

**Comprehensive Performance Progress Report  
Developing the Pacific Islands Ocean Observing System (PacIOOS)  
Cooperative Agreement # NA11NOS0120039  
June 1, 2011 – May 31, 2017**

**Submitted August 2017 by:  
University of Hawai‘i  
Office of Research Services**

This report is a final comprehensive performance progress report that covers activities conducted during the final six months of the NA11 award (Dec. 1, 2016 – May 31, 2017) as well as a summary of activities conducted during the *entire* award (June 1, 2011 – May 31, 2017). The total amount awarded to PacIOOS for this award was \$12,293,103.00.

### **1.0 Progress and Accomplishments**

All milestones proposed through our annual revised statements of work under this cooperative agreement have been addressed, as detailed in our semi-annual program reports. A summary of key accomplishments, as they relate to the PacIOOS sub-systems (coastal and ocean observing, modeling and analysis, data management, outreach and stakeholder engagement, and program management and governance) is included below.

#### **Coastal and Ocean Observing**

In situ, remote sensing, and forecasting efforts addressed four main focus areas (Marine Operations, Coastal Hazards and Resiliency, Water Quality, and Living Marine Resources) during this cooperative agreement.

#### **Marine Operations: Operate a Network of Real-Time Wave Buoys**

Throughout this cooperative agreement, PacIOOS operated and maintained a suite of directional wave buoys in the Hawaiian Islands, Guam, the Northern Mariana Islands, American Samoa, and the Marshall Islands. In addition to funding provided through this award, PacIOOS successfully secured support from partners to purchase additional wave buoys to complement the existing array. At the end of the cooperative agreement, PacIOOS was maintaining 13 wave buoy sites across the region. Eight of these buoys are new sites deployed during this cooperative agreement (Ritidian, Tanapag, Kāne‘ohe Bay, Hanalei, Aunu‘u, Pauwela, Hilo, and Kāne‘ohe WETS). Data from each of these systems is sent in real-time to the Coastal Data Information Program (CDIP) at Scripps Institution of Oceanography and populated on the web via PacIOOS ([www.pacioos.org](http://www.pacioos.org)) and CDIP (<http://cdip.ucsd.edu/>) websites and the PacIOOS data portal, Voyager ([www.pacioos.org/voyager](http://www.pacioos.org/voyager)).

These assets provide critical real-time wave information for recreational and commercial mariners in coastal waters and necessary validation points for regional wave models. The buoys provide essential observational data for NOAA National Weather Service forecasts as well as PacIOOS coastal inundation, harbor condition, and nearshore coastal hazard products. Two success stories related to PacIOOS wave buoys can be found on the PacIOOS website at:

[http://www.pacioos.hawaii.edu/wp-content/uploads/2016/06/success\\_story\\_NWS\\_Guam.pdf](http://www.pacioos.hawaii.edu/wp-content/uploads/2016/06/success_story_NWS_Guam.pdf) and [http://www.pacioos.hawaii.edu/wp-content/uploads/2016/06/success\\_story\\_RMI\\_wavebuoy.pdf](http://www.pacioos.hawaii.edu/wp-content/uploads/2016/06/success_story_RMI_wavebuoy.pdf).

### **Marine Operations: Install and Maintain Operational High Frequency Radars**

Throughout this cooperative agreement, PacIOOS deployed four new High Frequency Radio (HFR) sites (Ka'ena, Hilo, Pepekeo, and Chevron), growing the array to 7 sites that support surface current monitoring off O'ahu (5 sites) and Hawai'i Island (2 sites). The data from these systems are uploaded to the National HFR server every hour and made available to the public via their website and the PacIOOS website. Additionally, data from our systems are served to the U.S. Coast Guard search and rescue controllers in District 14 and Sector Honolulu through the USCG SAROPS system. Co-located with the Barbers Point HFR system, PacIOOS deployed AIS receivers to track AIS-transmitting vessels in the coastal ocean. These data are served in real-time via the PacIOOS Voyager.

### **Marine Operations: Develop and Maintain a Harbor Surge Forecast Tool for Hale'iwa Harbor**

We addressed the needs of the small-boat maritime industry on the north shore of O'ahu by focusing on Hale'iwa Harbor. Harbor surge is a major safety concern and potential source of damage to vessels, piers, and other harbor infrastructure. We deployed current meters, a wave buoy, and water level stations in the harbor and entrance channel to produce an integrated picture of real-time conditions in the immediate vicinity of the harbor. These data were used to create a Surge Current Index that provides a five-day warning of potentially damaging and dangerous water motion in the harbor. This tool, called the PacIOOS Hale'iwa Harbor Surge Forecast, is available on the PacIOOS website: <http://www.pacioos.hawaii.edu/shoreline/harborsurge-haleiwa/>.

### **Coastal Hazards and Resiliency: Develop and Maintain a Suite of High Water Level and Wave Run-Up Forecasts Tools**

The coastal communities of the Pacific Islands are vulnerable to short-term, high-water level events both. The combination of spring tides with seasonal swell events leads to frequent over-topping of coastal roads, flooding of storm drains, and inundation of low-lying shorelines and coastal margins. The addition of positive water level anomalies associated with mesoscale eddies and other ocean circulation features can exacerbate the impacts of these events, and the frequency and severity of inundation will only increase with rising sea levels. Accurate forecasting of these changes aids the decision-making of emergency managers, civil defense agencies, public safety, and NOAA National Weather Service partners.

Using data from water level stations, T-LIDAR beach surveys, beach cameras, directional wave buoys, and focused empirical oceanographic surveys, PacIOOS developed high-water level and coastal inundation/flooding predictions. During this cooperative agreement, PacIOOS maintained a nowcast and up to 6-day forecast product of high sea level events at 8 locations (Nawilili, Honolulu, Kahului, Hilo, Moku o Lo'e, Kawaihae, Pago Pago, and Majuro) and developed 2 new High Sea Level Forecasts (Apra Harbor, Guam and Malakal, Palau) - <http://www.pacioos.hawaii.edu/shoreline-category/highsea/>. In addition, PacIOOS maintained and improved upon 2 nowcasts and 6-day forecasts of coastal inundation from wave run-up (Waikiki and North Shore, O'ahu) and generated 2 new Wave Run-up Forecasts (Majuro and Kwajalein) - <http://www.pacioos.hawaii.edu/shoreline-category/runup/>.

A success story related to a PacIOOS wave run-up forecast can be found on our website at: [http://www.pacioos.hawaii.edu/wp-content/uploads/2016/06/success\\_story\\_RMI\\_waverunup.pdf](http://www.pacioos.hawaii.edu/wp-content/uploads/2016/06/success_story_RMI_waverunup.pdf)

### **Water Quality: Maintain an Array of Nearshore Water Quality Sensors and Buoys**

During this cooperative agreement PacIOOS collected and served water quality data to address the needs of marine resource managers, non-governmental organizations, and state and county health officials to effectively respond to and protect ecosystem, wildlife, and human health. In order to accurately assess water quality, we deployed and maintained an observational network of coastal moorings and sensors in the nearshore waters of Hawai‘i and the Insular Pacific. While the majority of these assets reported in real-time, several provided logged data that were retrieved at regular intervals. These systems each measure a subset of a range of variables, including temperature, depth, salinity, nutrients, dissolved oxygen, turbidity, chlorophyll, and carbon dioxide (air and water). Data from each system are made available through the PacIOOS website. Over the course of this reporting period, PacIOOS maintained and operated an array of 14 nearshore sensor packages (Hawai‘i Yacht Club, Hilton Waikīkī, Waikīkī Aquarium, Hawai‘i Kai, Wailupe, American Samoa, Majuro, Pago Bay, Kihei, Kahului, Majuro, Pohnpei, Saipan, and Koror) and 6 water quality buoys (Ala Wai, Kilo Nalu, Kāne‘ohe Bay, CRIMP, Hilo, and Kiholo Bay). Support for the CO<sub>2</sub> monitoring buoys in Kāne‘ohe Bay was provided by PMEL through the IOOS award to PacIOOS. See <http://www.pacioos.hawaii.edu/water-category/sensor/> and <http://www.pacioos.hawaii.edu/water-category/wqbuoy/> for data and more details.

PacIOOS also developed a new program called the Water Quality Sensor Partnership Program in which near shore sensors from discontinued sites are made available for PacIOOS partners to collect data for short-term (6 months to a year) projects requiring water quality data. To date, this program has been a success in terms of serving stakeholders, building capacity, and providing additional outreach opportunities for the program.

<http://www.pacioos.hawaii.edu/latest-news/water-quality-sensor-partnership-program/>

A success story related to PacIOOS nearshore water quality sensors can be found on our website at: [http://www.pacioos.hawaii.edu/wp-content/uploads/2016/06/success\\_story\\_UOG\\_WQ.pdf](http://www.pacioos.hawaii.edu/wp-content/uploads/2016/06/success_story_UOG_WQ.pdf).

### **Living Marine Resources: Expand monitoring arrays, including satellite tags and passive and acoustic instrumentation, of large pelagics in the Main Hawaiian Islands.**

The data collected under this effort help track the behavior, movement, and population dynamics of large pelagics, specifically sharks, in order to improve understanding and decision-making with regard to the health of ecosystems and living marine resources. PacIOOS and SOEST maintained a strong partnership with the Ocean Tracking Network throughout this cooperative agreement, and PacIOOS helped to maintain and collect data from partner acoustic receivers. PacIOOS and partners, including the State of Hawai‘i, provided funding to enhance the array of fin-mounted SPOT satellite tags on tiger sharks captured around Maui and O‘ahu. These data are available in near real-time to the public via a special PacIOOS webpage and the PacIOOS Voyager. <http://www.pacioos.hawaii.edu/projects/sharks/>

## **Living Marine Resources: Deploy an Array of Oceanographic Satellite Tags on Large Pelagics in the Main Hawaiian Islands, and Deploy an Array of Land-Based Receivers for Satellite Tags**

With IOOS Ocean Technology Transition funding, PacIOOS expanded shark-tagging efforts to test oceanographic satellite tags and land-based receivers, components necessary for a fully operational project using tagged sharks as the primary collector of oceanographic data for model assimilation. In addition to the sharks' locations, this new generation of tags records important oceanographic data, such as ocean temperature, oxygen profiles, and sea surface temperature. The tags are also capable of acquiring GPS-quality positional "fixes" associated with these profiles. Data will be made available in near-real time to databases that inform models to predict ocean circulation patterns (e.g., to improve weather forecasting). This is the first example of using "sharks as oceanographers."

In the past, data from tagged sharks were solely transmitted through the orbiting satellites system whenever the animal surfaced. However, since Argos satellite availability averages only 6-12 minutes per hour in Hawai'i, land-based receivers were installed at high elevations around Maui and O'ahu to augment the satellite array and increase data throughput from fin-mounted tags. Land-based receivers were deployed on Maui (Haleakala and Lāhainā) and O'ahu (Ka'ena, Mt. Ka'ala, and Makakilo). Land-based receivers can significantly increase data recovery and are able to detect signals in a range of 80-90 km.

### **Modeling and Analysis**

PacIOOS modeling efforts during this cooperative agreement provided near-term forecasts for response and planning. Three modeling systems (atmospheric, waves, and ocean circulation) were maintained and updated for the main Hawaiian Islands, and new model grids for each of these systems were developed for the Mariana Islands (Guam and CNMI) and the Samoan Archipelago. These forecasts are available on the PacIOOS website and the PacIOOS Voyager.

### **Maintain and Expand PacIOOS Atmospheric Forecasts Across the Region**

The atmospheric Weather Research and Forecasting (WRF) model with assimilation generates daily nowcast and forecasts for each archipelagic domain listed above, as well as higher resolution runs for each major island complex (O'ahu, Maui, Guam). These are provided directly to the local NWS forecast offices and are used by the wave and ocean circulation models for boundary conditions. <http://www.pacioos.hawaii.edu/weather-category/model-wind/>

A success story related to PacIOOS WRF forecast can be found on our website at:

[http://www.pacioos.hawaii.edu/wp-content/uploads/2016/02/success\\_story\\_channel\\_swim.pdf](http://www.pacioos.hawaii.edu/wp-content/uploads/2016/02/success_story_channel_swim.pdf).

### **Maintain and Expand PacIOOS Wave Forecasts Across the Region**

Using Wave Watch III and the Simulating Waves Nearshore (SWAN) models, daily nowcast and forecasts of wave conditions are produced for the entire Pacific Basin (100km resolution), each aforementioned archipelago (5km resolution), the Northwestern Hawaiian Islands (5km) and each major population center (0.5 to 1km resolution for O'ahu, Kaua'i, Maui, Hawai'i, Guam, and Tutuila). These forecasts feed into our high-resolution ocean circulation models and into tools estimating wave run-up and plume trajectory, equipping communities and responders with valuable information. <http://www.pacioos.hawaii.edu/waves-category/model/>

### **Maintain and Expand Ocean Circulation Forecasts Across the Region**

Estimates of general ocean circulation are produced using the Regional Ocean Modeling System (ROMS) in a nested configuration. Each day, nowcast and forecasts of the ocean-state are generated using advanced 4D-Var data assimilation to combine the observations and the models in a dynamically consistent way such that the result should be more accurate than either component alone. Output is provided at 3km resolution for the Samoa Archipelago, 2km for the Mariana Islands, 4km for the Hawaiian Islands, and 40m to 2km for the highly populated coastlines of O‘ahu. <http://www.pacioos.hawaii.edu/currents-category/model/>

The ocean circulation fields are used to generate several products for stakeholders including: circulation estimates and forecasts, particle (drifter, plume) trajectories, and probable paths of movement for search-and-rescue. A new plume model developed during this cooperative agreement is the Ala Wai Turbidity plume forecast, available on the PacIOOS website. <http://www.pacioos.hawaii.edu/water-category/model-plume/>

The provision of data for assimilation to the ocean circulation model is an essential element of our modeling capacity. During this cooperative agreement period, PacIOOS funded several 3-month ocean SeaGlider mission to generate assimilative data.

Two success stories related to PacIOOS ROMS forecast can be found on our website at: [http://www.pacioos.hawaii.edu/wp-content/uploads/2016/06/success\\_story\\_paddleboarder\\_rescue.pdf](http://www.pacioos.hawaii.edu/wp-content/uploads/2016/06/success_story_paddleboarder_rescue.pdf) and [http://www.pacioos.hawaii.edu/wp-content/uploads/2016/02/success\\_story\\_O‘ahu\\_usecg.pdf](http://www.pacioos.hawaii.edu/wp-content/uploads/2016/02/success_story_O‘ahu_usecg.pdf).

Pacific Ocean currents at 15 meters depth are also simulated using the Surface CurrenTs from a Diagnostic (SCUD) model for predicting the drift of marine debris, oil spills, or other flow tracers. This model was developed and deployed during this cooperative agreement. It is a daily forecast of upper ocean velocity. This model is available on the PacIOOS Voyager: <https://goo.gl/Sdj7AE>.

### **Data Management**

The PacIOOS data management sub-system enables the public to discover, access, and understand ocean and coastal information collected by PacIOOS and regional partners; therefore, data management activities are a central and critical component of PacIOOS.

### **Expand, Refine, and Maintain the PacIOOS Data Management Infrastructure to Address User and IOOS requirements**

During this cooperative agreement, the PacIOOS data management infrastructure was maintained and continuously upgraded. PacIOOS purchased and installed additional server space and capabilities to support the system throughout this award. In order to operate the Regional Data Assembly Center (DAC) efficiently and effectively, especially in times of emergency, the main servers were relocated to the new UH Information Technology Center building, which is a disaster-hardened, 8,000-square-foot data center for enterprise servers, storage, and communications that provides 24/7 operations with independent power.

The team incorporated a Sensor Observation Service (SOS) into the PacIOOS suite of data services, to which all PacIOOS point measurements (near-shore sensors and water quality buoys)

were added. During this award, the team also developed and implemented a catalog web service to allow users to search the vast PacIOOS data holding in an automated fashion. QARTOD implementation was also successfully achieved.

### **Serve as a Regional Data Assembly Center (DAC) for the Pacific Islands Region**

The PacIOOS data management architecture and functions have proven to be essential for serving PacIOOS data to stakeholders. Throughout this cooperative agreement, PacIOOS has increased its partner data holdings by identifying relevant and quality-controlled partner data and data products through continuous stakeholder engagement. At the end of the award, PacIOOS served regional partner data and data products (e.g., spatial data layers) from numerous partners, including the U.S. Geological Survey, NOAA NDBC, NOAA CO-OPS, NOAA PMEL, NASA, State of Hawai‘i, CORAL-Reef Alliance, City and County of Honolulu, the Intergovernmental Oceanographic Commission (IOC), Cascadia Research Collective, the Republic of the Marshall Islands EPA, U.S. Navy, Hawai‘i Institute of Marine Biology, Aloha Cabled Observatory, OceanWatch, The Nature Conservancy, and Pacific Disaster Center.

### **Continue to Address Stakeholder Requirements for Data Products and Tools**

Based on stakeholder engagement and user feedback, PacIOOS data management efforts work to enhance existing and develop new data products and tools. This includes data fusion tools or portals, forecast tools, specific web pages, etc. Making data or tools available to stakeholders is made possible through the efforts of the PacIOOS data management team. Below are a few examples of tools developed during this cooperative agreement that have not already been described above.

#### ***PacIOOS Voyager***

The PacIOOS Voyager is the program’s main data fusion tool. It is a map-based data-browsing and download tool that is built on the Google Maps platform. Dynamic data are incorporated in real-time from PacIOOS and partner data services, while others are static data sets directly collected or provided by outside partners. Released in 2012, the PacIOOS Voyager, has become a popular tool among stakeholders in the region, with several groups asking for PacIOOS to build them a version tailored to their specific needs. Over time, PacIOOS has improved the loading time, enhanced functionalities and the main interface, and added new data layers in response to user feedback and requests. Maintenance also included migrating over to a new version of the Google Maps API. A mobile version was also developed and released.

<http://www.pacioos.hawaii.edu/voyager/> and <http://www.pacioos.hawaii.edu/voyager/mobile/>

#### ***New web pages***

The data management team continuously worked with the outreach team and technical staff in each of the focus areas to improve user experiences and access to data and products.

Improvements include items such as new dynamic wave buoy plots:

<http://www.pacioos.hawaii.edu/new-tools/combined-wave-plots/>.

#### ***Project Pages***

During this cooperative agreement, PacIOOS started offering a new data management service called “Project Pages” to serve as a repository of ocean and coastal program and project data collected by researchers, NGOs, community groups, and partners throughout the Pacific for a

service fee. Many partners have taken advantage of this service. Project pages were developed for the Hawai'i Institute of Marine Biology (HIMB), the City and County of Honolulu, Researchers at UH Mānoa, NOAA OCM, NOAA ORR and NOAA ONMS, NOAA PMEL, the UH Coastal Geology Group, the State of Hawaii, and UH Sea Grant. For an example, visit: <http://www.pacioos.hawaii.edu/projects/fukushima/>.

### ***Hawai'i Shoreline Change Tool***

The Shoreline Change tool provides easy access to shoreline change rates and potential impacts of sea level rise in relation to a particular parcel. This tool was developed with the UH Coastal Geology Group data layers in order to address requests by county planners.

<http://www.pacioos.hawaii.edu/shoreline/slr-tool/>

### **Outreach and Stakeholder Engagement**

Outreach and stakeholder engagement efforts through this cooperative agreement have focused on two main areas: (1) working with the data management group, regional liaisons, and stakeholders to maintain and update effective data products, web-based information, and web services; and (2) increasing the impact of ongoing efforts through effective PacIOOS and IOOS branding, distribution of outreach materials, generation of regular newsletters detailing PacIOOS accomplishments, and collaboration with existing local, regional, and national ocean outreach initiatives. The feedback received through outreach and stakeholder engagement is a critical component that allows PacIOOS to modify and fine-tune its products in response to user input.

### **Maintain Diverse Representation among PacIOOS MOA Partners**

As the program further developed during this cooperative agreement, emphasis shifted from sheer numbers of signatories to the PacIOOS Memorandum of Agreement (MOA) to strategic engagement. This helped ensure that the limited program staff were able to fully engage in the partnerships into which we enter while simultaneously sustaining representation of a wide breadth of stakeholder interests among our MOA partners. As the PacIOOS Governing Council members are nominated from the pool of MOA partners, it is important to continue this diversity. The number of partners that have signed the PacIOOS Memorandum of Agreement (MOA) increased from 18 at the beginning of this cooperative agreement to 54 MOA partners at the end of the award period. Signatory partners represent federal, state, and local government agencies, non-government organizations, industry, and academia.

### **Conduct Targeted Stakeholder Engagement to Maximize Benefit to Stakeholders**

Targeted stakeholder engagement focused on individual and group meetings with partners and potential partners across the region. These meetings provided opportunities for dialogue to learn more about partner efforts and needs and to discuss PacIOOS activities and capabilities in order to identify and solidify opportunities for collaboration.

### **Update and Maintain a Web Presence for PacIOOS Users**

The new PacIOOS website went online in the Fall of 2016: <http://www.pacioos.hawaii.edu/>. The redesign focused on making data and information easy to access, use, and understand for PacIOOS stakeholders while still providing useful resources for more advanced users. It was also important to create a website that could be updated easily with new information and resources.

Coincident with the website redesign, PacIOOS also updated its logo and branding in order to better reflect our activities and mission.

Response over the past year to the new website and branding has been extremely positive. While the initial website user base started out at less than 10K users per year, throughout the award period the number of users increased to an average of at least 100K users per year, accounting for 600K-1M page views annually. From June 1, 2011 to May 31, 2017, the PacIOOS website was visited nearly 4 million times (3,885,785 page views). Half a million users visited the PacIOOS website over the same timeframe. Many web users return to the PacIOOS website, representing 60% of our users.

### **Keep Stakeholders Engaged and Informed on PacIOOS Activities and Accomplishments**

During this award, we increased the frequency and methods with which we engage PacIOOS stakeholders. Increasing the frequency of the newsletters to go out monthly, instead of quarterly, the PacIOOS e-newsletter is a consistent, easy-to-digest update on PacIOOS activities and accomplishments. At the end of this cooperative agreement, the newsletter was being sent to 1,745 recipients, with an open rate of 35-39% each month.

PacIOOS also provided presentations and hosted booths at related conferences, workshops, meetings, outreach events, etc. in order to keep stakeholders and partners informed, as well as to provide educational opportunities for interested residents and visitors to the region. During this agreement, PacIOOS developed content for 10 high-definition flat panel machines that partners provided. PacIOOS partnered with the COSEE program at UH to identify locations and deploy the flat panels across the region (O‘ahu, Maui, Hawai‘i Island, Majuro, and Guam).

PacIOOS also increased activity on social media outlets (i.e., Facebook and Twitter) during this period, resulting in a significant increase in the number of followers from both platforms. At the end of the cooperative agreement, the PacIOOS had 1,290 Facebook likes and 300 Twitter followers. Press releases, flyers, brochures, videos, webinars, and other communication and outreach methods were also employed during this cooperative agreement to engage with stakeholders.

To ensure further engagement of the diverse stakeholders in the Insular Pacific, PacIOOS supports regional liaisons at partner institutions to assist with solicitation of local requirements, dissemination and evaluation of ocean information and products, and coordination of local stakeholder councils. As the local face of the PacIOOS program, the liaisons are an essential link between stakeholder requirements and the observations, data, products, and services proposed, produced, and delivered by PacIOOS.

### **Foster Education in Ocean Observing**

PacIOOS provides a foundation for ocean observing research and operational experiences for undergraduate students across our region. Several PacIOOS components, including data management, water quality, outreach, and the wave buoys have offered both short- and long-term opportunities for undergraduate students to maintain ocean observing equipment, process data, and conduct related research. Most of the components in the coastal and ocean observing and modeling sub-systems have also provided support for graduate students that help maintain

operations and upgrades to the system. During this cooperative agreement, PacIOOS also participated in job fairs and worked with teachers from several different school levels to develop specific curriculum that collects and/or utilizes coastal ocean information.

### **Project Management and Governance**

The objective of this sub-system has been to ensure effective and strategic operations and successful implementation of the whole program. In order to ensure that direct project goals are achieved effectively, that appropriate partnerships for system growth are pursued, and that the system continues to generate public products that are valuable and relevant to the user community, a governance framework has been created for PacIOOS through the execution of a Memorandum of Agreement with partner agencies and organizations. The PacIOOS Governing Council provides strategic and policy guidance to program leadership and helps manage the observing system through an Executive Committee that meets between full Council meetings. Members of the Council are elected by their peers to serve 3-year terms.

### **Maintain an Active PacIOOS Governing Council**

By the end of the cooperative agreement, the 18-member Governing Council determined that the full council shall meet once a year in Honolulu in the Fall, and the smaller 5-member Executive Committee shall meet once a year in the Spring, elsewhere in the region. The members came to this determination after weighing member commitments, program needs, and staff and fiscal resources necessary to hold successful meetings. During this award, 6 full Council meetings were held, and 5 Executive Committee meetings. Governing Council meeting agendas and summaries are made available on the PacIOOS website. Council members and PacIOOS leadership work together closely to ensure meaningful engagement with stakeholders. Through this effort, PacIOOS maintains a diverse and engaged user base that contributes regular input on needs and priorities and provides critical assessment on the success of the regional system in satisfying user needs. <http://www.pacioos.hawaii.edu/about/>

### **Develop and Implement an Internal Evaluation Procedure and Operational Performance Measures**

During this cooperative agreement, PacIOOS management and outreach staff worked with the Governing Council to develop and implement an internal evaluation process of all PacIOOS program components and Performance Measures of the overall program. Basically, the internal evaluation involves scoring the components based on 11 different weighted attributes with a score of 1-5. This process allows the team to objectively review what's working well and what needs more attention. The results are presented every spring to the Executive Committee as one component to guide discussions for the upcoming year. The six high-level diagnostic performance measures provide a snapshot of growth and operational reliability across core subsystems of PacIOOS. The results are presented to the full Governing Council every fall to help guide discussion on any issues within the program that need to be addressed.

### **Maintain and Update the PacIOOS Strategic Operational Plan**

In late 2012, the PacIOOS Governing Council approved of the PacIOOS Strategic Operational Plan for 2013-2018: [http://www.pacioos.hawaii.edu/wp-content/uploads/2016/02/PacIOOS\\_Strat\\_Op\\_Plan\\_print.pdf](http://www.pacioos.hawaii.edu/wp-content/uploads/2016/02/PacIOOS_Strat_Op_Plan_print.pdf). The input received from the broader community shaped our priority setting and influenced both the long-term design and the

annual review of the PacIOOS Strategic Operational Plan (5-year horizon) and regional Build Out Plan (10-year horizon). Work has begun with the PacIOOS team and the Governing Council to draft the next iteration of the Strategic Plan for PacIOOS, which will cover 2018-2023.

### **Obtain Federal Certification as a Regional Information Coordination Entity**

In August 2015, IOOS certified PacIOOS as its first Regional Information Coordination Entity (RICE). Certification is a key milestone to the establishment of the full IOOS system and is mandated in the ICOOS Act. Certification signifies that PacIOOS is providing high-quality observations to National-level standards and extending the reach and ability of Federal programs.

### **Continue to Collaborate with Existing Regional, National, and International Efforts in Ocean Observing and Related Fields**

The synergy realized from effective collaboration with existing regional ocean partnerships has been a critical focus of PacIOOS leadership. Ongoing participation in various local and regional efforts, such as NOAA's Pacific Islands Regional Team, Sentinel Sites, and Habitat Blueprint initiatives, Hawai'i's Ocean Resource Management Plan working group, Micronesia Challenge's regional support team, the Pacific Islands Regional Planning Body, Pacific Risk Management 'Ohana (PRiMO), and the Pacific Climate Information System enable PacIOOS to document stakeholder requirements, chronicle existing capacity, and ensure collaborative development of observing platforms and public information products. PacIOOS also continued to collaborate within national and international efforts, including the IOOS Association, IOOS Federal Advisory Committee, Indo-Pacific Reference Panel for the Intergovernmental Oceanographic Commission (IOC), IOC Data Buoy Cooperation Panel for the Pacific Islands, IMOS, and PI-GOOS.

## **2.0 Scope of Work**

Activities under this award are complete. PacIOOS activities will continue under NA16 award.

## **3.0 Personnel and Organizational Structure**

While there were several changes in key PacIOOS personnel during the award period, they were well-planned with significant lead time so as to ensure smooth transitions. As of the end of the award on May 31, 2017, Chris Ostrander remained Principal Investigator for PacIOOS. Since then, Melissa Iwamoto transitioned to Principal Investigator for the NA16NOS0120024 award.

## **4.0 Budget Analysis**

Final financial reports have been submitted via Grants Online, and a final funding draw down has been made through the Automated Standard Application for Payments (ASAP). Expenditures under this award totaled \$12,293,103.00

Disposition paperwork for three assets is included with this progress report in the SF-428-C. All other equipment charged directly to the award by the University of Hawai'i is included in the final property report SF-428-B, remains on the inventory of the University, and will continue to be used by PacIOOS to achieve the milestones of Cooperative Agreement NA16NOS0120024.