submitted September 7, 2016, for the period October 1, 2016 through September 30, 2017.

Dear Dr. Simmen:

Based on my preliminary review, the below Applied Physics Laboratory (APL) Prorated Direct Cost (PDC) rate is approved for pricing and billing purposes, effective October 1, 2016.

Rate Category	Rate	Application Base
Prorated Direct Cost	31.80%	(a)

(a) APL Modified Total Direct Costs (MTDC) consisting of salaries and wages, applicable fringe benefits, materials and supplies, services, travel, and up to the first $25,000 of each subaward (regardless of the period of performance of the subawards). MTDC excludes equipment, capital expenditures, charges for patient care, rental costs, tuition remission, scholarships and fellowships, participant support costs and the portion of each subaward in excess of $25,000.

It should be noted that subsequent audits may result in necessary adjustments to the approved rate. The approved rate is subject to unilateral amendment by the government or bilateral amendment by the contracting parties at any time.

Please contact me if you have any questions or concerns at (206) 548-7240 or evan.wood@navy.mil.

Sincerely,

Evan M. Wood

Evan M. Wood
Administrative Contracting Officer

E-Copies to:

ONR 242/L. Shipp
ONR 25/E. Simonoff
NAVSEA/J. Piunno
DHHS/T. Lin
UW/D. Martin
UW/M. Kummer
UW/K. Hovick