

Performance Progress Report
Developing the Pacific Islands Ocean Observing System (PacIOOS)
Cooperative Agreement # NA11NOS0120039
Performance Period: June 1, 2016 through November 30, 2016

Submitted December 2016 by:
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This report covers activities conducted during the first six 6-month performance period of the no-cost extension for this award. PacIOOS' estimated operating budget on June 1, 2016, was \$377,571.00.

1.0 Progress and Accomplishments

Retrieve and re-deploy Kaua'i Wave Buoy; Original completion date: May 2017

Status: Complete. October 2016. Although the buoy had drifted almost 200 nautical miles North of its original location, we were extremely fortunate that one of our partners and former board members had a fishing vessel working in the area of the buoy. The captain was able to locate and retrieve the buoy for us. Once the buoy was cleaned up, it was redeployed successfully.

Rebuild mooring and re-deploy Ritidian Wave Buoy; Original completion date: July 2016

Status: Complete. June 2016.

Redeploy Maui Wave Buoy; Original completion date: June 2016

Status: Complete. April 2016.

Deploy new wave buoy in Kāne'ohe Bay; Original completion date: October 2016.

Status: Complete. August 2016. No IOOS funds were used to either purchase or deploy this buoy. Funding is from ONR via the Hawai'i Natural Energy Institute and data is made available via PacIOOS services.

Integrate geospatial data into PacIOOS data services and into web-based products; Original completion date: May 2017

Status: On-Track. Developed new position description with JIMAR and the staff at the NOAA Pacific Islands Fisheries Science Center (PIFSC) for a co-located, joint position with JIMAR (coordinated with PIFSC) and PacIOOS to work on data integration and management. Position description is currently being reviewed by RCUH. Expected new hire date is now early 2017.

Deploy an array of oceanographic satellite tags on large pelagics in the Main Hawaiian Islands; Original completion date: May 2017

Status: On-Track. New tags have been received. Deployments have been delayed due to extremely few weather windows during this reporting period. Expected completion date remains May 2017.

Deploy and array of land-based receivers for oceanographic satellite tags; Original completion date: February 2017

Status: Delayed. Staff have been hired, and two of the five land-based receivers have been deployed on O'ahu: Ka'ena and Mt. Ka'ala. Right of Entry permits for two additional receivers were delayed, but are now moving forward. Expected completion date is now April 2017.

Implement real-time time-series analysis and display for ship-based detection of tsunamis; Original completion date: October 2016

Status: Complete. October 2016.

Conduct analysis of the time-series collected to date to determine data completeness, accuracy, and robustness for ship-based; Original completion date: April 2017

Status: On-Track. A computer programmer has been hired to set up the display and test the system. Underlying problems with the models have been resolved, and analysis is currently in progress. Expected completion date remains April 2017.

Additional activities not mentioned above that highlight regional observing system successes are covered by the FY16 cooperative agreement and hence covered in that performance progress report.

2.0 Scope of Work

No changes to the project scope of work are anticipated.

3.0 Personnel and Organizational Structure

PacIOOS held 2016 elections in July 2016 to fill 5 seats on the PacIOOS Governing Council. New PacIOOS Governing Council Members include representatives from RMI EPA, Palau Office of Climate Change, and NOAA PIFSC (Regional). Re-elected members include representatives from Liquid Robotics, Inc. (HI), Western Pacific Regional Fisheries Management Council (Regional). PacIOOS added one new MOA partner during this reporting period: The Republic of Palau Office of Climate Change. The total number of MOA Signatories is now 54.

4.0 Budget Analysis

Spending for the no-cost extension is on track with projected program expenditures. The University of Hawai'i Office of Research Services submitted a semi-annual financial report for the period ending September 20, 2016 through Grants Online. That report showed total receipts of \$ 12,098,557.45

As of December 1, 2016 internal budget tracking shows expenditures of \$12,197,590.44 representing a draw down of 99.22% of the Federal funding for this award.

Performance Progress Report Addendum (covering December 2015 – November 2016, unless otherwise stated)

Education and Outreach Inventory

The Education and Outreach Inventory has been updated with PacIOOS activities. Please see the Google Doc for responses.

https://docs.google.com/a/noaa.gov/spreadsheets/d/1xsgY6Qz1ldwsotma1nmRLWVsJne5BWnt0J6qQZi9_Xk/edit?usp=sharing

Data Management, Products, and Services

PacIOOS data management group (DMG) ensures the data collected by PacIOOS are stored and accessible to users via standard services. Progress and challenges toward addressing each data management requirement are described below. See PacIOOS Data Management System (DMS) Plan (2016) for details.

1. Open Data Sharing

PacIOOS adheres to the NOAA Data Sharing Procedural Directive. All real-time and near real-time data managed by PacIOOS are freely available through open services, without delay or restriction. Avenues for accessing the data are available through the PacIOOS website: <http://www.pacioos.hawaii.edu/data-access/servers/>. Geospatial data are served via GeoServer and OpenLayers. PacIOOS does not restrict access to any data it collects or serves. Metadata are provided for all data, and data are machine-readable.

2. Data management planning and coordination

PacIOOS ensures local data storage and is working with NCEI for permanent archiving of data. PacIOOS routinely updates our data management plan, which was also part of our successful certification package. The PacIOOS DMG enables activities within PacIOOS modeling groups. PacIOOS continuously strives to make improvements to the system to ensure that regional DAC maintenance is stable, reliable, and efficient. Funding is always a challenge when planning for long-term operations and maintenance, including of a DMAC system. Additional funding sources outside of IOOS are continuously being pursued in order to ensure continuity and stability of the DAC.

PacIOOS supports data management coordination by participating in the operations, maintenance, and evolution of the national DMAC subsystem, including attending annual meetings and joining webinars and conference calls throughout the year. PacIOOS actively participates in cross-regional data management policy and implementation plan development, when invited to do so. PacIOOS is willing to participate in national data management committees and forums.

3. Provision of data to the Global Telecommunication System (GTS)

PacIOOS does not actively send data to the GTS. However, data that go through the functional DACs (e.g., data from the PacIOOS wave buoys) are sent by the DAC to the GTS when appropriate.

4. Data access services

All PacIOOS data are made available via data access services. Direct, binary access is provided through standard open-source protocols. Our main service is OPeNDAP (Open-source Project for a Network Data Access Protocol), and the system is built around the Thematic Real-time Environmental Distributed Data Services (THREDDS) DODS Server (TDS). In accordance with IOOS requirements, PacIOOS has also employed Sensor Observation Services (SOS) for providing data from point measurements via the latest version of THREDDS ncSOS service. PacIOOS maintains several web-based data browsing and display tools for gridded, point, and geospatial data, including a Live Access Server (LAS) for gridded data. In addition, the Environmental Research Division's Data Access Program (ERDDAP) is used for a variety of services, including display and browse, and a Web Map Server (WMS) based on GeoServer, is used to serve geospatial data.

5. Catalog registration

All PacIOOS data have complete and accurate metadata. These metadata are provided in a web accessible folder (WAF) that is read by various catalog services, including the IOOS catalog service.

6. Common data formats

PacIOOS offers data in IOOS-approved common data formats, including but not limited to, NetCDF, flat IEEE binary, ASCII, CSV, HDF, GRIB, and GIS formats. Our format is consistent with the NCEI netCDF templates.

7. Metadata standards

PacIOOS data sets conform to the Federal Geographic Data Committee (FGDC) and/or ISO 19115. A python-based PacIOOS web catalog service (pyCSW) provides access to all metadata with query capabilities. All our metadata are in a WAF and catalog service.

8. Storage and archiving

Local storage for data streams is on a Redundant Array of Independent Disks (RAID) system, which is essentially a single unit with multiple hard drives with data stored redundantly across the disks, so in the event of a hardware failure on a single disk data are preserved on another. In addition, all PacIOOS data are replicated across mirrored RAID systems. PacIOOS is currently working with NCEI to ensure archiving of PacIOOS data. The solution will be to use the PacIOOS ERDDAP server to provide data to the PacIOOS WAF, and then NCEI can harvest the data from there. At present we are experimenting with an initial data stream. Challenges incorporating all the suggested metadata, along with changing QARTOD specifications, have caused delays. Storage and archiving of data that go through a functional DAC from PacIOOS are handled by each respective functional DAC.

9. Ontologies, vocabularies, common identifiers

The PacIOOS DM sub-system employs a service-oriented architecture (SOA), built on controlled ontologies, vocabularies and identifiers, that enables six essential functions: 1)

data storage, 2) metadata management, 3) data discovery tools, 4) data transport servers, 5) on-line browse capabilities, and 6) data quality assurance/quality control (QA/QC). The vocabularies used for geophysical data adhere to the netCDF Climate and Forecast (CF) conventions. Biological data use the IOOS Biology Standard that is based on Darwin Core.

10. Consideration for Long-term Operations

PacIOOS aims to maintain and enhance a system that will persist long-term. Changes to the IOOS DMAC policies and procedures, such as QARTOD updates, will be incorporated as necessary. While PacIOOS has implemented, and will continue to implement automation in the system (through programming, etc.) as much as possible, there will also be a need for experienced, knowledgeable personnel. Federal requirements, software, stakeholder needs, etc. are always changing, and automation cannot always appropriately accommodate such evolutions. Funding, therefore, is always a key consideration when planning for short- or long-term activities. PacIOOS' strategic goals moving forward, therefore, include the need to diversify and expand funding and leveraged resources to create a resilient and robust financial foundation. Additional funding sources outside of IOOS are continuously being pursued in order to ensure continuity and stability of the DAC. This is an ongoing challenge.

Observing Assets

1. RA Observing Asset Inventory

Please see the attached Observing Asset Inventory spreadsheet for PacIOOS.

2. HFR Operations and Maintenance progress

Please see the attached spreadsheet for an annual update on HFR expenditures. Also, please see the attached annual update on HFR assets and staffing.

3. Annual Glider Days Inventory

Please see the attached Annual Glider Days Inventory spreadsheet.