TITLE PAGE (PROPOSAL COVER SHEET)

Proposal submitted to the Integrated Ocean Observing System Program, National Ocean Service (NOS), National Oceanic and Atmospheric Administration (NOAA), Department of Commerce, through the National Oceanographic Partnership Program (NOPP)

Pursuant to FY2011 Implementation of the U.S. Integrated Ocean Observing System (IOOS)

Topic Area 1: Coordinated Development of Regional Coastal Ocean Observing Systems

Developing the Pacific Islands Ocean Observing System (PacIOOS)

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Funding Request: $20,000,000

2. Project Summary

a. Project Name/Title

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e. Brief Project Summary including objectives and intended benefits

The School of Ocean and Earth Science and Technology at the University of Hawaii at Manoa, in collaboration with the Pacific Islands Ocean Observing System (PacIOOS) Governing Council and partners at non-governmental organizations, and local, state, territorial, and federal agencies, proposes to continue development of the Pacific Islands Ocean Observing System (PacIOOS). PacIOOS is the Pacific Islands regional partner in the 11-region U.S. IOOS Program and is engaged in observing system development as called for in the President's National Policy for the Stewardship of the Oceans, Coasts, and Great Lakes. Observing system planning and development was initiated in 2007 through the Hawaii Ocean Observing System (HiOOS) as a pilot program for the PacIOOS region. The goal of the proposed work is to maintain the existing capacity developed in Hawaii and elsewhere in the U.S. Insular Pacific through the initial stage of PacIOOS implementation and to continue to enhance the operational ocean monitoring and forecasting system to provide integrated, customized, and timely ocean information, data products, and marine spatial planning tools that meet defined user needs. Initial development of PacIOOS, through the HiOOS pilot project, has focused on four thematic areas: *Coastal Ocean-State and Forecasting, Coastal Hazards and Resiliency, Water Quality Sensing, and Marine Ecosystem Information and Monitoring.* PacIOOS presently serves data, information, and products through a dynamic web interface to stakeholders in each of these thematic areas (www.pacioos.org and www.hioos.org) and has developed a novel spatial-data viewer to visualize information for marine spatial planning (http://www.soest.hawaii.edu/hioos/map/). Integration of the two existing web portals has begun and will be finalized under www.pacioos.org late in 2010. The work proposed herein will continue to strengthen and integrate Federal and non-Federal observing assets within the PacIOOS region with other regional associations into the national system. An iterative, participatory process of engagement, outreach, and extension of PacIOOS capacity and data products has led to clearly defined stakeholder needs for additional customized and integrated data and information products in both Hawaii and the Insular Pacific region. To that end, PacIOOS proposes to continue to develop the observational, modeling, data management, and outreach components of the observing system to generate products that help ensure a safe, clean, and productive ocean and resilient coastal zone for the U.S. Pacific Islands.

f. Partners

Partners of PacIOOS listed below have been instrumental in the initial development of ocean observing capacity in the Pacific Islands region and have provided resources and funds for component systems, contributed data and/or products, maintained and managed observing instrumentation, assisted in planning or served on the PacIOOS Governing Council (whose Members and Delegates are shown in bold).

Federal: NOAA (**Pacific Islands Fisheries Science Center—Coral Reef Ecosystem Division**, IDEA Center, National Data Buoy Center, National Weather Service, Pacific Marine Environmental Lab, CO-OPS, Pacific Services Center, National Marine Sanctuary Program, Pacific Islands Benthic Habitat Mapping Center, Coastal Storms Program), **US Army Corps of Engineers**, US Coast Guard, US Navy (Oceanographic Office, Joint Typhoon Warning Center, Naval Maritime Forecast Center, Office of Naval Research), US Geological Survey, Environmental Protection Agency 9th District, Department of Homeland Security (National Center for Island, Maritime, and Extreme Environment Security (CIMES), Federal Emergency Management Agency), **Western Pacific Regional Fishery Management Council,** National Park Service, National Science Foundation, US Department of Agriculture

State: Department of Land and Natural Resources, Department of Health, Ocean Resources Management Plan (Office of Planning), **Department of Transportation – Harbors**, Hawaii Community Development Authority, Hawai'i State Civil Defense, Pacific Disaster Center, **Marine and Coastal Zone Advocacy Council, State Office of Planning—Coastal Zone Management Program**, University of

Hawai'i (**SOEST**, Hawai'i Institute of Marine Biology, Joint Institute for Marine and Atmospheric Research, Infrasound Laboratory, UH Sea Level Center, International Pacific Research Center, EPSCoR, Hawaii Mapping Research Group, UH Sea Grant College Program, Pacific Aquaculture and Coastal Resources Center, Waikiki Aquarium),

Territorial: **American Samoa Environmental Protection Agency**, American Samoa Community College, American Samoa Department of Marine and Wildlife Resources, American Samoa Department of Commerce, American Samoa Coral Reef Task Force, University of Guam, Guam Bureau of Planning and Statistics**, Office of the Governor of the Commonwealth of the Northern Mariana Islands**, CNMI Coastal Resources Management Office, CNMI Department of Environmental Quality

International: **College of the Marshall Islands**, Marshall Islands Department of Justice, Marshall Islands Sea Patrol, Marshall Islands Coastal Management Advisory Council, **College of Micronesia**, **Palau International Coral Reef Center,** Palau Automated Land and Resource Information System

Local: County of Hawai'i (Office of Planning), County of Maui (Office of Planning, Office of the Mayor), City and County of Honolulu (Board of Water Supply, Department of Environmental Services, Ocean Safety Division), County of Kauai (Office of Planning, Ocean Safety Division)

NGO: Alliance for Coastal Technologies, Conservation Society of Pohnpei, **Hawaii Harbor's User's Group**, Marine and Environmental Research Institute of Pohnpei, Mariana Islands Nature Alliance (MINA), Pacific Marine Resources Institute (PMRI), Yap Community Development Program

Private: Atlantis Adventures, Guam Fisherman's Cooperative, Hilton Hawaiian Village, Honolulu Yacht Club, **Liquid Robotics Inc., Outrigger Hotels and Resorts,** Sea Engineering, Sheraton Waikiki Hotel, Waikiki Yacht Club

3. Project Description

a. Background

The distinctive beauty of the Pacific Islands reflects the unique setting of our land, ocean, tropical climate, and biological diversity. The Pacific Islands region covers a vast area of the globe—spanning six time zones across the Pacific Ocean; the region is bisected by the International Date Line, straddles all four hemispheres, is distributed over a surface area of nearly 35 million km^2 and includes 2,500 km of coastlines and over 2,300 individual islands. The Exclusive Economic Zone (EEZ) of the Pacific Island jurisdictions covers an area larger than the other ten regions of U.S. IOOS combined and Hawaii alone constitutes nearly $1/5^{th}$ of the total U.S. EEZ. The Pacific Islands are uniquely an ocean region; over 99% of the surface area is ocean. The vast majority of the land lies within 10 km of the shoreline and all the land in the region is within the coastal zone.

Each of the island constituents of the PacIOOS region is distinct in terms of their respective governments, languages, legal systems, geography, cultural norms, societal structure, economies, and infrastructural development needs. The extreme geographic extent and remoteness of most island locations, coupled with a variety of local and federal governance and economic realities, present both significant opportunities and challenges for the growth of regional programs. Human activity is tightly coupled to the marine ecosystem—we are the top predators, introduce nutrients and pollutants, redistribute sediments, alter environmental links between land and sea, impinge upon the natural biological order of the ecosystem and, in the process, increasingly expose ourselves, our visitors and our endemic biota to natural and anthropogenic hazards, ecological depletion, and environmental stress.

The Federal government has played a significant role in the Pacific since the end of World War II. As the islands and their economies are each considerably more isolated than continental cities of comparable size and population, Federal resources have been needed to create and sustain infrastructure that, in other regions, might be supported by state, county, or city governments. The Federal government also plays an important role in region-wide coordination in large part associated with military facilities and

activities, weather services, fisheries and coastal zone management. As we continue to integrate coastal ocean information with ocean observing capabilities into a system that serves end users, we confront resource limitations that face other regions, as well as the special dependence on Federal resources uniquely endemic to the Pacific Islands.

Present situation

Regional Coastal Ocean Observing System

Coastal ocean observing system development within the PacIOOS region was *initiated* in 2007 with a cooperative agreement between SOEST and NOAA to establish the Hawaii Ocean Observing System (HiOOS). Given the prohibitive cost associated with developing an observing system over *an area four times larger than the continental United States*, HiOOS was instead designed as a demonstration project within the larger PacIOOS region that could be jump-started by leveraging substantial SOEST capacity and partner assets/funding. Its development as part of the national IOOS network of regional coastal ocean observing systems was undertaken with the intent, following the initial demonstration phase, of transferring technology, expertise, and best practices, with adequate Federal support, to other archipelagos in the PacIOOS region.

The initial focus of the Hawaiian effort, similar to the current focus of the national IOOS program, has been on the provision of operational products to the public, private sector, and agencies to ensure for a safe, clean, productive ocean and resilient coastal zone for all. Early scoping meetings with multiple agency personnel, followed by sustained, iterative, participatory stakeholder engagement, led PacIOOS to implement regional modeling, sensor deployment, and data integration in four key product areas: *Coastal Ocean-State and Forecasting, Coastal Hazards and Resiliency, Water Quality Sensing, and Marine Ecosystem Information and Monitoring*. New sensors were deployed primarily along the south shore of Oahu, the regional center of population, commerce and tourism, with additional water quality sensors being deployed in each of the PacIOOS insular jurisdictions outside Hawaii (Appendix 1, Table 1).

The initial observing efforts of PacIOOS were possible due to significant leveraging of existing (non-IOOS) ocean observing assets within the Pacific Islands Region (Appendix 1, Figure 1) including: the cabled Kilo Nalu Observatory (NSF/ONR), the CRIMP-CO2 system in Kaneohe Bay (NOAA/Sea Grant and PMEL), the Hawai'i Ocean Time Series (NSF), Coral Reef Ecosystem Integrated Observing System — CREIOS (NOAA-PIFSC), NOAA CO-OPS, the UH Sea Level Center (NOAA-JIMAR), CDIP, NOAA-NWS, the Ocean Tracking Network, and various county and state agencies (especially for water quality and fish tag monitoring at aggregation devices).

Annual funding at a level 40% less than the amount proposed limited the development of the PacIOOS pilot project as initially designed. However, substantial fiscal contributions by the University of Hawaii, the State of Hawaii, SOEST, the City and County of Honolulu, the DHS Center for Island, Maritime, and Extreme Environment Security (CIMES), the Joint Institute for Marine and Atmospheric Research (JIMAR), the UH Sea Grant College Program, and in-kind contributions by numerous PacIOOS partners have allowed for the successful demonstration of an end-to-end observing system pilot project that has achieved initial success in each of the aforementioned four key product areas. Work proposed herein builds upon these initial successes and leveraged systems towards a vision of a comprehensive end-to-end ocean observing system for the whole of the Pacific Islands region.

Regional Association

Planning for PacIOOS Regional Association (RA) development began in 2005 with funding from NOAA's Coastal Services Center to the East-West Center (EWC). Upon the initialization of observing infrastructure development by SOEST in 2007, program staff and management at the EWC requested that SOEST take the lead for the PacIOOS RA cooperative agreement. The EWC-to-SOEST transition for PacIOOS planning and management was completed in Q4 of 2007. SOEST entered into a cooperative

agreement with NOAA in 2008 to formalize a framework for collaborative governance and establish the PacIOOS Regional Association. The establishment of collaborative governance over the whole of the PacIOOS region, given the geographic expanse, diversity of cultures, modes of government, distribution of populations, and disparities in economic development is a daunting challenge unequaled in existing regional governance systems within U.S. IOOS. PacIOOS program partners, regional stakeholders, existing regional organizations, international collaborative bodies, the NOAA regional collaboration team, and PacIOOS regional liaisons were engaged to propose and review prospective governance modes for the PacIOOS RA. After a thorough review of existing regional and international governance mechanisms, SOEST proposed a PacIOOS governing framework in 2009. This was formalized in a Memorandum of Agreement that was executed by partners in the regional stakeholder community in 2010. Execution of the MOA by partners created a PacIOOS Governing Council charged with oversight, guidance, and support of the Regional Association, formalized the organization of the system under a PacIOOS Council Chair (Dr. Brian Taylor) and Director (Mr. Chris E. Ostrander), and provided a framework for continued collaboration on the execution, management, and design of the PacIOOS RA and RCOOS.

Stakeholder engagement

Broad, consistent interaction through an iterative, participatory process involving scientists, educators, recreational and commercial communities (tourists, divers, fisherman, mariners), resource managers, government officials, and other decision makers in the public and private sector has been a key focus of PacIOOS stakeholder and partner engagement during the initial phase of system development. The purpose of this engagement has centered on five key focus areas: (1) evaluation of potential modes of system governance, (2) discovery of existing observations and data to include in the PacIOOS data management and product development system, (3) assessment and documentation of local and regional ocean observing information, product and service requirements, (4) evaluation of observations, data, and products produced by the system and (5) prioritization of effort and analysis of options for future PacIOOS development activities. Liaisons hired through partner institutions in each of the jurisdictions that comprise the Pacific Islands region facilitate this end-to-end linkage of stakeholders to the program planning process and work consistently to identify new partners and stakeholders and bring them into the engagement process. Due to the geographic breadth of the region, remoteness of some island locations, and the diversity of stakeholder groups, multiple means of engagement have been employed to ensure consistent input from stakeholders including: multiple focused workshops in each of the jurisdictions, face-to-face meetings, written assessments, engagement of existing regional collaborative groups, review of existing regional reports, online surveys and, where appropriate, the establishment of local PacIOOS stakeholder councils. Input received and reviewed through this iterative, multi-year process has been used to formalize and establish the aforementioned Governing Council as well as prioritize the deployment (location, timing, and focus) of observing assets, the development of products, the engagement of users through education, outreach, and extension, and the system development proposed herein.

Prioritization of Effort

Observing system development through Hawaii and the Insular Pacific has been limited by an annual lack of sufficient financial resources within the U.S. IOOS Program to sustain and expand operations over the whole of the PacIOOS geographic domain. In light of this persistent financial constraint on system development, the U.S. IOOS Program Office recommended in 2010 a two-tiered prioritization of effort for future IOOS- funded activities (Appendix 2). As requested by U.S. IOOS, the principal focus of this proposal is on the State of Hawaii, the Commonwealth of the Northern Mariana Islands, and the Territories of Guam and American Samoa, following the established prioritization. Also, as encouraged by the IOOS Program Office, we have included in this proposal continued support for personnel, existing

observing system assets, and data development efforts presently engaged in the Freely Associated States in the Pacific (the Republic of Palau, the Republic of the Marshall Islands, Federated States of Micronesia) and the U.S. Minor Outlying Islands (Howland, Baker, Johnston, Kingman, Jarvis, Wake, Palmyra, Midway) that comprise the second priority area.

b. Goals and Objectives

The primary goal of the proposed work is to continue the development of an operational ocean monitoring and forecasting system that provides integrated, customized, and timely products that enable an ocean-literate and well-informed public and policy makers. PacIOOS has focused initial development on water quality sensing, ocean-state and forecasting, the provision of marine ecosystem information, prediction of coastal hazards, and the development of integrated data visualization capabilities to inform marine spatial planning, operations, commerce, and recreation. Through this proposed effort, PacIOOS will enhance development of observing and product suites in each of the aforementioned focus areas and will continue to engage users, stakeholders, and system partners in the use, extension, education, and outreach of technical capacity, data visualization, and ocean information.

Specific objectives towards this goal are detailed in the Work Plan (Section 3.d.) with further detail, including objectives to be completed in each year of the proposed work, included in the Milestones (Appendix 3) and the detailed budget narrative (Appendix 5).

c. Audience and Benefits

With initial PacIOOS funding, a wide-range of user groups have been identified and actively engaged to help define, and refine, PacIOOS. This engagement has been wide-reaching, both geographically as well as programmatically, including many levels of Federal, State and local/regional government, the ocean recreation and commerce (fisheries, transportation, offshore energy) sectors, the hotel and tourism industry, nongovernmental organizations, the media, as well as residents and visitors to the State of Hawaii, Territories, Nations, and unincorporated possessions that comprise the domain of the PacIOOS RA. Despite the inherent diversity among these groups and their wide range of interests, our interactions with them indicate some commonalities for ocean-related data products. This audience is asking for increasingly focused, innovative, and accurate products upon which to base decision-making, policy, safety, and future cultural and community planning.

Focus groups established to evaluate existing PacIOOS products and data distribution mechanisms have identified delivery of information via web-based, dynamic and frequently updated map-oriented products as the principle means of providing ocean users with an improved basis for decision-making and planning. The work proposed herein will continue to distribute information and services via the PacIOOS web portal (www.pacioos.org) guided by iterative, regular engagement with focus groups to evaluate and recommend improvements to web tools, services, and visualizations. While the majority of users request that data be processed and included in map-oriented product displays, access to raw data sets and providing the audience with the ability to manipulate data for customized user needs is, and will continue to be, an important part of the PacIOOS data management and distribution system. PacIOOS currently operates a variety of tools for data discovery (LAS, Dchart, ERDDAP) and access (OPeNDAP, SOS, WMS/FS/CS) that benefit from existing knowledge or targeted training to use to their full capacity. PacIOOS has initiated training workshops for data users covering the full range of data services and will continue to provide training on product and data discovery, access, and visualization (GIS and web) in concert with annual stakeholder meetings convened in each PacIOOS jurisdiction.

Given the strong presence of the ocean in all aspects of life in the Pacific Islands, the need for a better understanding of the ocean environment is pervasive. Lifeguards and safety officials identify drowning as the #1 preventable cause of death among visitors and residents of our islands. Working with

those safety officials we have developed and operate the first beach safety forecasting website in the country (and indeed, the world) and propose to continue serving real- and near real-time coastal ocean conditions for beaches and shorelines region-wide.

The U.S. Coast Guard, territorial emergency responders, and maritime rescue agencies in Hawaii, the Territories, and the U.S.-affiliated nations of the Pacific request real-time, accurate, and highly resolved information on coastal currents, waves, and offshore conditions for effective search-and-rescue (SAR) operations. We have developed operational models, deployed HF radars, wave buoys, gliders, and drifters in the Hawaiian Islands and propose to expand that development to meet ever-growing user demand for real-time ocean information and forecasts in other areas of the PacIOOS region.

Developers, planners, and coastal zone management departments cite coastal erosion, sea-level rise, and the lack of data to define appropriate setbacks and planning benchmarks as major challenges. We presently operate coastal cameras and conduct T-LIDAR surveys at two locations and propose to expand that capacity to eight additional locations. That additional capacity, coupled with our existing high water level forecasting system, will allow for inundation forecasting, accurate sea-level rise projections, and increased information on the effect of coastal erosion region-wide.

National Marine Sanctuary, National Monument, and Marine Protected Area managers, water quality personnel and environmental groups identify sewage spills, sediment plumes, reef dredging, upland deforestation, and industrial pollution as major threats to coastal ecosystems. They ask for real-time monitoring of water quality parameters and knowledge of the fate of spills, plumes, and discharge in the coastal waters. We have developed map-based visualizations of water quality parameters for coastal Waikiki and propose to expand that capability region-wide in concert with the deployment of new sensor platforms through focused partnerships with local community groups. This enhanced spatial network of water quality sensors, coupled with expanded numerical modeling capability, will allow for near real-time predictions of plume dispersal, particle trajectory, and water quality in priority coastal areas.

Island communities, industry, and transportation officials point to maritime commerce as providing a critical lifeline for food, material goods, and transportation within the Pacific Islands and to North America, Australia, and East Asia. The seaways are our interstate highways and railways. Harbormasters, recreational and commercial boat owners, and government maritime agencies desire accurate measurements and predictions of the state of the coastal and open ocean and of seiche amplitude in their harbors forced by wind, high swell, storm surge, and tsunamis. The PacIOOS website presently serves model and observational data on open and coastal ocean conditions from around the Pacific region. Expanded observations and model domains proposed herein will grow existing web-based visualization capacity in both resolution and spatial area. Harbor monitoring systems currently in place in Barber's Point Harbor will be expanded through this proposal to three other priority harbors in Hawaii (Haleiwa, Hilo, and Kahului) to provide needed information to mariners, harbormasters, and contractors currently engaged in the $618 million Hawaii Harbor Modernization Program.

As the regional population grows so too does the inevitable conflict and competition for limited ocean resources. Planners, resource managers, policy makers, and the public are increasingly asking for centralized data portals that provide integrated visualization of marine and coastal information from which to base commercial, planning, policy and conservation decisions. We have been approached by a variety of state and local agencies who request help in making their data more easily available and accessible and have worked with them to integrate their data into our information management system. We have developed and deployed a data viewer for the Hawaiian Islands and are in the process of finalizing an integrated data viewer for the rest of the Pacific Islands region. Through the work proposed herein we will continue to populate those viewers with real-time, archived, and spatial data sets that inform industry, managers, policy makers, and the public and improve access to marine data for integrated planning, management, commerce, and conservation.

d. Work Plan

Work proposed for the 2011-2016 phase of PacIOOS development is presented below and organized by PacIOOS thematic areas of effort. Numerical modeling, data management (and MSP visualization), education/outreach, and project management—components which are tied to each of the PacIOOS thematic areas, are presented individually. Costs and details associated with equipment, supplies, travel, personnel, contractual commitments, fringe benefits, and partner responsibilities are presented in the detailed budget narrative (Appendix 5)

Water Quality

Automated sensing of coastal water quality parameters has been identified as a high-priority focus within each of the PacIOOS jurisdictions. In order to assess accurately water quality we have deployed an observational network of cabled platforms, autonomous underwater vehicles, and coastal moorings in the nearshore waters of Hawaii and nearshore sensors in each of the jurisdictions within PacIOOS. Our top priority in the coming funding cycle is to maintain the existing water quality network and to merge PacIOOS data streams and those coming from leveraged sources with modeling output and HF radio observations in order to generate a suite of real-time map-based visualizations showing water quality indices related to water clarity, salinity, temperature, and biological activity. An initial map-based visualization (http://www.soest.hawaii.edu/hioos/data_product/WQ/) for Waikiki will be used as a template for regional expansion.

The Kilo Nalu Observatory is a cabled coastal ocean observatory situated within the Waikiki geographic focus area that has been in operation since 2004. Kilo Nalu serves as both a power and communications hub for some of the PacIOOS water quality, coastal hazards, and ocean-state and forecast platforms and, at a minimum, support is requested to maintain this essential capacity.

PacIOOS currently operates an array of eleven nearshore sensor packages—nine measure light attenuation (turbidity), temperature, salinity, and fluorescence, while two monitor only salinity and temperature. These nearshore sensor packages are a core component of both our water quality network as well as our extension effort to build technical capacity in the region (Figure 1). Working with our PacIOOS liaisons and local partners we have installed one of these sensor packages in each of the PacIOOS jurisdictions. In addition to this nearshore sensor network PacIOOS operates two CO_2 and water quality buoys in cooperation with NOAA's Pacific Marine Environmental Lab (PMEL). These systems are core components of the global CO_2 monitoring network and provide a coastal, shallow-water signal of climate variability. In addition to the variables measured by the nearshore sensor packages, these buoys measure barometric pressure, relative humidity, dissolved oxygen and CO_2 in both the atmosphere and ocean surface water and dissolved nitrate, an important nutrient element and frequent land and human derived contaminant. At a minimum, we request funds to maintain these existing nearshore and CO_2 climate buoy arrays—additional funds requested will be used to upgrade two existing nearshore sensor packages to also measure light attenuation and fluorescence.

The University of Hawaii at Hilo currently operates a real-time buoy in Hilo Bay (YSI EMM 68 buoy) and funds are requested to provide for annual operation and maintenance of this system. The buoy provides Hilo Bay users with measurements of biological activity, light attenuation, dissolved oxygen, phycoerythrin, salinity, temperature, pH, PAR, and nitrate. Hilo Bay is heavily influenced by surface runoff and ground water discharge and is a major center of commercial and recreational maritime activity. In addition to the Hilo Bay buoy, co-PI Adolf will install, through EPSCoR funding, two real-time Satlantic water quality buoys off the Kona coast of Hawaii Islands in 2011. Funds to maintain these systems will be provided at no cost to this effort; however, data from those instruments will be processed by the PacIOOS data management system and served via the PacIOOS website.

Should funding be available, we request additional resources to expand our water quality monitoring effort through: 1) regular and event response-driven autonomous underwater vehicle surveys (AUV) and, 2) the deployment of additional water quality sensors in each PacIOOS jurisdiction. Monthly, 1-day AUV surveys along the south shore of Oahu will allow for a better understanding of the spatial dynamics of water properties in the Waikiki area and allow for increased resolution of map-based spatial data products related to coastal water quality. Additional response-driven surveys will allow PacIOOS to better characterize water quality variability following extreme events (sewage spill, storm discharge).

In consultation with the Alliance for Coastal Technologies (ACT), PacIOOS has identified a variety of options for affordable sensor platforms that provide for basic measurement and telemetry of temperature, pressure, salinity, and turbidity data. We propose to expand significantly the geographic domain of the PacIOOS water quality network through the purchase and deployment of 35 ACT-PacIOOS identified sensor packages. We request funds for the purchase, deployment, telemetry, and annual calibration of these new sensors. In order to ensure deployment of these new sensors in priority locations and to maximize user involvement in their deployment, operation, and maintenance we propose to partner with established community conservation groups (such as: Malama Maunalua, Surfrider Foundation, Pacific Marine Resources Institute of Saipan) to identify sites, deploy sensors, and perform regular maintenance of the systems. We request funds to support a technician within the PacIOOS water quality group to work with ACT personnel to train community group members and volunteers on the proper operation and maintenance of these sensors as well as travel funds to deploy and service sensor systems annually. We view this community-based observational network as a novel means to generate local ownership and interest in PacIOOS observations, ensure the successful extension of technology and capacity region-wide, and provide affordable, end-to-end development of observations and public information products in priority areas of the PacIOOS jurisdictions.

Coastal Hazards and Resiliency

The coastal margins of the Pacific Islands are vulnerable to both long-term and episodic changes in coastal water levels and accurate forecasting of these changes has been identified as a common priority among all PacIOOS jurisdictions. Observing systems are in place to assess sea-level rise and interannual to decadal sea level variations for the region; however, the immediate local need is for predictions of short-term, high water level events. The combination of spring tides with seasonal swell events leads to the regular over-topping of coastal roads, flooding of storm drains, and inundation of low-lying beaches 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.

During the initial development of the PacIOOS project, we have focused on developing the data streams (water level, swell, wave set-up, atmospheric pressure) needed to specify all components of high water level events. Using these data sources, we have developed an empirical model for high water level based on incident wave and water level conditions. Our observational and model data streams have been combined into a nowcast and up to 6-day forecast product of extreme swash/water level events at eight locations (see the "High Sea Level – Inundation Hazards" topic on the HiOOS Coastal Hazards page: www.soest.hawaii.edu/hioos/hazards.php). At a minimum, we request funding to maintain the observational components (wave buoys, tide gauges, pressure sensors) and modeling components (forecast wave heights) that go into the high-water level product and to use existing personnel to continue to refine the water level prediction tool. The present network of PacIOOS near-shore sea-state instrumentation and wave buoys (in partnership with CDIP) requires ongoing maintenance to remain in operation.

To improve the accuracy of high water level forecasts by providing estimates of horizontal run-up, we have deployed an observational network of digital cameras and tripod scanning LIDAR (T-LIDAR) at two focus sites on Oahu (Waikiki, Waimea). The camera and T-LIDAR datasets can be combined to map the elevation of the run-up line along the beach during a range of wave and water level conditions. Previous limitations in program funding have prevented our development of such an inundation forecast and we request funds to develop that inundation-forecasting capability at the two sites listed above. At a minimum, personnel are needed to continue the camera datasets, which provide real-time run-up observations that are posted on the PacIOOS website, as well as the time series needed to validate and improve the inundation nowcast/forecast product.

To build capacity for inundation prediction outside of Hawaii, we plan to extend the camera (2012-2014) and T-LIDAR (2011-2016) survey locations to provide estimates of variable beach state (erosion/accretion phases) as a function of incident wave forcing and water level conditions at eight locations in both the Hawaiian Islands and the Insular Pacific. Funding is also sought for personnel to quality assess the components that go into the inundation product, and to quantify the empirical inundation model skill versus prediction time, which will be added to the on-line inundation product. In addition to providing necessary measurement of wave run-up, the existing and proposed network of PacIOOS coastal cameras provides real-time visualization of the coastal zone and has been identified as a valuable tool by emergency responders, disaster and resource managers.

Finally, our extremely successful Hawaii Beach Safety site has been transitioned to the PacIOOS server, is being integrated into the PacIOOS webpage, and is being maintained with partner funding (http://oceansafety.soest.hawaii.edu/).

Coastal Ocean-State and Forecasting

Commonly identified as a region with a small terrestrial area, the Pacific Islands most accurately are depicted as a large-ocean region. The ocean is the primary pathway for the transport of fuel, food, manufactured goods and raw materials to, from and between the islands and provides the backbone for the commercial and recreational maritime economy. The ocean is the regional inter- and intra-state highway and railway system with every shipping route to and between the islands using one of 6 primary ports on Oahu (Honolulu Harbor, Barber's Point Harbor, Pearl Harbor), Guam (Apra Harbor), American Samoa (Pago Pago Harbor) and Saipan (Saipan Harbor).

Essential to the efficiency, safety, and timeliness of transit in the marine environment is reliable information on the state of the ocean as well as timely and accurate forecasts on future conditions. Generally, stakeholders have identified this ocean-state information as the highest priority for observing system development and, along with modeling, is the principle thematic focus of our proposed system expansion. PacIOOS currently operates the initial components of an observational network of high-frequency radios (HFRs), ocean gliders, wave buoys, coastal ocean and harbor moorings, and numerical models in order to produce the most accurate information possible. This information is served in real- and near-real time via the PacIOOS website. Funds requested herein are dedicated to maintaining existing regional capacity for ocean-state observations and forecasting and expanding PacIOOS capacity to additional geographic priority areas.

PacIOOS presently operates three high-frequency Doppler radio systems along the southern shore of Oahu with a fourth to be installed along the western shore of Oahu in early 2011. HFR allows for real-time imaging of coastal currents and wave spectra over a large spatial area extending 100km from shore. The data derived from HFR observations are processed in real-time, yielding derived data products (currents, wind direction, wave spectra) made available on the PacIOOS website and are assimilated into the numerical models. At a minimum, PacIOOS requests funds to maintain the four existing HFR systems and add one new location at Barber's Point on the southwest corner of Oahu in FY11. Barber's Point is a

major commercial harbor for the state and offshore resides the only oil lightering facility in Hawaii. With large vessel and tanker groundings occurring on average every 18 months, accurate imaging of currents and waves is essential to ensure safe transfer of oil to shore stations and improve the safety of operations of large vessels in the coastal environment. Deployment of this new HFR at Barber's Point will be done in concert with the Hawaii Department of Transportation—Harbors Division, a PacIOOS partner and landowner of the deployment site. PacIOOS requests additional funds in each additional year to deploy one WERA type HFR per year at locations designated in the U.S. National Surface Current Mapping Plan. Surface current mapping through the use of HFR, while a high priority for search-and-rescue, pollution tracking, and interisland shipping in the Hawaiian Islands, has not been expressed as a high priority in the Insular Pacific. That prioritization, coupled with the significant cost of system expansion over a large geographic area has led to the proposed use of these additional HFR systems to augment the existing Hawaii-based array and allow for real-time spatial coverage of the island of Oahu as well as coastal areas of Molokai, Lanai, and Maui.

Collaborating with PacIOOS, the U.S. Army Corps of Engineers, and local partners, the Coastal Data Information Program (CDIP) has deployed a fleet of 5 Datawell directional wave buoys in the waters surrounding Hawaii (Waimea Bay, Mokapu, and Lanai), Guam, and the Marshall Islands (Majuro). These buoys provide critical wave information for recreational and commercial mariners in coastal waters and are essential validation points for existing and proposed regional wave models. PacIOOS, through support from partners in the region, has purchased three additional Datawell buoys and plans to deploy them offshore important harbors in the State of Hawaii (Barber's Point, Kahului, Hilo) in the coming year. While the capital costs to establish the observational network in the region were borne by PacIOOS and partners, annual support for operation and maintenance no longer exists for the buoys. We request support, at a minimum, for annual maintenance of the six buoys that will reside in the Hawaiian Islands beginning in 2011. These funds will allow for routine service and maintenance, recovery in the event of a buoy/mooring separation, and processing (telemetry, QA/QC, archiving) of the data by CDIP. These buoys are key systems in the National Operational Wave Observation Plan, a core component of PacIOOS operations and are essential for the development of coastal inundation, harbor condition, and nearshore safety products. We request additional support in each program year to maintain the two existing CDIP buoys in Majuro and Guam as they are the only real-time wave measurement stations in coastal waters of the western and central Pacific.

In the present funding cycle we have begun to address the needs of the maritime industry through a focus on shipping activities related to Barber's Point Harbor, the second most active commercial harbor in Hawaii. In consultation with harbor users and the State Department of Transportation we identified waves, water level, and currents as priority variables to measure and have deployed current meters, wave buoys, 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. At a minimum we request funds to maintain these existing systems for Barber's Point Harbor and, should funding be available, propose to expand this capability to three other harbors on Oahu, Hawaii, and Maui (Haleiwa, Hilo, Kahului) through the addition of new equipment.

With the development of an operational modeling system and, through the integration of existing data streams (PacIOOS and leveraged assets), it is now possible to expand our ocean information services beyond real-time measurements and begin providing ocean state forecast products. To accomplish this new forecasting role we request support to maintain two deep-water multi-purpose moorings off the coast of Oahu and to purchase one Liquid Robotics Wave Glider. The Wave Glider is a customizable autonomous oceanographic vehicle capable of extended open and coastal ocean deployments that supports a variety of sensor payloads measuring oceanographic and atmospheric variability. The system is powered by wave energy and uses solar panels to power integrated payloads and satellite

communications. We propose to outfit the Wave Glider with CO_2 sensors for integration into our coastal CO_2 monitoring array, an acoustic doppler current profiler (ADCP) for current measurements, and subsurface sensors of temperature, salinity, dissolved oxygen, and chlorophyll. Long-term deployments of the Wave Glider will provide data over a broad spatial area for inclusion in map-based products and serve to validate and assimilate into our regional numerical models.

The two deep-water moorings, capitalized through collaboration within SOEST and manufactured by McClane Labs, consist of fixed sensors and a profiling package that traverses the full water column. Measurements include the full range of properties (T, S, DO, turbidity, chlorophyll, PAR) as well as waves and currents at multiple levels. As a primary data source, these profilers will also provide essential validation and assimilation points for the circulation models and have been sited to maximize that assimilated value to the models. As the moored profilers do not have a surface expression (for security in heavily trafficked coastal waters), we propose to integrate acoustic modems into each profiler to enable the real-time transfer of subsurface data to the WaveGlider as it passes by the mooring locations.

To build observing system and technical capacity in the Insular Pacific jurisdictions we request resources to begin the assemblage of an instrument pool consisting of current meters, wave sensors, stream flow gages, and water quality sensors that can be used by partners in each PacIOOS sub-region to conduct short-term process studies and evaluate baseline marine ecosystem properties. Understanding the coastal marine environment is essential in the development of long-term monitoring plans and the site selection of future instrument deployments. Establishing observational capacity to measure and define variability in Insular Pacific marine ecosystems by using common, shared instrumentation has been requested by a multitude of users. Personnel central to PacIOOS will manage the instrument pool and train users on deployment, maintenance, and data processing and work with users to integrate data into the PacIOOS data management system as well as produce data products for local management needs.

While the bulk of the proposed PacIOOS work in the upcoming funding cycle is focused on pre-defined user priorities and the development of customized public information products, we also request funding for annual rapid event response. These additional resources will allow for component specific (e.g. HFR, AUV, T-LIDAR) observing system response (information, products, observations) to critical events that occur in the region including tsunamis (such as Samoa/Tonga 2009), severe runoff events, oil tanker spills, typhoons/cyclones (storm surge, flooding) and search-and-rescue. The Governing Council will direct the expenditure of rapid response funds in consultation with the U.S. IOOS Program Office, PacIOOS researchers, public emergency responders, and stakeholder groups.

Marine Ecosystem Monitoring and Information

SOEST is a major partner in the Ocean Tracking Network (www.oceantrackingnetwork.org) and currently supports an array of automated acoustic receivers that span the whole of the Hawaiian archipelago, from Midway Atoll to the Island of Hawai'i. These receivers monitor the presence of fish tagged with acoustic transmitters that broadcast a unique identification code and other information (depth, water properties). This array monitors movements of ecologically important top predators, and the data collected from this system are used to estimate transfer rates between areas, describe patterns of residency and associative behavior of groups of fish, to improve estimates of the population size, and to better inform local agencies regarding public safety issues with respect to sharks. Additionally, development of 'smart-tag' technology within this array allows for the transfer of data between tagged animals away from the receivers located near the Hawaiian Islands. This technology has the potential to revolutionize the collection of subsurface water property data essential to model validation and assimilation. We request funds to maintain this novel array, to continue technology development, and to expand the integration and distribution of ecologically important data to stakeholders.

The aggregation of existing biological data from previous studies and the development of standards by which that data can be served through the data management subsystem has been a priority area of development through the initial PacIOOS funding cycle. The continuation and expansion of data integration and distribution, an essential component of our marine ecosystem monitoring and information focus area, is described in the data management and education and outreach sections.

Modeling

At present, three modeling systems (atmospheric, waves and ocean circulation) produce a comprehensive package for ocean state prediction in the main Hawaiian Islands. The atmospheric Weather Research and Forecasting (WRF) model with assimilation is used to generate daily nowcast and forecasts for the main Hawaiian Islands region as well as higher resolution runs for each island. These are provided directly to the local NWS office and are used by the wave and ocean models for forcing. Using Wave Watch III and the Simulating Waves Nearshore (SWAN) models, daily nowcast and forecasts of ocean wave conditions are produced for each of the main Hawaiian Islands as well as for the entire Pacific basin. These forecasts provide estimates of wave run-up and allow estimates of inundation for use by state and federal agencies during storm mitigation efforts. 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. The ocean circulation fields are used to generate a number of products for stakeholders including: circulation estimates and forecasts, particle (drifter, plume) trajectories, probable locations of advection for search-and-rescue, and are currently being included in the development of an optimal ship routing tool for inter-island transportation. Each modeling group also uses numerical output to produce regular climatologies of key marine and atmospheric parameters.

We propose to maintain this baseline capacity for modeling and analysis and to expand each modeling suite to cover the whole of the jurisdictions within the first PacIOOS priority geographic area (Hawaii, Guam, American Samoa, CNMI). Implementation of new modeling domains will require 1 year of development per sub-region and will be executed by personnel hired through the funding proposed herein. Upon completion of model development, existing personnel responsible for maintaining each numerical model will assume operation of each new domain. Operational modeling for PacIOOS is run on a dedicated machine at SOEST, with model development occurring through the Hawaii Open System Computing facility at the University of Hawaii. Annual user fees are requested to support model development proposed herein.

Atmospheric: We propose to expand the WRF domain with assimilation to cover the Northwest Hawaiian Islands (NWHI), Guam, American Samoa, and the CNMI and to provide daily nowcast and forecasts of atmospheric conditions. These outputs will be fed directly to the regional NWS office and sub-regional Weather Forecast Offices (WFOs). Boundary conditions for the WRF sub-regional models will be drawn from existing NCEP 30km basin-scale model output.

Waves: PacIOOS presently runs Wave Watch III for the entire Pacific Basin at 100km resolution and at 10km resolution for the main Hawaiian Islands. We propose to expand this 10km spatial resolution to the NWHI and to the Commonwealth and Territories in the western and south Pacific. For islands containing population centers in our insular jurisdictions (Guam, Tutuila, Saipan, Tinian, Rota), we propose to use the SWAN model to generate nowcast and forecasts for each island at 1km resolutions.

Ocean: ROMS is presently run for the main Hawaiian Islands at 4km resolution with a nested grid covering the southern shore of Oahu at 1km resolution. We propose to expand this 1km grid to cover the whole of the main Hawaiian Islands and propose to expand the 4km grid to cover the NWHI, Guam, CNMI, and American Samoa. Essential to the expansion of the 4km grid is a basin-scale ROMS model from

which nested grids can be generated. Development of this basin-scale grid will be completed in the first year of effort. Validation of output and the provision of data for assimilation to the ocean model is an essential element of our modeling capacity in the Hawaiian Islands. For this purpose, PacIOOS presently operates an iRobot SeaGlider within the 1km Oahu ROMS grid and proposes to continue glider operations through use of capacity within the SOEST SeaGlider Operations Group. At a minimum we request 2 three-month missions per year with the ideal scenario allowing for four in the first year of proposed work, six in each of years 2 and 3, five in year 4, and four in year 5.

Data Management and Product Development

Central to the PacIOOS effort, and critical to its success, is the link between data (instruments) and information (data-synthesis products) in the data management system. The initial focus of the PacIOOS data management system has been to provide the architecture through which data from the observing network could be archived, evaluated, integrated, and transmitted to users in the form of raw data and refined products, including the development and maintenance of the PacIOOS web pages. The data management system, following the 2005 Data Management and Communication Plan for IOOS, and the 2009 PacIOOS Regional Data Management Plan provides five essential functions: 1) data archive, 2) metadata management, 3) data discovery tools, 4) data transport servers, and 5) on-line browse capabilities. More recently, IOOS has developed a guideline for implementation of DMAC subsystems within the regions. This specifies the additional task of sensor-to-database data acquisition. In this proposal, we combine this into the more broadly defined "data archive" activity. Data management activities are a critical component of the PacIOOS development effort. Maintenance of core capacity within the data management system is essential in any funding scenario and is presented first in this section. Additional support for system administration, server upgrade and replacement, and integrated biological product development is presented as a desirable add-on to existing data management core capacity.

***Data archive**:* The PacIOOS data archiving activities encompass initial data collection (at the individual sensor), to entry into a database or file system, to final archiving at NDBC. There are two main types of data steams within PacIOOS, data from active sensors (funded primarily through IOOS) and data from external sources. The first category includes near-shore sensors, gliders, HFR, water quality buoys, acoustic devices, and numerical models. The second category includes a huge variety of maps, single point measurements, databases, etc., both one-time and repeat observations, and are in various stages of maturity (e.g., ranging from hard-copy plots to complete databases with standard metadata). PacIOOS initially divided these into two distinct efforts and we propose to continue doing so. One part of the data management team is focused on maintaining the IOOS-funded data streams while another part of the team is focused on acquiring existing data in the region, including legacy data sets and continuous measurements made by PacIOOS partners. These include, for example, State Department of Health water quality measurements, NOAA and NWHI National Monument ecosystem data, USGS stream flow data, and an extensive list of data from providers region-wide. Finally, PacIOOS will continue to rely on NDBC for long-term archive, as well as providing data via the GTS, for all locally collected data (although at present PacIOOS has not identified any users who subscribe to GTS).

***Metadata management**:* PacIOOS is actively engaged in providing the most accurate metadata for all data and data services. This has allowed PacIOOS to become one of the first regional programs integrating assets into the National Data Catalog (http://ioos.gov/catalog/). Both FGDC and ISO metadata standards are used at present, and we will continue to rely on existing standards for metadata.

***Data discovery tools**:* Through the PacIOOS pilot project for Hawaii, and funds for the initial development of the PacIOOS RA, two different data discovery tools have been developed. Both are web-browser based; one (focused on the Hawaii domain) is based on GoogleMaps and allows users to geographically search for existing assets and data (www.soest.hawaii.edu/hioos/map/), while the other is

Insular Pacific focused and based on map services (GeoServer; http://128.171.104.45:8080/geoserver/www/styler/index.html). These two services were constructed as complementary, but separate services, based on input received through several meetings with stakeholders and data providers. Given the successful development of the PacIOOS RCOOS and RA, we have begun the integration of these two systems into a single system served through the PacIOOS web-portal.

Data transport: PacIOOS is presently running three complimentary data servers that allow for direct, binary access to the data archive. Two are based on Data Access Protocol (DAPPER and OPeNDAP), while the third is based on the Open Geospatial Consortium (OGC) Sensor Observation Service (SOS). OPeNDAP services are handled with Thematic Real-time Environmental Distributed Data Services (THREDDS). Our implementation of THREDDS (http://oos.soest.hawaii.edu/thredds/catalog.html) provides both Web Coverage Services (WCS) and a simple Web Map Service (WMS). The SOS implementation that we have employed is based on the IOOS standard developed by the OOSTETHYS group (http://oos.soest.hawaii.edu/oostethys/). Initially PacIOOS used TDS for the gridded data (e.g., model output) and SOS for point measurements. However, we now serve both point measurements and gridded data via TDS and propose further development of a more sophisticated map server for the wider Pacific region.

Data browse: The 2005 DMAC Plan specifies this component as providing users with a way to query data via web-based browsers. We interpret this more broadly to additionally include web page development and data product development (to provide users with information based on IOOS data). Web pages for PacIOOS will continue to be developed and maintained by the data management group. PacIOOS has employed three web-browsing tools: DChart (http://oos.soest.hawaii.edu/dchart/), Live Access Server (LAS; http://oos.soest.hawaii.edu/las/getUI.do) and the Environmental Research Division's Data Access Program (ERDDAP; http://oos.soest.hawaii.edu/erddap/info/index.html). All three allow for web-based data queries, sub-setting, plotting and data download. These servers access data both directly and through the PacIOOS TDS and we propose to expand the data holdings in these servers in concert with our regional liaisons and PacIOOS partners.

In addition to these five tenets of data management, product development has and will continue to be a primary focus of the data management as well as the education and outreach group. PacIOOS has recently hired a dedicated product developer within the data management system and proposes to hire an additional developer through this proposal. These product developers will work with existing focus groups, partners, regional liaisons, PacIOOS researchers, stakeholder groups, and the education and outreach staff to develop, refine, and display user-defined public information products for each of the PacIOOS observation and modeling components.

The PacIOOS effort continues to expand, and now includes several machines for data acquisition and archival. To date, the University of Hawaii/SOEST has led the effort, and all machines are owned and operated by the School. As PacIOOS continues to grow, we request additional support to upgrade and replace the existing SOEST machines and for a full-time system administrator to maintain the computing and data archive system hardware. Additionally, the system administrator will work to ensure PacIOOS standardization of data services, monitoring of server response and availability, tracking of data viewing and download, capture of web usage statistics, and will develop a service for registering data distributed through the PacIOOS data management system.

The Pacific Islands have long been a focus of research, science, and process studies by institutions around the world. The biological diversity (1/4 of all endangered species are found only in the PacIOOS region), abundance of marine and estuarine resources, temperate climate, and relative isolation have drawn incredible interest that has led to the collection of large amounts of biological and ecological data. Through this proposal, we request additional support for our outreach and data management groups

to work with regional partners (Papahanaumokuakea Marine National Monument, NOAA PIFSC, U.S. OBIS, NOAA Humpback Whale National Marine Sanctuary) on the identification of past, current, and proposed biological and ecological studies within the jurisdictions that comprise PacIOOS for the purposes of not only accessing available data sets (acoustic recordings, benthic surveys, fish population surveys, habitat mapping, bathymetric mapping, time series data) but also for collaboration on studies and/or sharing of resources and funding for projects. Data and information from this effort will inform the creation of an online database that allows for area-based or project-topic searches.

PacIOOS is currently engaged with the U.S. IOOS Program Office and regional partners on the development of data standards for the integration of biological data into the IOOS data management system. This PacIOOS data standards effort will continue through FY11 and all possible data sets identified through the proposed PacIOOS discovery and aggregation initiative will be integrated into PacIOOS web-based servers using standards identified through this ongoing project.

PacIOOS will actively collaborate with the other IOOS regional associations along with Pacific Ocean coastlines (AOOS, NANOOS, CENCOOS, and SCCOOOS) over the course of the funding cycle to advance stakeholder access to cross-regional data services as defined by commonalities in specified user requirements. At a minimum and initially, PacIOOS and the other Pacific RAs propose to improve access to existing data services (products, map-based visualizations, information) through collaborative effort to establish common website linkages. Future effort will focus on the development of shared visualization services (common Application Programming Interface (APIs) and Web-Map Services (WMS)) that focus on data and products common to all regions (i.e. glider data, model nowcasts and forecasts, key climate variables and high frequency radar). These common data services will be established and maintained as a core component of our DMAC effort.

Data management lead and PacIOOS co-PI Jim Potemra has been representing PacIOOS data management activities on the IOOS Data Integration Framework (DIF) team, and will continue to participate as the DIF evolves. He is also involved in numerous other national and international data management efforts including PI-GOOS, Argo, and the Asia-Pacific Data Research Center (APDRC).

Education and Outreach

The education and outreach team (E/O Coordinator Marcie Grabowski and a part-time individual to be hired through this proposal) will continue to work with PacIOOS investigators, liaisons, and technical staff to interpret and communicate effectively complex scientific information and data to natural resource managers, researchers, educators, and the public in a clear, understandable manner. They will focus on two main areas: (1) working with the data management group, regional liaisons, and existing stakeholder focus groups to maintain and update effective data products, web-based information, and web services and, (2) increasing the impact of ongoing outreach efforts through effective PacIOOS and IOOS branding, distribution of public outreach materials (flyers, PSAs, flat panel displays, commercials, press releases, articles, web features), generation of a regular newsletter detailing PacIOOS success stories, and collaboration with existing regional and national ocean outreach initiatives.

The education and outreach team, in cooperation with the web and product developers within the data management group, have worked with focus groups to refine web content and product design and will continue that regular engagement throughout the course of the proposed project period. The feedback received in these regular meetings, coupled with annual feedback from the larger stakeholder community at regional meetings, is a critical component that will allow PacIOOS to modify and fine-tune their products in response to user input.

Interpretation of real-time data and ocean observing products is an important part of the education and outreach mission. One area of successful development during the Hawaii pilot project has focused on placing real-time data in a larger temporal and spatial context through the development of a Hawaii Ocean

Atlas (www.soest.hawaii.edu/hioos/oceanatlas/index.htm). We propose to continue the development of this Ocean Atlas for each of the jurisdictions within the Pacific Islands region, populating the Atlas through the use of existing real-time observations and data derived from historical studies and observing programs.

Many efforts have been initiated to increase awareness for PacIOOS products and activities during the initial phase of system development. Public presentations and lectures showcasing PacIOOS developed products have been a consistent part of our outreach effort to date and will continue through his proposal. We have generated a PacIOOS Newsletter and will continue that publication as part of our regular outreach effort. Partners have provided 10 high-definition flat panel machines on which to display ocean observing public information products and community-specific data visualizations and we are in the process of developing content for and negotiating the deployment of those systems in high traffic areas (Waikiki Aquarium, College of the Marshall Islands, Palau International Coral Reef Center, American Samoa Public Library, Outrigger Hotels, Waikiki and Hawaii Yacht Clubs, Pacific Marine Resources Institute of Saipan). We are collaborating with local agencies and the regional NOAA team to populate those machines with additional content complementary to PacIOOS efforts and request funds through this proposal to augment, upgrade and replace our existing machines.

As concerned residents of the Pacific Islands region, we are dedicated to the "K through Gray" education of our public so that present and successive generations may make informed choices to enhance the use and preservation of the life-sustaining resource that is our ocean. As educators at various universities throughout the region, we are also dedicated to the preparation of our primary and secondary students and education of undergraduate and graduate students. PacIOOS has been involved in the collaborative generation of primary school curriculum through the NOAA-funded Navigating Change Program and, through the part-time education and outreach specialist to be hired through this proposal, will continue to work with the NFRA E/O Committee, Navigating Change, the Hawaii Ocean Resources Management Plan advisory body, as well as the UH Sea Grant College Program on the generation of marine science and oceanography modules for use in public schools. PacIOOS provides a foundation for research experiences for both undergraduate students at the University of Guam, the 10-campus University of Hawaii system, the College of Micronesia, the College of the Marshall Islands, and the American Samoa Community College. Work proposed herein will continue to develop that research foundation as well as provide support for graduate students through the M.S. and Ph.D. degree programs at the University of Guam and the University of Hawaii.

Project Management

In order to ensure that direct project goals are achieved effectively, 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 Governing Council of PacIOOS (Section 2.f) provides strategic and policy guidance to the system Director (Mr. Chris Ostrander) and is involved in the management of the observing system through an Executive Committee that meets between full Council meetings. Members of the Governing Council are elected by their peers to serve two-year terms and select from their membership a Chairperson to serve as the presiding officer of the Council (currently Dr. Brian Taylor, Dean of SOEST).

To ensure broad engagement of the diverse community of stakeholders in the Insular Pacific, PacIOOS has contracted regional liaisons at partner institutions in each jurisdiction to assist with the solicitation of local information, product, and service requirements, dissemination and evaluation of ocean information and products, and coordination of local stakeholder councils. These liaisons are the local face of the PacIOOS program and work to update and refine user requirements and priorities in the time between annual stakeholder workshops and training sessions in each jurisdiction. The network of regional

liaisons dedicated to the development of PacIOOS are the essential linkage between stakeholder expressed requirements and the observations, data, products, and services proposed, produced, and delivered by the PacIOOS.

The synergy realized from effective collaboration with existing regional and national ocean partnerships is a critical focus of the PacIOOS leadership. Director Ostrander serves as a member of NOAA's Pacific Islands Regional Collaboration Team, is a member of the Leadership Team for NOAA's Coastal Storms Program and works with both programs to ensure consideration and fulfillment of PacIOOS priorities within regional NOAA initiatives. Dean Taylor and Director Ostrander are both involved in Hawaii's Ocean Resource Management Plan implementation and oversight (Taylor at the executive level, Ostrander at the working group level) and both serve as the PacIOOS representatives to the National Federation of Regional Associations. Taylor also serves on the Board Executive of the Consortium for Ocean Leadership that has the NSF contract for implementing the Ocean Observing Initiative. PacIOOS is closely involved with the IOC regional ocean observing system for the Pacific, Data Management Lead (Dr. Jim Potemra) sits on the Advisory Board of the Pacific Islands Global Ocean Observing System (PI-GOOS). PacIOOS has and will continue to work closely with the Pacific Risk Management Ohana (PRiMO), the NOAA Integrated Data and Environmental Applications (IDEA) Center, the Pacific Climate Information System (PaCIS), the Pacific Islands Coastal Storms Program and the Pacific Regional Integrated Data Enterprise (PRIDE) to document stakeholder requirements, chronicle existing capacity, and ensure collaborative development of observing platforms, data servers, and public information products.

e. Milestone Schedule

A timeline for major tasks, target milestones for product development, and key project outcomes are shown in Appendix 3. Lines in blue represent observations; lines in red represent products; and lines in black represent modeling efforts.

f. Cost Proposal

See Appendix 4 (Cost Proposal) and Appendix 5 (detailed budget information)

g. References

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4. APPENDICES

Appendix 1: Figures/Tables

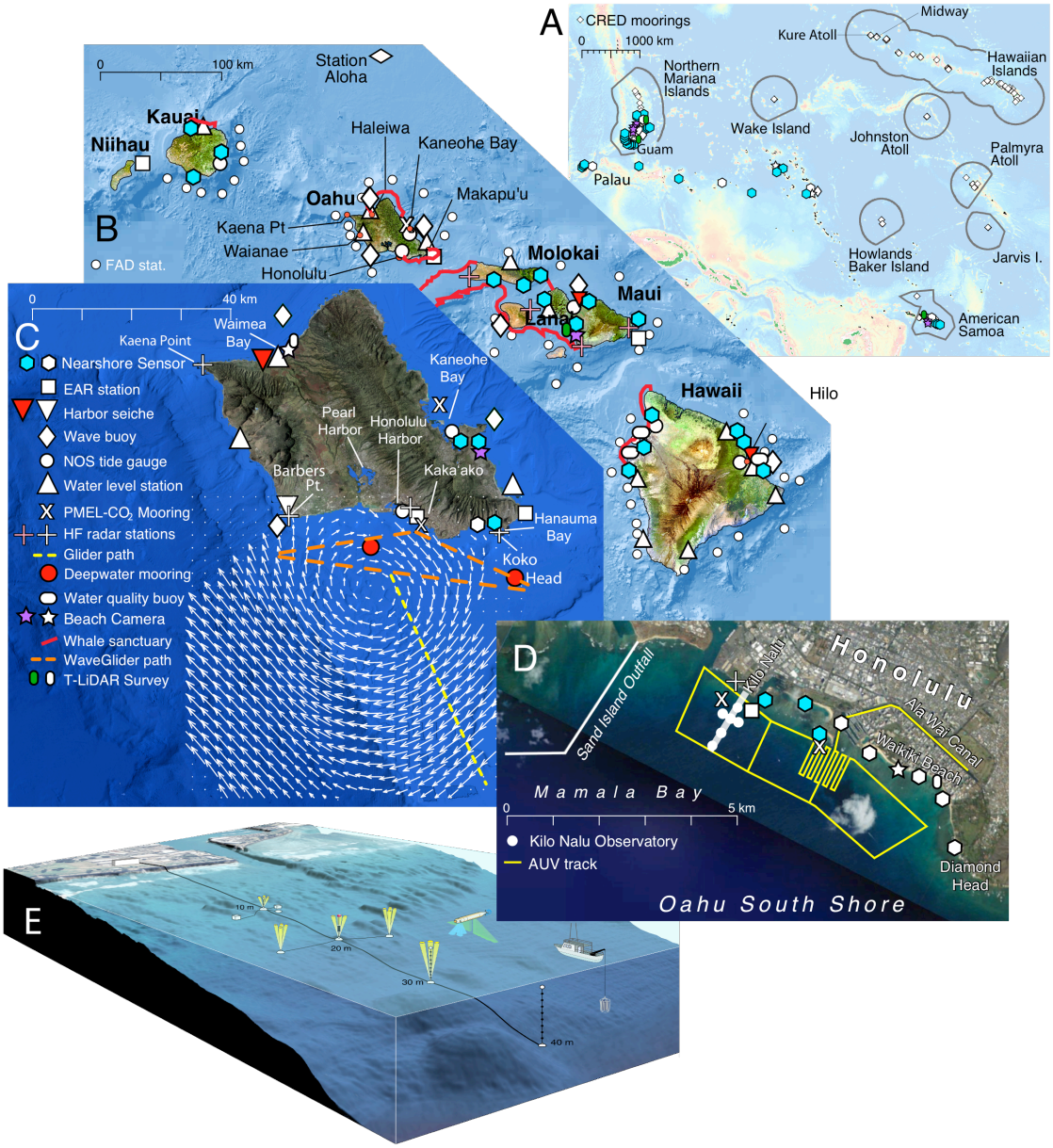

Figure 1: Observing system assets existing and in place by the beginning of 2011 (shown in white) and proposed observing system locations (colored shapes and lines) in (A) The PacIOOS region, (B) The main Hawaiian Islands, (C) The island of Oahu, (D) the Waikiki section of Mamala Bay and (E) The Kilo Nalu Nearshore Observatory off of Kaka'ako, Oahu. Proposed T-LiDAR and nearshore water quality sensor locations are approximate.

Table 1: IOOS-funded observing network assets currently operated by PacIOOS. More information about system type, variables measured, and location can be found at http://www.soest.hawaii.edu/hioos/data_product/assets.php.

Component Group	Instrument Type	Variables Measured	Location(s)
Kilo Nalu	ADCP	currents (u,v,w)Ts,Dp,Tp	Kaka'ako, Oahu
	Thermistor	T	Kaka'ako, Oahu
	Seahorse Profiler	T,S,P,turbidity,DO, chlorophyll-a	Kaka'ako, Oahu
HF Radio	WERA	Surface currents (u,v),Ts, Dp, Tp	Kaka'ako, Oahu Barber's Point, Oahu Koko Head, Oahu Kaena Point, Oahu (pending)
Water Quality	SBE 16+V2 with ECO FLNTUS	T,S,P, turbidity, chl-a	Waikiki Coast (x3) Cetti Bay, Guam (x1) Pago Pago, AS (x1) Laulau Bay, CNMI (x1) Majuro, RMI (x1) Koror, Palau (x1) Pohnpei, FSM (x1)
	SBE16+V2 without ECO FLNTUS	T,S,P	Waikiki Coast (x2)
	PMEL-CO2 Buoy	T,S,P, DO, CO2, turbidity, chlorophyll-a, nutrients	Kāne'ohe Bay, Oahu Ala Wai, Oahu Kaka'ako, Oahu
Gliders	iRobot SeaGlider	T,S,P,DO, chlorophyll-a	Various
Waves, Water Level, and Coastal Hazards	Waverider Buoy	Ts,Dp,Tp,Ta,SST	Waimea Bay, Oahu Mokapu Point, Oahu Kaumalapau, Lanai
	Nortek Aquadopp	currents (u,v,w), P, T	Kalaelao Harbor, Oahu
	Nortek AWAC	currents (u,v,w), P, T	Barbers Point, Oahu
Coastal Hazards	T-LiDAR	coastal imagery	Waimea Bay, Oahu Waikiki Beach, Oahu
	Camera (PL-A741)	coastal imagery	Waimea Bay, Oahu Waikiki Beach, Oahu
Remus AUV	Remus AUV	T,S,P,DO,turbidity, chlorophyll-a, currents (u,v,w), bathymetry	Various (Waikiki)
Fish Telemetry	VR3S modem	data telemetry from tags	Various (Hawai'i FADs)
	Fish tags	T, P	Various

Appendix 2: NOAA IOOS Prioritization Memorandum for PacIOOS

March 15, 2010

MEMORANDUM FOR: Brian Taylor
Dean and Principal Investigator
Pacific Islands Ocean Observing System
School of Ocean and Earth Science and Technology
University of Hawaii at Manoa

FROM: Zdenka S. Willis
Director, NOAA Integrated Ocean Observing System

SUBJECT: Prioritization of Effort of the Pacific Islands Ocean Observing System

This memorandum serves to inform you that the U.S. Integrated Ocean Observing System (IOOS®) recommends a prioritization of effort of the Pacific Islands Ocean Observing System (PacIOOS) for the purpose of future IOOS-funded activities beginning in FY10. This prioritization is driven by a lack of sufficient financial resources available to sustain and expand the current operations over the whole of the PacIOOS geographic domain.

The current regional focus of PacIOOS, which encompasses a vast area four times larger than the continental United States and includes the State of Hawaii, the Commonwealth and Territories of the United States in the Pacific, the Freely Associated States in the Pacific (the Federated States of Micronesia, the Republic of the Marshall Islands, the Republic of Palau), and the U.S. Minor Outlying Islands in the Pacific (Howland, Baker, Johnston, Kingman, Jarvis, Wake, Palmyra, Midway), will remain in effect for the two existing cooperative agreements (Pacific Integrated Ocean Observing System Regional Association Support 2008-2011, NA08NOS4730299 and Developing the Hawaii-Pacific Ocean Observing and Information System, NA07NOS4730207). The geographic scope of PacIOOS will remain as identified above for future cooperative agreements.

For future cooperative agreements, we recommend the first priority area of PacIOOS effort will be to develop, implement, and expand a coastal and ocean observing system for the State of Hawaii, the Commonwealth of the Northern Mariana Islands, and Territories of Guam and American Samoa. Stakeholders from the geographic areas within this main priority area should comprise the governing body of the PacIOOS Regional Association. Proposals for and progress towards developing an ocean observing system in the Pacific Islands region will be evaluated using this first priority area. A second priority area is develop, implement, and expand a coastal and ocean observing system in the U.S. Minor Outlying Islands and the Freely Associated States. We recommend including stakeholders from the locations listed within this second priority in the governing process of PacIOOS in an ex-officio capacity.

We understand the difficulties of establishing and maintaining a robust coastal and ocean observing system over the expanse of the PacIOOS geographic area, and appreciate the efforts PacIOOS has made to expand their work beyond the immediate shores of the Hawaiian Islands. We recognize PacIOOS presently employs personnel, operates observing systems and distributes data products to those locations listed in priority area two, and encourage PacIOOS to maintain their personnel support, system maintenance and data distribution to each of those jurisdictions.

If you have concerns regarding this issue, please contact James Verlaque at 301-427-2443.

Appendix 3. Milestone schedule

Text in blue denotes equipment deployed, red denotes product/data development, and black denotes modeling development.

FY11-12	FY12-13	FY13-14	FY14-15	FY15-16
Instrument Pool equipment continuously deployed				
2-5 3-month glider missions per year.				
Glider data assimilated by numerical ocean models				
	Barber's Point HFR deployed			
		Molokai HFR deployed		
			Lanai HFR deployed	
				Maui HFRs deployed
HFR surface currents online				
	Waveglider deployed			
	Profling moorings deployed			
	Waveglider and profiling mooring data assimilated by ocean models			
	Kahului harbor systems deployed			
	Hilo harbor systems deployed			
		Haleiwa harbor systems deployed		
	Harbor condition products available online			
8 Waverider buoys in operation in Hawaii, Guam, and the Marshall Islands				
		6 Coastal cameras installed		
			2 coastal cameras installed	
Real-time wave data and forecasts online				
High-water level forecasts available online				
Coastal camera imagery available online				
Ongoing T-Lidar surveys in Hawaii, Guam, CNMI, and American Samoa				
Ongoing AUV surveys along Waikiki				
AUV survey data on-line				
Water quality data and products online				
	Nearshore water quality sensors deployed through community groups			
	2 Nearshore stations upgraded			
Water quality indices on-line				
Sea level heights/trend products on-line				
ROM circulation model in operation for Hawaii				
WRF atmospheric model in operation for Hawaii				
Regional WWIII wave model in operation				
	Development of ROMS (high resolution) for Hawaii			
	Development of Pacific-basin ROMS models			
	ROMS, WRF, and WWIII models in operation for Guam and CNMI			
		ROMS, WRF, and WWIII models in operation for American Samoa		
			ROMS, WRF, and WWIII models in operation for NWHI	
Model data and products on-line				
Vessel traffic on-line				
Route forecasting and ocean condition products online				
Transmitting tags deployed on pelagics throughout year				
Service acoustic receivers throughout year				
Collate and prepare biological results for integration/model forecasting				
Ocean Atlas development and refinement ongoing				
Integration of biological data into data management system ongoing				
	Educational flat-panel displays installed and upgraded			

Appendix 4. Cost Proposal
A. Summary Budget Table

University of Hawai'i						
Developing the Pacific Islands Ocean Observing System						
PI: Dr. Brian Taylor						
Summary Proposal Budget						
		FY11-12	FY12-13	FY13-14	FY14-15	FY15-16
A	**Salaries and Wages**					
	Base Capacity	$ 992,865	$1,023,676	$1,109,674	$1,171,741	$1,236,554
	Enhanced Capacity	$ 474,692	$ 518,833	$ 539,445	$ 495,980	$ 510,859
	Total Salaries and Wages	$1,467,557	$1,542,509	$ 1,649,119	$1,667,721	$1,747,413
B	**Fringe Benefits**					
	Base Capacity	$ 213,802	$ 220,521	$ 241,009	$ 255,484	$ 270,613
	Enhanced Capacity	$ 103,649	$ 114,132	$ 119,228	$ 120,285	$ 123,625
	Total Fringe Benefits	$ 317,451	$ 334,653	$ 360,237	$ 375,769	$ 394,238
C	**Travel**					
	Base Capacity	$ 59,000	$ 64,000	$ 64,500	$ 65,000	$ 65,500
	Enhanced Capacity	$ 25,000	$ 25,500	$ 15,500	$ 13,000	$ 13,000
	Total Travel	$ 84,000	$ 89,500	$ 80,000	$ 78,000	$ 78,500
D	**Equipment**					
	Base Capacity	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000
	Enhanced Capacity	$ 510,000	$ 240,000	$ 100,000	$ 70,000	$ -
	Total Equipment	$ 565,000	$ 295,000	$ 155,000	$ 125,000	$ 55,000
E	**Supplies**					
	Base Capacity	$ 66,000	$ 66,000	$ 66,000	$ 66,000	$ 66,000
	Enhanced Capacity	$ 154,726	$ 174,726	$ 177,726	$ 177,426	$ 171,226
	Total Supplies	$ 220,726	$ 240,726	$ 243,726	$ 243,426	$ 237,226
F	**Contractual**					
	Base Capacity	$ 48,000	$ 49,500	$ 51,075	$ 52,725	$ 54,465
	Enhanced Capacity	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000
	Total Contractual	$ 54,000	$ 55,500	$ 57,075	$ 58,725	$ 60,465
G	**Construction**					
	Total Construction	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
H	**Other**					
	Base Capacity	$ 337,800	$ 350,946	$ 364,092	$ 377,238	$ 390,384
	Enhanced Capacity	$ 346,500	$ 438,800	$ 426,500	$ 394,900	$ 339,900
	Total Other	$ 684,300	$ 789,746	$ 790,592	$ 772,138	$ 730,284
I	**Direct Costs**					
	Base Capacity	$1,772,467	$1,829,643	$1,951,350	$2,043,188	$2,138,517
	Enhanced Capacity	$1,620,567	$1,517,990	$1,384,399	$1,277,591	$1,164,610
	Total Direct Costs	$3,393,034	$3,347,634	$3,335,749	$3,320,779	$3,303,127
J	**Indirect Costs**					
	Base Capacity	$ 385,949	$ 395,993	$ 421,276	$ 440,448	$ 463,845
	Enhanced Capacity	$ 221,017	$ 256,373	$ 242,975	$ 238,773	$ 233,027
	Total Indirect Costs	$ 606,966	$ 652,366	$ 664,251	$ 679,221	$ 696,874
K	**Total**					
	Base Capacity	$2,158,416	$2,225,637	$2,372,627	$2,483,637	$2,602,362
	Enhanced Capacity	$1,841,584	$1,774,363	$1,627,374	$1,516,364	$1,397,637
	Program Total	**$4,000,000**	**$4,000,000**	**$4,000,000**	**$4,000,000**	**$4,000,000**

B. Detailed Budget Table

Detailed budget information listed by component and item, separated into budget categories. Cells with a white background indicate items that are essential to maintain base capacity. Cells with a blue background indicate items that would enhance PacIOOS capacity in the region. A detailed description of each component and item is included in Appendix 5.

University of Hawai'i							
Developing the Pacific Islands Ocean Observing System							
PI: Dr. Brian Taylor							
Summary Proposal Budget							
Costs by component and item, by category							
			FY 11-12	FY12-13	FY13-14	FY14-15	FY15-16
1	**Water Quality and Nearshore Cabled Observations**						
A	**Salaries and Wages**						
	a Nearshore sensor Technician	12 mo/yr	45000	46350	47741	49173	50648
	b Technician, NGO partnership sensors	12 mo/yr	45000	46350	47741	49173	50648
	c Buoy Technician	6 mo/yr	25000	25750	26523	27318	28138
	d Marine Operations Technician (DeCarlo)	2 mo/yr	8000	8240	8487	8742	9004
	e Undergraduate assistant (Adolf)	$10/hr	3000	3000	3000	3000	3000
	f Undergraduate assistant (McManus)	$10/hr	2000	2000	2000	2000	2000
	g Undergraduate assistant (DeCarlo)	$10/hr	2000	2000	2000	2000	2000
B	**Fringe Benefits**						
	a Base Capacity		19528	20113	20716	21336	21975
	B Enhanced Capacity		11250	11588	11935	12293	12662
C	**Travel**						
	a sensor servicing, Insular Pacific		9000	9000	9000	9000	9000
	b community sensor deployment/service		15000	12500	7500	5000	5000
D	**Equipment**						
	a Water quality sensors (NGO Partnerships)	$4k x 25/10	100000	40000	0	0	0
	b nearshore sensor upgrades (NS03, NS04)	$20k each	40000	0	0	0	0
E	**Supplies**						
	a general supplies		10000	10000	10000	10000	10000
	b water quality sensor supplies		20000	30000	30000	30000	30000
H	**Other**						
	a Instrument insurance		21650	21650	21650	21650	21650
	b Telemetry		9000	9000	9000	9000	9000
	c additional Telemetry		24000	31200	31200	31200	31200
	d vessel support		7250	7250	7250	7250	7250
	e sensor shipping		2250	2250	2250	2250	2250
	f additional sensor shipping		7500	10500	0	0	0
	g sensor calibration		9000	9000	9000	9000	9000
	h additional sensor calibration		16500	17200	17200	17200	17200
	i analytical costs		10000	10000	10000	10000	10000
	j network fees		420	420	420	420	420
	k Kilo Nalu User Feeds	$7083/mo	85000	85000	85000	85000	85000

	AUV Surveys	$2,666/day, 15 days	40000	40000	40000	40000	40000
I	**Direct**						
	a Base Capacity		268098	271023	274036	277139	280335
	B Enhanced Capacity		319250	239338	185576	184866	186710
J	**Indirect**						
	a Base Capacity (25% * (Base Direct - Kilo Nalu - vessel support - network fees))		43857	44588	45341	46117	46916
	b Enhanced Capacity (25% * (Enhanced Direct - AUV - Equipment))		34813	39834	36394	36217	36678
	Subtotal Base Capacity		311955	315611	319377	323256	327251
	Subtotal Enhanced Capacity		354063	279172	221970	221083	223388
K	**Total Water Quality and Nearshore Cabled Observations**		666018	594783	541348	544339	550639
2	**Waves, Harbors, and Coastal Inundation**						
A	**Salaries and Wages**						
	a Graduate Student (product development)	12 mo/yr	25000	25750	26523	27318	28138
	b Buoy technician (waves and harbors)	12 mo/yr	60000	61800	63654	65564	67531
	c Technician (water level forecast)	2 mo/yr	10000	10300	10609	10927	11255
	d Technician (wave buoys)	2 mo/yr	10000	10300	10609	10927	11255
	e Technician Hawaii coastal cameras)	2 mo/yr	10000	10300	10609	10927	11255
	f Technician (Pacific coastal cameras)	2 mo/yr	0	10300	10609	10927	11255
	g Technician (MMP moorings)	5.5 mo/yr	23833	24548	25284	26043	26824
	h Programmer (MMP moorings)	12 mo/yr	66000	67980	70019	72120	74284
	I Technician (WaveGlider)	6 mo/yr	30000	30900	31827	32782	33765
	j Investigator (MMP moorings)	1 mo/yr	15000	15450	15914	16391	16883
B	**Fringe Benefits**						
	a Base Capacity		25083	25835	26610	27408	28231
	b Enhanced Capacity		38102	42232	43499	44804	46148
C	**Travel**						
	a T-Lidar surveys and camera maintenance		5000	8000	8000	8000	8000
D	**Equipment**						
	WaveGlider w/ sensor payloads		220000	0	0	0	0
	Acoustic modem for MMP moorings	$10k x 2	20000	0	0	0	0
	Coastal camera	$10k x 8	0	60000	0	20000	0
	Harbor water level and current meters	$40K x 3	80000	40000	0	0	0
E	**Supplies**						
	a wave buoy and harbor supplies		50000	50000	50000	50000	50000
	b additional wave buoy supplies		24000	24000	24000	24000	24000
	c MMP mooring supplies		56226	56226	56226	56226	56226
	d additional coastal camera supplies		0	4000	1000	3500	1500
	e additional harbor supplies		5000	5000	5000	5000	5000
F	**Contractual**						
	CDIP for Hawaii WaveRider buoys	$3k x 6					
	a less than 25k threshhold		18000	1000	0	0	0
	b over 25k threshhold		0	17000	18000	18000	18000
	CDIP for Guam & Majuro WaveRider buoys	$3k x 2					
	a less than 25k threshhold		6000	0	0	0	0
	b over 25k threshhold		0	6000	6000	6000	6000

H	**Other**						
	a MMP insurance		15000	15000	15000	15000	15000
	b MMP freight		6000	6000	6000	6000	6000
	c MMP vessel costs		1000	1000	1000	1000	1000
	d MMP truck transport		12000	12000	12000	12000	12000
	e UH network fees		500	500	500	500	500
	f T-Lidar Surveys		85000	85000	85000	85000	85000
I	**Direct**						
	a Base Capacity		198083	201985	206005	210145	214409
	b Enhanced Capacity		718661	524436	427487	456220	440640
J	**Indirect**						
	a Base Capacity (25% * (Base Direct - Base Contractual over 25k))		49521	46246	47001	48036	49102
	b Enhanced Capacity (25% * (Enhanced Direct - Equipment - Enhanced Contractual over 25k - vessel costs - network fees - TLiDAR surveys))		78040	97984	83747	90930	87035
	Subtotal Base Capacity		247603	248231	253006	258181	263511
	Subtotal Enhanced Capacity		796701	622420	511234	547150	527674
K	**Total Waves, Harbors and Coastal Inundation**		**1044304**	**870651**	**764239**	**805330**	**791186**
3	**High Frequency Radio**						
A	**Salaries and Wages**						
	a Investigator, Pierre Flament	1 mo/yr	11463	11807	12161	12526	12902
	b Technician, Ken Constantine	12 mo/yr	51600	53148	54742	56385	58076
	c Technician	12 mo/yr	51600	53148	54742	56385	58076
	d Technician	0/6/12/12/12 mo/yr	0	0	54742	56385	58076
	e Technician	0/0/0/6/12 mo/yr	0	0	0	28193	58076
	f Graduate student	12 mo/yr	23946	24664	25404	26166	26951
	g Graduate student	12 mo/yr	23946	24664	25404	26166	26951
B	**Fringe Benefits**		29784	30677	45283	53690	62560
C	**Travel**						
	a Instrument deployment/service		0	5000	5500	6000	6500
D	**Equipment**						
	a 16-Channel Doppler Radio, UH construction, 1 unit	1 unit/year	55000	55000	55000	55000	55000
H	**Other**						
	a Utilities - power, 1.5KW x $.35/kWh x # radios	5/6/7/8/9	22680	27216	31752	36288	40824
	b Telecom, $110/site/mo x # radios	5/6/7/8/9	6600	7920	9240	10560	11880
	c Electronics Maintenance, 5%/yr x $55,000 x # radios	5/6/7/8/9	13750	16500	19250	22000	24750
	d Vehicle, $.50/mi		5200	6240	7280	8320	9360
	e Computer replacement/upgrade		5000	7500	10000	12500	15000
	f Computer media, 2Tb/year/site x # sites x $500 Tb	5/6/7/8/9	5000	6000	7000	8000	9000
	g Electrical hookup		7000	7000	7000	7000	7000
I	**Direct**		312569	336485	424502	481564	540983
J	**Indirect** (25% * (Direct - Equipment))		64392	70371	92375	106641	121496
K	**Total High Frequency Radio**		**376961**	**406856**	**516877**	**588204**	**662479**

4	**Fish Telemetry**						
A	**Salaries and Wages**						
	a Technician	9 mo/yr	39000	40170	41375	42616	43895
	b Technician	3 mo/yr	13000	13390	13792	14205	14632
B	**Fringe Benefits**						
	a Base Capacity		7800	8034	8275	8523	8779
	b Enhanced Capacity		2600	2678	2758	2841	2926
H	**Other**						
	a replacement recievers, boat time		20000	20000	20000	20000	20000
	b additional supplies		15000	15000	15000	15000	15000
	c fish tags		8000	8000	8000	8000	8000
	d additional fish tags		24000	25400	23600	32000	17000
I	**Direct**						
	a Base Capacity		74800	76204	77650	79140	80674
	b Enhanced Capacity		54600	56468	55150	64047	49558
J	**Indirect**						
	a Base Capacity (25% * Base Direct)		18700	19051	19413	19785	20168
	b Enhanced Capacity (25% * Enhanced Direct)		13650	14117	13788	16012	12389
	Subtotal Base Capacity		93500	95255	97063	98925	100842
	Subtotal Enhanced Capacity		68250	70585	68938	80058	61947
K	**Total Fish Telemetry**		**161750**	**165840**	**166000**	**178983**	**162790**
5	**Modeling**						
A	**Salaries and Wages**						
	a Ocean Model Technician	12 mo/yr	65000	66950	68959	71027	73158
	b Wave Model Technician	8 mo/yr	43330	44630	45969	47348	48768
	c Wave Model Technician	4 mo/yr	21670	22320	22990	23679	24390
	d Atmospheric Model Technician	8 mo/yr	43330	44630	45969	47348	48768
	e Atmospheric Model Technician	4 mo/yr	21670	22320	22990	23679	24390
	e Graduate Student (ocean model development)	12 mo/yr	23022	23713	24424	0	0
	e Graduate Student (atmos. model development)	12 mo/yr	25347	26107	26891	0	0
	f Technician (wave model development)	6 mo/yr	24000	24720	25462	0	0
B	**Fringe Benefits**						
	a Base Capacity		19564	20151	20756	21378	22020
	b Enhanced Capacity		12329	12699	13080	6109	6293
C	**Travel**						
	a site visits for model development		5000	5000	0	0	0
	Supplies						
	a general supplies	RAID storage	3000	3000	3000	3000	3000
	b additional supplies	workstations	1000	3000	3000	3000	3000
H	**Other**						
	a Glider surveys	$40k per 3-month survey	80000	80000	80000	80000	80000
	b additional glider surveys		80000	160000	160000	120000	80000
	c Hawaii Open System Computing user fees		20000	20000	20000	20000	20000

I	**Direct**						
	a Base Capacity		254224	259361	264652	270101	275714
	b Enhanced Capacity		234038	319879	318836	196468	158072
J	**Indirect**						
	a Base Capacity (25% * (Base Direct - Base Glider surveys))		43556	44840	46163	47525	48929
	b Enhanced Capacity (25% * (Enhanced Direct - Enhanced Glider surveys - HOSC Fees))		33510	34970	34709	14117	14518
	Subtotal Base Capacity		297780	304201	310815	317627	324643
	Subtotal Enhanced Capacity		267548	354849	353544	210585	172590
K	**Total Modeling**		**565328**	**659050**	**664359**	**528212**	**497233**
6	**Data Management**						
A	**Salaries and Wages**						
	a Server Administrator	12 mo/yr	72000	74160	76385	78676	81037
	b Web and Data Specialist	12 mo/yr	65000	66950	68959	71027	73158
	c Data telemetry specialist	12 mo/yr	65000	66950	68959	71027	73158
	d Web and Product Developer	12 mo/yr	63150	65045	66996	69006	71076
	e System Administrator	12 mo/yr	70000	72100	74263	76491	78786
	f Web and Product Developer	12 mo/yr	63150	65045	66996	69006	71076
B	**Fringe Benefits**						
	a Base Capacity		66288	68276	70324	72434	74607
	b Enhanced Capacity		33288	34286	35315	36374	37465
D	**Equipment**						
	a replacement server	50k each	0	50000	50000	0	0
E	**Supplies**						
	a general supplies		1000	1000	1000	1000	1000
	b additional supplies		2500	2500	2500	2700	2500
H	**Other**						
	a network fees		1000	1000	1000	1000	1000
	b disk maintenance		4000	4000	4000	4000	4000
I	**Direct**						
	a Base Capacity		337438	347381	357622	368171	379036
	b Enhanced Capacity		168938	223931	229074	184571	189827
J	**Indirect**						
	a Base Capacity (25% * (Base Direct - network fees))		84109	86595	89156	91793	94509
	b Enhanced Capacity (25% * (Enhanced Direct - Equipment))		42234	43483	44768	46143	47457
	Subtotal Base Capacity		421547	433976	446778	459963	473545
	Subtotal Enhanced Capacity		211172	267413	273842	230713	237284
K	**Total Data Management**		**632719**	**701389**	**720619**	**690677**	**710828**

7	**Management, Outreach, and Education**						
A	**Salaries and Wages**						
	a Director	12 mo/yr	82000	84460	86994	89604	92292
	b Education and Outreach Coordinator	12 mo/yr	67000	69010	71080	73213	75409
	a Regional Liaison Coordinator	3 mo/yr	17500	18900	19845	20837	21879
	d American Samoa Liaison	2 mo/yr	9000	9450	9922.5	10419	10940
	e Marshall Islands Liaison	2 mo/yr	9000	9450	9922.5	10419	10940
	f Education and Outreach Specialist	0/4/5/9/9 mo/yr	0	19600	25235	45423	46786
	g Instrument Pool Technician	6 mo/yr	23000	23690	24401	25133	25887
B	**Fringe Benefits**						
	a Base Capacity		45756	47435	49045	50714	52442
	b Enhanced Capacity		6081	10650	12641	17864	18131
C	**Travel**						
	a Governing Council Meetings		25000	25000	25000	25000	25000
	b NFRA, IOOS, Stakeholder Meetings		25000	25000	25000	25000	25000
D	**Equipment**						
	A Instrument Pool		50000	50000	50000	50000	0
E	**Supplies**						
	a General Supplies		2000	2000	2000	2000	2000
	b Instrument Pool Supplies		2000	6000	8000	9000	9000
	c Event Rapid Response Supplies		40000	40000	40000	40000	40000
	d Flat panel upgrades	2k each	4000	4000	8000	4000	0
F	**Contractual**						
	University of Guam (Guam Liaison)	2 mo/yr					
	a less than 25k threshhold		10000	10500	4500	0	0
	b over 25k threshhold		0	0	6525	11575	12155
	PMRI (CNMI Liaison)	2 mo/yr					
	a less than 25k threshhold		10000	10500	4500	0	0
	b over 25k threshhold		0	0	6525	11575	12155
	Palau Int. Coral Reef Center (Palau Liaison)	2 mo/yr					
	a less than 25k threshhold		10000	10500	4500	0	0
	b over 25k threshhold		0	0	6525	11575	12155
H	**Other**						
	a Printing, workshops, and communications		10000	10000	10000	10000	10000
	b NFRA dues		5000	5000	5000	5000	5000
I	**Direct**						
	a Base Capacity		327256	337205	346885	356930	367366
	b Enhanced Capacity		125081	153940	168277	191420	139803
J	**Indirect**						
	a Base Capacity (25% * (Base Direct - Contractual over 25k))		81814	84301	81827	80551	82725
	b Enhanced Capacity (25% * (Enhanced Direct - Equipment))		18770	25985	29569	35355	34951
	Subtotal Base Capacity		409070	421506	428712	437481	450091
	Subtotal Enhanced Capacity		143851	179924	197846	226775	174754
K	**Total Management, Outreach, and Education**		**552921**	**601431**	**626558**	**664255**	**624845**
8	**PacIOOS Program Totals**						
	Subtotal Base Capacity		2,158,416	2,225,637	2,372,627	2,483,637	2,602,362
	Subtotal Enhanced Capacity		1,841,584	1,774,363	1,627,374	1,516,364	1,397,637
8	**Total PacIOOS**		**4,000,000**	**4,000,000**	**4,000,000**	**4,000,000**	**4,000,000**

Appendix 5: Budget Narrative

General Information

The following general information pertains to all aspects of the included budget. This information is provided as requested in NOAA's publication "Additional Explanations, Tips, and Definitions for Grants and Cooperative Agreements".

Salaries and Wages. All personnel are employees of the applicant organization. An annual cost of living adjustment of 3% has been built in to each budget year.

Fringe Benefits. Fringe rates are 36.68% for Faculty and Staff of the University of Hawaii and for staff of the Research Corporation of the University of Hawaii (RCUH) and include standardized benefits established by the RCUH and the University of Hawaii. When known, accurate fringe rates where used in the budget in place of the standard rate. The University of Hawaii has established fringe rates for Graduate Assistants at 7.53% and Undergraduate Student hires at .40%.

Travel. Travel requested is detailed in each component below. All requests are estimates based on costs from previous trips.

Equipment. Each piece of equipment to be purchased is specified in the detailed budget, and descriptions are given in the following justification. All general-use equipment proposed herein will be used 100% for this project. All equipment to be purchased is itemized in the detailed budget table (Appendix 4). Upon the completion of the work proposed project all equipment will be requested to remain with the University of Hawaii. A lease versus purchase analysis is included, where appropriate, in each component description.

Supplies. An explanation is provided for supplies in the budget narrative and line-item budget, where appropriate.

Contractual. Each subcontract is listed as a separate item. Services to be obtained from the contracts are provided in the justification. UH policy is to charge indirect costs to the first $25k of each unique subcontract. All subcontracts (liaison and CDIP) are to be awarded as multi-year contracts. As such, the first $25k of each subcontract (cumulative over the 5-year period) is charged indirect costs at the standard rate of 25%.

Other. Items are described in the detailed budget by type of material or nature of expense.

Indirect costs. The indirect costs are based on the approved Indirect Cost Rate Agreement and charged at a rate of 25% (On-Campus, Other sponsored activity). A copy of the approved rate agreement is included as part of this application (Appendix 12).

The following narrative describes components of each subcategory for which we request funding. All funds will be received by the University of Hawaii at Manoa, located in Honolulu, Hawaii, within the 1st Congressional District of Hawaii. Small sub-contracts will be extended to select partners (detailed below). Work proposed within this project will be performed primarily on the campus of the University of Hawaii at Manoa (modeling, data management, project management), within the Pacific Islands region (outreach and education, stakeholder engagement, product distribution), and in the coastal and open ocean waters of the

U.S. EEZ in the Pacific (observational network). Work will be performed in the 1st and 2nd Congressional Districts of Hawaii, the 3 At-large Congressional Districts of Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands, and in the three U.S. Affiliated Nations in the Pacific (Republic of Palau, Republic of the Marshall Islands, and Federated States of Micronesia). Via subcontract, work is also performed in the 53rd Congressional District of California.

1 Water Quality and Nearshore Cabled Observations

Salaries. To maintain base capacity, we request support for: 1) a technician (1 FTE) to maintain the existing nearshore sensors in Hawaii and the Insular Pacific, 2) a buoy technician (0.5 FTE) responsible for inspection, installation, and routine maintenance of the CO_2 buoys and their attendant instrumentation, 3) a marine operations technician (.16 FTE) to assist with CO_2 buoy maintenance and servicing and, 4) three part-time undergraduate students ($10/hr) to assist with the maintenance of the nearshore sensors, CO_2 buoys, and Hilo Bay buoy. To enhance capacity we request a technician (1 FTE) to order, configure, distribute, and work with our PacIOOS liaisons, ACT and community groups to install additional water quality sensors region-wide.

Travel. To maintain base capacity, funds are requested for one technician to travel to each Insular Pacific jurisdiction to service our existing nearshore water quality sensors. Cost estimates for these trips (3 x 1 week each at $3,000 per trip) are derived from previous trips. To enhance capacity we request additional resources to support multiple trips to guide the installation of water quality sensors region-wide.

Equipment. To maintain base capacity, we do not request any additional equipment. To enhance capacity we request funds to purchase 35 additional nearshore water quality sensor packages ($4,000 each) that have been chosen in consultation with the regional ACT team to maximize observations of priority stakeholder variables (temperature, salinity, turbidity) with minimal maintenance and cost. These systems (YSI 600 OMS w/ flourometer and Raven XT modem for real-time output) will be purchased and configured by the technician requested above and deployed in partnership with local community groups in each jurisdiction. These systems are compatible with the existing data telemetry systems already used by PacIOOS. Data from these sensors will stream in near real-time via the PacIOOS website. These systems are a custom configuration and a lease option is not available. Additionally, we request funds to upgrade two existing nearshore sensors in the Waikiki region to measure additional variables (pressure, chlorophyll, turbidity). These systems, which include a Sea-Bird Electronics (SBE) 16+V2 and a Wetlabs ECOCLNTUS are custom configured and a lease option is not available.

Supplies. Funds are requested to purchase general supplies for the water quality instruments. These funds also include batteries, mounting hardware and other minor supplies necessary for sensors (e.g., replacement antifouling devices) and buoy maintenance (sandpaper, fiberglass, epoxy resin, E-paint, sacrificial anodes).

Other. The proposed budget includes funds for access and field support expenses for the Kilo Nalu Observatory (see http://www.soest.hawaii.edu/OE/KiloNalu/). The Observatory, managed and operated as a facility by UH SOEST, provides cabled power and data connections at 12 and 20 m depth offshore of Kakaako Waterfront Park, just west of Ala Moana on the south shore of Oahu and is an essential component of PacIOOS base capacity. The instrumentation deployed currently includes an acoustic profiler, thermistor chain and water chemistry measurements at 12m and 20m depths, and two moored profiling instruments (Sea-Horse). The baseline array is presently being expanded under NSF and ONR

funding with a bottom fixed thermistor chain extending offshore to a depth of 100m. The proposed work will continue use of Kilo Nalu baseline array to provide data products on water quality, currents, waves and stratification.

The access charge of $7083 per month is determined based on estimated annual costs for technical support, management, administration and peripheral expenses to maintain and operate the backbone cabled system, distributed among a target base of eight users. Access charges include indirect costs at a rate of 12.8%.

At a minimum, we also request funds essential to component operation, as detailed below. Funds are requested for insurance of water quality instrumentation. Funds are requested to cover the cost of cell phone coverage for near-real time data transmission from the in-water instruments to the database. Funds are requested for certified factory instrument servicing and calibration at manufacturer-recommended time intervals. We request funding for one ($420) personal computer connection to the SOEST network annually. All SOEST personal computers are charged a quarterly fee to support network operation and maintenance. We request $7,250 to support routine at sea operations (mainly service and maintenance with a small boat) and event sampling expeditions and to carry out annual buoy haul-outs using a mid-sized coastal vessel equipped with a boom capable of lifting the entire buoy/sensor mooring assembly out of the water and transporting it to the UH Marine Facility and for subsequent redeployment. Funds are requested to support recharge based laboratory analyses of water samples collected for the purposes of 1) ground-truth and verify buoy sensor data and 2) for event based sampling necessary to develop dispersion maps of water quality (especially nutrients and possibly bacterial abundances).

To enhance PacIOOS water quality capacity we request additional funds for sensor shipping, calibration, and telemetry as well as funds for regular and event-driven surveys of Waikiki coastal waters using a REMUS autonomous underwater vehicle (AUV). The budget includes support for 12 monthly and 3 event-driven 1-day surveys. Survey costs are calculated using a day use charge for the SOEST REMUS AUV. The day charge is determined based on estimated annual costs for technical support, management, administration and peripheral expenses to maintain and operate the AUV at a usage rate of 60 days per year. Day charges include indirect costs at a rate of 12.8%.

2 Waves, Harbors, and Coastal Inundation

Salaries. To maintain base capacity, we request funding to support four personnel: 1) a buoy technician (1 FTE) to support existing CDIP buoys in the region as well as harbor instrumentation in Barber's Point Harbor, 2) a graduate student (1 FTE) to develop and refine harbor products, 3) a technician (0.16 FTE) to maintain our existing cameras in Waikiki and Waimea Bay, and 4) a technician (0.16 FTE) to refine and maintain our high water level forecasting tool. To enhance PacIOOS capacity for wave, harbor, and coastal inundation monitoring and forecasting we request additional support (0.16 FTE) for a technician to maintain the CDIP buoys in Guam and Majuro, additional support for our camera technician (0.16 FTE) to install and operate cameras in Insular Jurisdictions, a Wave Glider technician (0.5 FTE) to operate and maintain the Wave Glider, as well as support for three individuals to deploy, maintain, and manage the 2 MMP moorings to be installed in the waters south of Oahu (1 programmer (1 FTE), 1 technician (0.45 FTE), and 1 Investigator (0.08 FTE)). The MMP moorings have been purchased through another source of funding and we proposed to maintain and operate them through PacIOOS.

Equipment. To enhance PacIOOS observational capacity we request funds to purchase one Wave Glider autonomous vehicle outfitted with temperature, salinity, dissolved oxygen, chlorophyll and CO_2 sensors as

well as a profiling acoustic current meter. We also request funds to purchase and install two WHOI acoustic modems on our MMP moorings that will allow the Wave Glider to download and retransmit data from the MMP moorings to the PacIOOS shore station at Kakaako. These systems are customized and a lease option is not available. We request funds to purchase additional harbor monitoring systems (Nortek Aquadopp and Nortek AWAC) to be installed at Hilo Harbor (Hawaii Island), Kahului (Maui) and Haleiwa (Oahu). These systems are customized and intended to be permanent equipment in the observational array. As such, a lease option is not viable. We also request funds to purchase and deploy 8 additional coastal camera systems (Firewire 1394 Dcam, with lenses, hard drives, loggers, and housing) in each of the PacIOOS jurisdictions. There is not a lease option available for this equipment.

Travel. Should funds be available to enhance capacity for observations, we request funds to support annual camera maintenance and T-LiDAR surveys in each of Guam, American Samoa, and the CNMI.

Supplies. At a minimum, we request funds for supplies (cables, lenses, hardware, mooring equipment) adequate for the maintenance and operation of our existing equipment. To maintain enhanced capacity, we request additional supplies for each of the MMP moorings, the Wave Glider, new camera systems, and harbor sensor packages including housings, batteries, anti-fouling agent, hard drives, lenses, mooring equipment, straps, steel chain, and e-tape.

Contractual. A contractual charge is included for data quality control, archive, and online wave products from the existing and proposed PacIOOS wave buoys with the Coastal Data Information Program (CDIP) at the Scripps Institution of Oceanography. Work by CDIP will be performed in La Jolla, California, in the 53rd Congressional District of California. CDIP has been instrumental in establishing directional wave buoys in the region in collaboration with UH investigators. Each buoy is charged at a rate of $3,000 per year. A SF-424A for the CDIP contract is included in Appendix 7.

Other. To operate the equipment identified as enhancements to existing capacity we request funds for instrument insurance, vessel costs for MMP and Wave Glider deployment, transportation of instruments to and from deployment locations, and UH network fees. Additionally, we request funds to conduct annual T-LiDAR surveys of stakeholder priority locations in American Samoa, Guam, and the CNMI (5 days each) in addition to the existing survey locations of Waikiki and Waimea (Oahu) and a proposed additional site at Wailea, Maui (4 days each, per year). Survey costs are calculated using a day use charge for the SOEST T-LiDAR at $3,000 per day. The day charge is determined based on estimated annual costs for technical support, management, administration and peripheral expenses to maintain and operate the T-LiDAR. Day charges include indirect costs at a rate of 12.8%.

3 High Frequency Radio (HFR)

Salaries. A principal investigator, Dr. Pierre Flament, will manage all aspects of this component. Six technical staff (4 technicians, two graduate assistants) are required to perform installations, maintenance, data processing, quality control, and produce deliverables.

Travel. Funds are requested for regular day trips to the neighbor islands to install, maintain, and build local service capacity for the HF radios. Estimated costs are $250/person/trip. Additional funds are requested annually associated with increased numbers of systems deployed. Linear scaling of travel costs is not used to estimate costs due to efficiencies achieved through co-location of HF radios within Maui County.

Equipment. Five HF Doppler radios are proposed to be installed at the following locations: Barbers Point (Oahu), Lopa Beach (Lanai), La Perouse (Maui), Kipahulu (Maui), and Laau Points (Molokai), covering the west shore of Oahu, the south shore of Maui and Molokai, the west shore of Lanai, and complementing the three systems currently in operation along the south shore of Oahu and the fourth to be installed (Kaena Point, Oahu) in early FY11. All radios will be built at the University of Hawaii using established methods and procedures that have been shown successful in the three systems currently deployed along on Oahu. A lease option is not available for these instruments.

Other. We request funds for materials and services associated with the installation and maintenance of the nine radios as detailed in the line-item budget (Appendix 4B). The budget includes complete activity from hardware installation to routine production of deliverables to stakeholders.

4 Fish Telemetry

Salaries. To maintain the capacity of the existing tracking array we request salary support (.75 FTE) to maintain the network of automated acoustic receivers as well as deploy acoustic tags on target species. Should funds be available, we request additional funds to support the efforts of this technician (0.25 FTE).

Other. We request funds for acoustic fish tags, replacement acoustic receivers, mooring supplies, and vessel costs that will allow for ongoing acoustic tracking efforts in the Hawaiian Archipelago. To enhance existing capacity, we request funds for additional fish tags and supplies to expanded the receiver array.

5 Modeling

Salaries. To maintain existing base capacity, we request funds for a three technicians; one each to operate the ocean circulation model (1 FTE), the atmospheric model (0.66 FTE) and the wave model (0.66 FTE). To enhance capacity, as described in the work plan, we request funds for two graduate students (1 FTE each) and a technician (0.5 FTE) to develop modeling capacity throughout the PacIOOS region in years 1-3 of the proposed effort. We also request funds to augment the existing technician salary support for the maintenance and operation of our atmospheric and wave models (0.33 FTE each).

Travel. To assist with the model development describe above, funds are requested in the first two years of the proposed work period for site visits and assessments prior to model development in the Samoan and Mariana archipelagos. Costs are based on estimates derived from previous trips and allow for one trip to each archipelago by two individuals for four days each.

Supplies. At a minimum, funds are requested for the annual purchase of expansions to the existing RAID disk to archive model data ($3,000 per year). Additional funds are requested to update the existing workstations on which model configuration and development is done.

Other. We request funds to pay for multiple, three-month SeaGlider missions using existing gliders in the SOEST SeaGlider Operations Group. A minimum of 2 missions is requested per year to maintain base capacity for model validation and assimilation with 2-4 additional 3-month surveys requested each year to enhance the capabilities of our numerical ocean circulation modeling. Survey costs are calculated using a mission use charge for the SOEST gliders at $40,000 per 3-month mission. The mission charge is determined based on estimated annual costs for technical support, management, administration and

peripheral expenses to maintain and operate each iRobot SeaGlider. Mission charges include indirect costs at a rate of 12.8%.

The University of Hawaii presently operates a supercomputing facility (HOSC) collocated with the Maui High Performance Computing Center (MPHCC). While PacIOOS maintains a machine for running our operational models we rely heavily on HOSC to test and develop enhancements to our existing model suites. The University presently supports HOSC though it is anticipated future support will be generated through user fees for time on the machine. We request funds to pay annual user fees to continue using HOSC. Should user fees not be required the funds requested will be used to purchase additional glider missions from the SOEST SeaGlider Operations Center (see above).

6 Data Management

Salaries. We request funds for four full-time (1 FTE each) personnel to maintain base capacity for data management: 1) a server administrator who is responsible for our OPeNDAP servers and ensures all data are available to end users via IOOS-standard web services, 2) a web and data specialist who is responsible for integrating spatial data into web-based products, 3) a data telemetry specialist who ensures the continuous transfer of information from sensors to the data system, and 4) a web and product developer responsible for generating web and product content in consolation with stakeholders, focus groups, and the PacIOOS team. To enhance our existing capacity we request additional support for a second web and product developer (1 FTE) who will focus on biological content and a system administrator (1 FTE) who will ensure the continuous operability of all PacIOOS machines (hardware and software).

Equipment: PacIOOS presently operates two computer servers (Dell PowerEdge 2850, dual processor) and requested additional resources to expand and upgrade this existing server capacity in years 2 and 3 of the proposed work. These systems are customized and a lease option is not available.

Supplies. Funds are requested for general supplies to maintain the operations of our data management system (consumables, peripherals, batteries, software). Additional funds are requested to upgrade our existing data management workstations.

Other. Funds are requested for SOEST network fees ($1,000) and for expansion of existing RAID storage disks ($4,500).

7 Management, Outreach, and Education

Salaries. To maintain existing PacIOOS capacity we request funds to support the PacIOOS Director (1 FTE, Chris Ostrander), education and outreach coordinator (1 FTE, Marcie Grabowski), our regional liaison coordinator (0.25 FTE), our American Samoa Liaison (0.16 FTE), and our Marshall Islands Liaison (0.16 FTE). The Director is responsible for the management and execution of the system and reports to the Governing Council for guidance and oversight. The education and outreach coordinator will focus primarily on increasing the impact of ongoing outreach and stakeholder engagement efforts, thus increasing awareness and utility of PacIOOS data, products and resources. Additionally, she will work with regional educators to share PacIOOS science and data products and educate a diverse audience on how to apply our products to their specific applications. To enhance our outreach capacity we also request support for an education and outreach specialist (.33 - .66 FTE) to assist with the generation of products, focusing

specifically on the development of an Ocean Atlas for each of the PacIOOS jurisdictions. This individual will also work with the data management group on the generation of biological data products. Our Regional Liaison Coordinator is the liaison to the Federated States of Micronesia and serves to coordinate the engagement of stakeholders in each of the Insular Pacific jurisdictions through the efforts of our local liaisons. To expand our capacity, we also request support for a technician (1 FTE) who will manage the PacIOOS instrument pool and work with local users to configure, deploy, and recover instruments involved in process studies.

Travel. We request travel funds for PacIOOS personnel to attend annual NFRA meetings (Board Meetings, Outreach Committee, Modeling Committee) and IOOS regional coordination workshops (Annual workshops, DMAC Committee Meetings). We also request travel funds for annual stakeholder workshops in each of the PacIOOS jurisdictions. We request funds for 2 Governing Council meetings per year, with support being given to Governing Council members to meet a common location in the region.

Equipment. To enhance our capacity in the Insular Pacific, we request funds annually in each of the first four years of the proposed work to assemble an instrument pool for shared use in the Insular Pacific jurisdictions. Stakeholders have expressed need for instruments (current meters, stream flow gages, nutrient sensors, wave gages) to understand baseline conditions in their regions. These systems are intended to be permanent additions to PacIOOS capacity and, as such, a lease is not a practical vehicle for acquisition.

Contractual. Funds are requested to maintain support for our regional liaisons in Guam, the CNMI, and Palau. Our regional liaisons are the PacIOOS local point of contact for stakeholders and manage our regional stakeholder engagement. They are also responsible for the maintenance of existing nearshore water quality sensors in each jurisdiction.

Subcontracts, funded at $10,000 per year, will be issued to: 1) the University of Guam, Mangilao, Guam, for work to be formed on the island of Guam, 2) the Pacific Marine Resources Institute (PMRI) based in Saipan, Commonwealth of the Northern Mariana Islands for work to be formed on Saipan, Rota, and Tinian in the CNMI, and 3) the Palau International Coral Reef Center based in Koror, Palau, for work to be performed in Palau. An individual SF-424A for each subcontract is attached in Appendix 7.

Supplies. At a minimum we request funds to continue the operation of our management, outreach and education efforts (consumables, paper, ink, software, office supplies). We also request supplies to maintain and operate our instrument pool (batteries, mooring hardware, cables, chain) and expand and upgrade our existing set of 10 flat panel educational displays ($2k each). These displays are in the process of being configured and will be deployed in high-profile locations in each jurisdiction in late 2010.

We also request funds annually to enhance our ability to rapidly respond to extreme events (tsunamis, floods, tropical storms, oil spills, in the Pacific Islands region with targeted data collection (AUV, HF radio, T-LiDAR), model operation (circulation, inundation), and product development (integrated spatial maps, particle trajectories, search vectors, etc.). The Governing Council will direct the expenditure of rapid response funds in consultation with the U.S. IOOS Program Office, PacIOOS researchers, local and federal emergency responders, and stakeholder groups.

Other. Funds for developing printed materials, hosting stakeholder workshops, and disseminating web-friendly material specifically aimed at education and outreach applications (data visualizations, activities, demonstrations) are being requested. We also request funds for our annual dues to NFRA ($5,000).

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Appendix 6. SF-424A for each year of proposal

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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. NOAA IOOS	11.012	$	$	$ 4,000,000.00	$	$ 4,000,000.00
2.						0.00
3.						0.00
4.						0.00
5. Totals		$ 0.00	$ 0.00	$ 4,000,000.00	$ 0.00	$ 4,000,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total
	(1) PacIOOS Yr 1	(2)	(3)		(5)
a. Personnel	$ 1,467,557.00	$	$	$	$ 1,467,557.00
b. Fringe Benefits	317,451.00				317,451.00
c. Travel	84,000.00				84,000.00
d. Equipment	565,000.00				565,000.00
e. Supplies	220,726.00				220,726.00
f. Contractual	54,000.00				54,000.00
g. Construction	0.00				0.00
h. Other	684,300.00				684,300.00
i. Total Direct Charges *(sum of 6a-6h)*	3,393,034.00	0.00	0.00	0.00	3,393,034.00
j. Indirect Charges	606,966.00				606,966.00
k. TOTALS *(sum of 6i and 6j)*	$ 4,000,000.00	$ 0.00	$ 0.00	$ 0.00	$ 4,000,000.00
7. Program Income	$	$	$	$	$ 0.00

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. NOAA IOOS	$	$	$	$ 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	$ 4,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 4,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00

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.NOAA IOOS	$ 4,000,000.00	$ 4,000,000.00	$ 4,000,000.00	$ 4,000,000.00
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 4,000,000.00	$ 4,000,000.00	$ 4,000,000.00	$ 4,000,000.00

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: $3,393,034 in year 1	22. Indirect Charges: $606,966 for year 1

23. Remarks: 25% for on-campus, other sponsored activity

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. NOAA IOOS	11.012	$	$	$ 4,000,000.00	$	$ 4,000,000.00
2.						0.00
3.						0.00
4.						0.00
5. Totals		$ 0.00	$ 0.00	$ 4,000,000.00	$ 0.00	$ 4,000,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total
	(1) PacIOOS Yr 2	(2)	(3)		(5)
a. Personnel	$ 1,542,509.00	$	$	$	$ 1,542,509.00
b. Fringe Benefits	334,653.00				334,653.00
c. Travel	89,500.00				89,500.00
d. Equipment	295,000.00				295,000.00
e. Supplies	240,726.00				240,726.00
f. Contractual	55,500.00				55,500.00
g. Construction	0.00				0.00
h. Other	789,746.00				789,746.00
i. Total Direct Charges *(sum of 6a-6h)*	3,347,634.00	0.00	0.00	0.00	3,347,634.00
j. Indirect Charges	652,366.00				652,366.00
k. TOTALS *(sum of 6i and 6j)*	$ 4,000,000.00	$ 0.00	$ 0.00	$ 0.00	$ 4,000,000.00
7. Program Income	$	$	$	$	$ 0.00

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. NOAA IOOS	$	$	$	$ 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	$ 4,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 4,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00

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.NOAA IOOS	$ 4,000,000.00	$ 4,000,000.00	$ 4,000,000.00	$ 0.00
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 4,000,000.00	$ 4,000,000.00	$ 4,000,000.00	$ 0.00

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: $3,347,634 in year 2	22. Indirect Charges: $652,366 in year 2

23. Remarks: 25% for on-campus, other sponsored activity

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. NOAA IOOS	11.012	$	$	$ 4,000,000.00	$	$ 4,000,000.00
2.						0.00
3.						0.00
4.						0.00
5. Totals		$ 0.00	$ 0.00	$ 4,000,000.00	$ 0.00	$ 4,000,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY (1) PacIOOS Yr 3	(2)	(3)		Total (5)
a. Personnel	$ 1,649,119.00	$	$	$	$ 1,649,119.00
b. Fringe Benefits	360,237.00				360,237.00
c. Travel	80,000.00				80,000.00
d. Equipment	155,000.00				155,000.00
e. Supplies	243,726.00				243,726.00
f. Contractual	57,075.00				57,075.00
g. Construction	0.00				0.00
h. Other	790,592.00				790,592.00
i. Total Direct Charges *(sum of 6a-6h)*	3,335,749.00	0.00	0.00	0.00	3,335,749.00
j. Indirect Charges	664,251.00				664,251.00
k. TOTALS *(sum of 6i and 6j)*	$ 4,000,000.00	$ 0.00	$ 0.00	$ 0.00	$ 4,000,000.00
7. Program Income	$	$	$	$	$ 0.00

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. NOAA IOOS	$	$	$	$ 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	$ 4,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 4,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00

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.NOAA IOOS	$ 4,000,000.00	$ 4,000,000.00	$ 0.00	$ 0.00
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 4,000,000.00	$ 4,000,000.00	$ 0.00	$ 0.00

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: $3,335,749 in year 3	22. Indirect Charges: $664,251 in year 3

23. Remarks: 25% for on-campus, other sponsored activity

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. NOAA IOOS	11.012	$	$	$ 4,000,000.00	$	$ 4,000,000.00
2.						0.00
3.						0.00
4.						0.00
5. Totals		$ 0.00	$ 0.00	$ 4,000,000.00	$ 0.00	$ 4,000,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY (1) PacIOOS Yr 4	(2)	(3)		Total (5)
a. Personnel	$ 1,667,721.00	$	$	$	$ 1,667,721.00
b. Fringe Benefits	375,769.00				375,769.00
c. Travel	78,000.00				78,000.00
d. Equipment	125,000.00				125,000.00
e. Supplies	243,426.00				243,426.00
f. Contractual	58,725.00				58,725.00
g. Construction	0.00				0.00
h. Other	772,138.00				772,138.00
i. Total Direct Charges *(sum of 6a-6h)*	3,320,779.00	0.00	0.00	0.00	3,320,779.00
j. Indirect Charges	679,221.00				679,221.00
k. TOTALS *(sum of 6i and 6j)*	$ 4,000,000.00	$ 0.00	$ 0.00	$ 0.00	$ 4,000,000.00
7. Program Income	$	$	$	$	$ 0.00

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. NOAA IOOS	$	$	$	$ 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	$ 4,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 4,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00

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.NOAA IOOS	$ 4,000,000.00	$ 0.00	$ 0.00	$ 0.00
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 4,000,000.00	$ 0.00	$ 0.00	$ 0.00

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges:
$3,320,779 in year 4

22. Indirect Charges:
$679,221 in year 4

23. Remarks: 25% for on-campus, other sponsored activity

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. NOAA IOOS	11.012	$	$	$ 4,000,000.00	$	$ 4,000,000.00
2.						0.00
3.						0.00
4.						0.00
5. Totals		$ 0.00	$ 0.00	$ 4,000,000.00	$ 0.00	$ 4,000,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY (1) PacIOOS Yr 5	(2)	(3)		Total (5)
a. Personnel	$ 1,747,413.00	$	$	$	$ 1,747,413.00
b. Fringe Benefits	394,238.00				394,238.00
c. Travel	78,500.00				78,500.00
d. Equipment	55,000.00				55,000.00
e. Supplies	237,226.00				237,226.00
f. Contractual	60,465.00				60,465.00
g. Construction	0.00				0.00
h. Other	730,284.00				730,284.00
i. Total Direct Charges *(sum of 6a-6h)*	3,303,126.00	0.00	0.00	0.00	3,303,126.00
j. Indirect Charges	696,874.00				696,874.00
k. TOTALS *(sum of 6i and 6j)*	$ 4,000,000.00	$ 0.00	$ 0.00	$ 0.00	$ 4,000,000.00
7. Program Income	$	$	$	$	$ 0.00

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. NOAA IOOS	$	$	$	$ 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	$ 4,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 4,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00	$ 1,000,000.00

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.NOAA IOOS	$ 0.00	$ 0.00	$ 0.00	$ 0.00
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: $3,303,127 in year 5	22. Indirect Charges: $696,874 in year 5

23. Remarks: 25% for on-campus, other sponsored activity

Appendix 7. SF-424A for each subcontract

1. University of Guam
2. Palau International Coral Reef Center
3. Pacific Marine Resources Institute
4. Coastal Data Information Program, Scripps Institution of Oceanography

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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. NOAA IOOS	11.012	$	$	$ 55,255.00	$	$ 55,255.00
2.						0.00
3.						0.00
4.						0.00
5. Totals		$ 0.00	$ 0.00	$ 55,255.00	$ 0.00	$ 55,255.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total
	(1) UOG Subcontract	(2)	(3)		(5)
a. Personnel	$ 0.00	$	$	$	$ 0.00
b. Fringe Benefits	0.00				0.00
c. Travel	0.00				0.00
d. Equipment	0.00				0.00
e. Supplies	0.00				0.00
f. Contractual	55,255.00				55,255.00
g. Construction	0.00				0.00
h. Other	0.00				0.00
i. Total Direct Charges *(sum of 6a-6h)*	55,255.00	0.00	0.00	0.00	55,255.00
j. Indirect Charges	0.00				0.00
k. TOTALS *(sum of 6i and 6j)*	$ 55,255.00	$ 0.00	$ 0.00	$ 0.00	$ 55,255.00
7. Program Income	$	$	$	$	$ 0.00

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. NOAA IOOS	$	$	$	$ 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	$ 10,000.00	$ 2,500.00	$ 2,500.00	$ 2,500.00	$ 2,500.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 10,000.00	$ 2,500.00	$ 2,500.00	$ 2,500.00	$ 2,500.00

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.NOAA IOOS	$ 10,500.00	$ 11,025.00	$ 11,575.00	$ 12,155.00
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 10,500.00	$ 11,025.00	$ 11,575.00	$ 12,155.00

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: $55,255 total for 5 years	22. Indirect Charges: $0 total for 5 years

23. Remarks: subcontract to University of Guam for PacIOOS liaison services

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. NOAA IOOS	11.012	$	$	$ 55,255.00	$	$ 55,255.00
2.						0.00
3.						0.00
4.						0.00
5. Totals		$ 0.00	$ 0.00	$ 55,255.00	$ 0.00	$ 55,255.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total
	(1) PICRC Subcontract	(2)	(3)		(5)
a. Personnel	$ 0.00	$	$	$	$ 0.00
b. Fringe Benefits	0.00				0.00
c. Travel	0.00				0.00
d. Equipment	0.00				0.00
e. Supplies	0.00				0.00
f. Contractual	55,255.00				55,255.00
g. Construction	0.00				0.00
h. Other	0.00				0.00
i. Total Direct Charges *(sum of 6a-6h)*	55,255.00	0.00	0.00	0.00	55,255.00
j. Indirect Charges	0.00				0.00
k. TOTALS *(sum of 6i and 6j)*	$ 55,255.00	$ 0.00	$ 0.00	$ 0.00	$ 55,255.00
7. Program Income	$	$	$	$	$ 0.00

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. NOAA IOOS	$	$	$	$ 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	$ 10,000.00	$ 2,500.00	$ 2,500.00	$ 2,500.00	$ 2,500.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 10,000.00	$ 2,500.00	$ 2,500.00	$ 2,500.00	$ 2,500.00

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.NOAA IOOS	$ 10,500.00	$ 11,025.00	$ 11,575.00	$ 12,155.00
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 10,500.00	$ 11,025.00	$ 11,575.00	$ 12,155.00

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: $55,255 total for 5 years	22. Indirect Charges: $0 total for 5 years

23. Remarks: subcontract to Palau International Coral Reef Center for PacIOOS liaison services

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. NOAA IOOS	11.012	$	$	$ 55,255.00	$	$ 55,255.00
2.						0.00
3.						0.00
4.						0.00
5. Totals		$ 0.00	$ 0.00	$ 55,255.00	$ 0.00	$ 55,255.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total
	(1) PMRI Subcontract	(2)	(3)		(5)
a. Personnel	$ 0.00	$	$	$	$ 0.00
b. Fringe Benefits	0.00				0.00
c. Travel	0.00				0.00
d. Equipment	0.00				0.00
e. Supplies	0.00				0.00
f. Contractual	55,255.00				55,255.00
g. Construction	0.00				0.00
h. Other	0.00				0.00
i. Total Direct Charges *(sum of 6a-6h)*	55,255.00	0.00	0.00	0.00	55,255.00
j. Indirect Charges	0.00				0.00
k. TOTALS *(sum of 6i and 6j)*	$ 55,255.00	$ 0.00	$ 0.00	$ 0.00	$ 55,255.00
7. Program Income	$	$	$	$	$ 0.00

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. NOAA IOOS	$	$	$	$ 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	$ 10,000.00	$ 2,500.00	$ 2,500.00	$ 2,500.00	$ 2,500.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 10,000.00	$ 2,500.00	$ 2,500.00	$ 2,500.00	$ 2,500.00

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.NOAA IOOS	$ 10,500.00	$ 11,025.00	$ 11,575.00	$ 12,155.00
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 10,500.00	$ 11,025.00	$ 11,575.00	$ 12,155.00

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: $55,255 total for 5 years	22. Indirect Charges: $0 total for 5 years

23. Remarks: subcontract to Pacific Marine Resources Institute for PacIOOS liaison services

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. NOAA IOOS	11.012	$	$	$ 120,000.00	$	$ 120,000.00
2.						0.00
3.						0.00
4.						0.00
5. Totals		$ 0.00	$ 0.00	$ 120,000.00	$ 0.00	$ 120,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total
	(1) CDIP Subcontract	(2)	(3)		(5)
a. Personnel	$ 0.00	$	$	$	$ 0.00
b. Fringe Benefits	0.00				0.00
c. Travel	0.00				0.00
d. Equipment	0.00				0.00
e. Supplies	0.00				0.00
f. Contractual	120,000.00				120,000.00
g. Construction	0.00				0.00
h. Other	0.00				0.00
i. Total Direct Charges *(sum of 6a-6h)*	120,000.00	0.00	0.00	0.00	120,000.00
j. Indirect Charges	0.00				0.00
k. TOTALS *(sum of 6i and 6j)*	$ 120,000.00	$ 0.00	$ 0.00	$ 0.00	$ 120,000.00
7. Program Income	$	$	$	$	$ 0.00

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SECTION C - NON-FEDERAL RESOURCES				
(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. NOAA IOOS	$	$	$	$ 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	$ 24,000.00	$ 6,000.00	$ 6,000.00	$ 6,000.00	$ 6,000.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 24,000.00	$ 6,000.00	$ 6,000.00	$ 6,000.00	$ 6,000.00

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.NOAA IOOS	$ 24,000.00	$ 24,000.00	$ 24,000.00	$ 24,000.00
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 24,000.00	$ 24,000.00	$ 24,000.00	$ 24,000.00

SECTION F - OTHER BUDGET INFORMATION	
21. Direct Charges: $120,000 total for 5 years	22. Indirect Charges: $0 total for 5 years
23. Remarks: subcontract to Coastal Data Information Program (CDIP) at Scripps Institution of Oceanography	

Appendix 8: Complementary funding

Projects and funding listed below are distinct from the Pacific Islands Ocean Observing System (PacIOOS) effort but are closely related to our ocean observing system development efforts and enhance the capabilities of the PacIOOS system. Funds listed are not be construed as cost match/sharing or in-kind contributions for this proposal.

$651,490. 2010-2011. Funding to the UH Sea Grant College Program to coordinate the regional development of NOAA's Coastal Storms Program.

$500,000. 2009-2010. Funding to the Center for Island, Maritime and Extreme Environment Security (CIMES). This is a DHS funded program that aims, in part, to design low-cost, low-power HF radio's for extreme island environments, to be used as an economical substitute to existing WERA and CODAR systems. Two 8-channel prototypes built through this program are in the process of being tested, and will be configured as rapid deployment mobile units available to support USCG SAR applications, augmenting the coverage of the fixed PacIOOS sites.

$6,000,000. 2009-2012. NSF funding to M. Church et al. for the continuation of the Hawaii Ocean Time-series (HOT) at Station ALOHA. The HOT program, in existence since 1988, aims to provide a comprehensive description of the ocean at a site representative of the North Pacific subtropical gyre through both repeat transects and the operation of real-time instrumentation.

$2,084,993. 2005-2011. Funding to G. Pawlak, M. McManus, EH DeCarlo, et al. for "Benthic Boundary Layer Geochemistry and Physics at the Kilo Nalu Observatory" from NSF.

$1,250,000. 2010-2013. Funding to K. Seraphin for marine science education: "Exploring our Fluid Earth: NOAA Ocean Science Curriculum, Teacher Professional Development and Public Outreach".

$300,000. 2007-2011. Contribution to the Hawai'i Ocean Observing System (HiOOS) from the School of Ocean and Earth Science and Technology (SOEST) for the purchase of instrumentation essential to the observing system development network.

$300,000. 2010. Contribution to PacIOOS from the Joint Institute for Marine and Atmospheric Research (JIMAR) for the purchase of two Waverider buoys and two McLane moored profilers.

$143,880. 2010. Funding to UH Hilo and UH Manoa for the deployment of two water quality buoys along the Kona Coast of Hawaii from EPSCoR.

$600,000. 2008-2011. Funding to K. Holland for the research of "Movements of Coastal Top Predators" from the Monterey Bay Aquarium. This project is placing electronic tags on near-shore large sharks to determine movement patterns and habitat selection.

$583,000. Annual. Funding from the State of Hawai'i to SOEST for 6 SOEST Ocean Observing faculty positions.

$1,459,000. 2009-2011. Funding to SOEST for "Hawai'i Interisland Power Cable Project Ocean Floor Survey" from the State of Hawai'i Department of Business, Economic Development and Tourism. This

project is mapping the seafloor between Oahu, Molokai, and Lanai for the placement of a submarine power cable.

$225,000. 2009-2012. Funding to B. Powell for "Modeling of Hurricane Surge and Waves in North Pacific" from the US Army Corps of Engineers. The project is working to develop a database of storm surge scenarios and a stochastic modeling tool for real-time forecasts of hurricane inundation in the North Pacific.

$400,000. 2009-2012. Funding to B. Powell from the Office of Naval Research to understand "Predictability of the Ocean". This project aims to quantify the errors in the ocean circulation models and observations that affect the predictability of regional oceanic circulation.

$237,065. 2009-2011. Funding to EH DeCarlo from NOAA Sea Grant to study "Ocean Acidification: Impacts on Calcification and Carbonate Mineral Dissolution on the Barrier Reef in Kāneʻohe Bay, Hawaiʻi.

Appendix 9: Resumes

Brian Taylor

School of Ocean and Earth Science and Technology, University of Hawaii at Manoa
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Education

Ph.D., Columbia University, 1982 (M.Phil., 1979; M.A., 1978) Marine Geology & Geophysics
B.Sc.Hons. (1st class), University of Sydney, 1976 in Geology and Geophysics

Professional Experience

2006-present	Dean, SOEST, University of Hawaii at Manoa
1994-2006	Acting Associate Dean of Research, SOEST, University of Hawaii
1991-2006	Professor, Department of Geology and Geophysics, University of Hawaii
1988	Visiting Researcher, Dépt. de Géotectonique, Université Pierre et Marie Curie, and Dépt. de Géologie, École Normale Supérieure, Paris
1982-1991	Assistant then Associate Professor, Hawaii Institute of Geophysics and Department of Geology and Geophysics, University of Hawaii
1976-1981	Fulbright Scholar, Faculty Fellow and Graduate Research Associate, Lamont-Doherty Geological Observatory, Columbia University

Recent Professional Activities

2007-present	Consortium for Ocean Leadership, Board of Trustees and Treasurer
2007-present	Integrated Ocean Drilling Program – Mgmt. Intl. Board of Governors (Vice-Chairman: 2008-2009; Chairman: 2009-2011)
2006-present	Natl. Fedn. Regional Assocns. for Coastal & Ocean Observing, Board mbr.
2006-2007	Consortium for Oceanographic Research and Education Board of Governors
2003-2007	Joint Oceanographic Institutions Board of Governors (EXCOM: 2004-2007)
2003-2006	IODP-MI member for SOEST, University of Hawaii
2001	Lead Proponent: RIDGE Integrated Studies Site in the Lau backarc basin
1997-2000	Chairman, NSF MARGINS Program
1996-2003	JOIDES Executive Committee member
1977-present	American Geophysical Union member

Recent Oceanographic Expeditions (* = chief or co-chief scientist)

2010	R/V KILO MOANA 10-01*-03*	Sea trials; HI north arch Mohole site (MGG)
2009	R/V KILO MOANA 09-17*	Inter-island power cable route survey, Hawaii
2006	R/V KILO MOANA 06-15*-31*	IMI-30&JasonII trials; Kilauea S flank acoustic GPS
2004	R/V KILO MOANA 04-18*	E Woodlark Basin spreading & margins (MGG)
	R/V KILO MOANA 04-10*	E Lau Basin Spreading (IMI-30, DSL-120, MAPR)
2003	R/V KILO MOANA 03-26*	Canyons, reefs & volcanism off Kauai & Niihau
2002	R/V MAURICE EWING 02-02*	Mariana trench-arc-backarc MCS
2001	R/V MAURICE EWING 01-08*	Gulf of Corinth MCS, rifting & low-angle normal faults
2000	R/V MAURICE EWING 00-02*	Woodlark Basin OBS/H (seismicity & refraction)
1998	D/V JOIDES RESOLUTION*	ODP Leg 180, Woodlark Basin drilling

Some Recent Publications

Oakley, A.J., B. Taylor, G.F. Moore, and A.M. Goodliffe, 2009, Sedimentary, volcanic & tectonic processes of the central Mariana arc: Mariana Trough backarc basin formation and the West Mariana Ridge, Geochem. Geophys. Geosystems, 10, Q10X07, doi:10.1029/2008GC002312.

Taylor, B., A. Goodliffe and F. Martinez, 2008, Initiation of transform faults at rifted continental margins, Comptes Rendus Geoscience, 341, 428-438, doi:10.1016/j.crte.2008.08.010.

Goodliffe, A.M., and B. Taylor, 2007, The boundary between rifting and sea-floor spreading in the Woodlark Basin, Papua New Guinea, Geological Society, London Spec. Pub. 282, 217-238.

Martinez, F., and B. Taylor, 2006, Modes of crustal accretion in back-arc basins: inferences from the Lau Basin, AGU Geophys. Monogr. 166, 5-30.

Taylor, B., 2006, The single largest oceanic plateau: Ontong Java – Manihiki – Hikurangi, Earth Planet. Sci. Lett., 241, 372-380.

Martinez, F., and B. Taylor, 2002, Mantle wedge control on back-arc crustal accretion, Nature, 416, 417-420.

Dr. Jason Earl Adolf
Assistant Professor, Marine Science UH Hilo

jadolf@hawaii.edu

Professional Preparation

Roger Williams College	Marine Biology	B.S. 1993
University of Hawaii at Manoa	Botany	M.S. 1996
University of Maryland College Park	Biol. Oceanography	Ph.D. 2002

Postdoctoral training:

UMD Horn Point Laboratory	Phytoplankton Ecology	2002-2004
UMD Center of Marine Biotechnology	Phytoplankton Ecology	2004-2008

Appointments

2008 – present - Assistant Professor, Marine Science, University of Hawaii Hilo, HI
2006 – 2008 – Adj. Assistant Professor, Environmental Science, Gettysburg College, PA
2004 – 2008 - Assistant Research Scientist, UMBI COMB
2003 – 2004 - Assistant Research Scientist, Horn Point Laboratory
2001 – 2002 - Maryland Sea Grant Traineeship, Horn Point Laboratory
1996 – 2001 – Grad. Research Asst., Horn Point Laboratory
1994 – 1996 – Grad. Research Asst., Dept. of Chemistry, University of Hawaii Manoa
1993 – Teaching Assistant, Department of Biology, University of Hawaii Manoa

Select Publications

Adolf, J. E., Bachvaroff, T.R., and Place, A.R. (2009). Environmental modulation of Karlotoxin levels in strains of the cosmopolitan dinoflagellate, *Karlodinium veneficum* (Dinophyceae). *J. Phycol.* 45(176-192).

Adolf, J. E., Bachvaroff, T.R., and Place, A.R. (2008). Can cryptophyte abundance trigger toxic *Karlodinium veneficum* blooms in eutrophic estuaries? *Harmful Algae* 8: 119-128.

Adolf, J.E., Yeager, C.L., Mallonee, M.E., Miller, W.D., and Harding, L.W. Jr. (2006a). Environmental forcing of phytoplankton floral composition, biomass, and primary productivity in Chesapeake Bay, USA. *Estuarine, Coastal and Shelf Science* 67:108-122.

Adolf, J.E., Krupatkina, D., Bachvaroff, T., and Place, A.R. (2007). Karlotoxin mediates grazing of *Oxyrrhis marina* on strains of *Karlodinium veneficum. Harmful Algae* 7, 400-412 http://dx.doi.org/10.1016/j.hal.2006.12.003.

Adolf, J.E., D.K. Stoecker, and L.W. Harding, Jr. (2006b). The balance of autotrophy and heterotrophy during mixotrophic growth of *Karlodinium micrum* (Dinophyceae) *J. Plank. Res* 28(8):737-751.

Hall, N.S., Litaker, R.W., Fensin, E., **Adolf, J.E.**, Place, A.R., and Paerl, H.W. (2008) Environmental Factors Contributing to the Development and Demise of a Toxic Dinoflagellate (*Karlodinium veneficum*) Bloom in a Shallow, Eutrophic, Lagoonal Estuary. *Estuaries and Coasts* DOI 10.1007/s12237-008-9035-x

Sheng, J., Malkiel, E., Katz, J., **Adolf, J.**, Belas, R., Place, A.R., (2007). Digital holographic microscopy reveals prey-induced changes in swimming behavior of predatory dinoflagellates 10.1073/pnas.0704658104. Proceedings of the National Academy of Sciences 104(44), 17512-17517.

Glenn S. Carter
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Email: gscarter@hawaii.edu

Academic qualifications:
BSc 1992 Applied Math, University of Auckland
BE(hons) 1994 Engineering science, University of Auckland
MSc 2001 Oceanography, University of Washington
Ph.D 2005 Oceanography, University of Washington

Employment record:
1994-1998 National Institute of Water and Atmospheric Research Limited (NIWA), Christchurch New Zealand
1998-2005 Research Assistant, Applied Physics Lab, University of Washington
2005-2008 JIMAR Assistant Reseacher, University of Hawai`i
2008-Present Assistant Professor, Department of Oceanography, University of Hawai`i

Awards:
2002 American Geophysical Union Outstanding Student Poster Award, Ocean Sciences Meeting

Five most recent publications:
G. S. Carter. Barotropic and baroclinic M2 tides in the Monterey Bay region. Journal of Physical Oceanography, 40(8):1766{1783, 2010.
C. Chavanne, P. Flament, G. S. Carter, M. A. Merrifeld, D. Luther, E. Zaron, and K-W. Gurgel. The Surface Expression of Semidiurnal Internal Tides near a Strong Source at Hawaii. Part I: Observations and Numerical Predictions. Journal of Physical Oceanography, 40(6):1155{1179, 2010.
J. H. Foster, G. S. Carter, and M. A. Merrifeld. Ship-based measurements of sea surface topography. Geophysical Research Letters, 36:L11605, doi:10.1029/2009GL038324, 2009.
L. Rainville, T. M. S. Johnston, G. S. Carter, M. A. Merrifeld, R. Pinkel, B. D. Dushaw, and P. F. Worcester. Interference pattern and propagation of the M2 internal tide south of the Hawaiian Ridge. Journal of Physical Oceanography, 40(2):311{325, 2010.
N. V. Zilberman, J. M. Becker, M. A. Merri eld, and G. S. Carter. Model estimates of M2 internal tide generation over Mid-Atlantic Ridge topography. Journal of Physical Oceanography,

Eric Heinen De Carlo

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Education

Ph.D. Chemistry, University of Hawaii, Honolulu, Hawaii 1982
M.S. Chemistry, Old Dominion University, Norfolk, Virginia 1978
B.S. Oceanography, Cum Laude, Florida Institute of Technology, Melbourne, Florida 1975

Professional Experience

July2008-present Professor, Department of Oceanography, University of Hawaii, 1000 Pope Rd., Honolulu, Hawaii 96822.
Aug 2003-Jun2008 Research Professor, Department of Oceanography, University of Hawaii.
Jan 1991-Jul 2003: Associate Research Professor, Department of Oceanography, University of Hawaii.
Oct 1989-July 2003: Faculty Affiliate, US Geological Survey, Honolulu District, Hawaii
Jan-June 1997, and Aug 1989-July 1995: Visiting Associate Professor, Dept. of Chemistry, UH Manoa
July 1, 1989-Dec 31, 1990: Associate Geochemist, Hawaii Institute of Geophysics, UH Manoa.
August 1985-June 30, 1989: Visiting Assistant Professor, Department of Chemistry, UH Manoa
July 1983-June 30, 1989: Assistant Geochemist, Hawaii Institute of Geophysics, UH Manoa
August 1982-July 1983: Research Associate, Department of Oceanography, UH Manoa

Selected Publications

Tomlinson, M., De Carlo, E.H., McManus, M., Pawlak, E., Steward, G., Sansone, F., Nigro, O., Ostrander C., Timmerman, R., Patterson, J., Uribe, S.J. Physical and biogeochemical response of the coastal ocean in Hawaii to storm flow. Submitted to Estuaries and Coasts
Solomon, R.F., De Carlo, E.H., Mackenzie, F.T., Maenner-Jones, S., Fagan, K.E., Sabine, C.L., and Feely, R.A., The role of local climatic variability in the exchange of CO_2 between the ocean and atmosphere in a tropical coral reef environment. Submitted to Marine Chemistry
Drupp, P., De Carlo, E.H., and Mackenzie, F.T. Nutrient inputs, dynamics and phytoplankton response in a semi-enclosed subtropical embayment, Kaneohe Bay, Hawaii. In press Aquatic Geochemistry
Bienfang, P, De Carlo, E.H., Christopher, S., DeFelice, S. and Moeller, P. Trace element concentrations in coastal Hawaiian waters. Marine Chemistry (2009) 113(3-4), 149-256 http://dx.doi.org/10.1016/j.marchem.2009.01.007
Ostrander, C.E., McManus, M.A., DeCarlo, E.H. and Mackenzie, F.T. Temporal and spatial variability of freshwater plumes in a semi-enclosed estuarine-bay system. Estuaries and Coasts: (2008) 31:192–203 http://dx.doi.org/10.1007/s12237-007-9001-z
De Carlo, E.H., Hoover, D.J., Young, C.W., Hoover, R.S. and Mackenzie, F.T. Impact of storm runoff from subtropical watersheds on coastal water quality and productivity. Applied Geochemistry (2007) 22:1777-1797, http://dx.doi.org/10.1016/j.apgeochem.2007.03.034
Hoover, R.S., Hoover, D., Miller, M., Landry, M.R., De Carlo, E.H., and Mackenzie, F.T. Zooplankton response to storm runoff in a tropical estuary: Bottom up and top down controls. Marine Ecology Progress Series (2006) 318:187-201.
Tomlinson, M.S. and De Carlo, E.H. The need for high-resolution time series data to characterize Hawaiian streams. Journal of the American Water Resources Association (JAWRA), (2003), 39:1, 113-123

Synergistic Activities

Development of public relations and K-12 teaching materials on oceanographic and environmental topics, participation in public education with Bishop Pauahi Museum through outreach/presentations.
Hawaii Academy of Sciences representative to Hawaii Science Teachers Association technical committee.
Steering Committee, Global Environmental Science B.S. program, Univ. of Hawaii.
Development of laboratory course companion to (~400 student) lower division introductory oceanography course, development/enhancement (with F.J. Sansone, C.I. Measures) of graduate oceanography methods lecture/laboratory course.
Journal reviewer (EPSL, GCA, L&O, DSR., Aq. Geochem., Mar. Chem., Chem. Geol., Mar. Geol., Proc. ODP, Anal. Chem., Env. Sci. and Tech.), proposal reviewer (NSF, NOAA, ACS-PRF, NRC Canada, NERC U.K.).

Chen, Yi-Leng
Department of Meteorology, University of Hawaii, Honolulu, Hawaii, 96822
Ph.: (808) 956-2570; Fax (808) 956-2877; E-mail: yileng@hawaii.edu

Education:
MS 1976; Ph.D. 1980, University of Illinois; B.S. 1972, National Central University, Taiwan

Professional Experience:
Department of Meteorology, University of Hawaii: Professor 1996 to present; Graduate Chair, 2002-2008; Associate Professor 1990-1996; Assistant Professor 1984-1990; OPHIR Co., Lakewood, Colorado, Atmospheric Scientist, 1984; Iowa State University: Postdoc, 1983-1984; National Center for Atmospheric Research, Boulder, CO, Scientist I, 1980-1983.

Recent Refereed Publications Related to Hawaii Weather and Modeling:

Tu, C.-C., and Y.-L. Chen, 2010: Favorable conditions for the development of a heavy rainfall event over Oahu during the 2006 wet period. *Wea. Forecasting* (Submitted).

Jayawardena, S., Y.-L. Chen, A. J. Nash and K. Kodama, 2010: Analysis of an unusual heavy rainfall period over the Hawaiian Islands during 19 February-2 April, 2006. *J. Climate Appl. Meteor.* (In revisions).

Hartley, T., and Y.-L. Chen 2010: Characteritics of summer trade-wind rainfall over Oahu. *Wea. Forecasting* (In Press).

Carlis, D., L., Y.-L. Chen, and V. Morris, 2010: Numerical simulations of island-scale airflow and the Maui vortex during summer trade-wind conditions. *Mon. Wea. Rev.*, **138**, 2706-2736.

Nguyen, H. V., Y.-L. Chen and F. M. Fujioka, 2010: Numerical Simulations of island effects on airflow and weather during the summer over the Island of Oahu. *Mon. Wea. Rev.*, **138**, 2253–2280.

Stopa, J. E., K. F. Cheung, and Y.-L. Chen: 2010: Assessment of wave energy resources in Hawaii. *J. Renewable Energy.* doi:10.1016/j.renene.2010.07.014.

Yang, Y., Y.-L. Chen, and F. M. Fujioka, 2008: Effects of trade-wind strength and direction on the leeside circulations and rainfall of the Island of Hawaii. *Mon. Wea. Rev.,* **136**, 4799-4818.

Esteban, M. and Y.-L. Chen, 2008: The impact of trade-wind strength on precipitation over the windward side of the island of Hawaii. *Mon. Wea. Rev*., **136**, 913-928.

Yang, Y. and Y.-L. Chen, 2008: Effects of terrain heights and sizes on island-scale circulations and rainfall. *Mon. Wea. Rev*., **136**, 120-146.

Yang, Y., Y.-L. Chen, and F. M. Fujioka, 2005: High-resolution simulations of the island-induced circulations for the island of Hawaii during HaRP. *Mon. Wea. Rev*., **133**, 3693-3713.

Zhang, Y., Y.-L. Chen, S.-Y. Hong, H.-M. H. Juang and K. Kodama, 2005: Validation of the coupled NCEP Mesoscale Spectral Model and an advanced Land Surface Model over the Hawaiian Islands: Part I: Summer trade-wind conditions over Oahu and heavy rainfall events. *Wea. Forecasting*, **20**, 847-872.

Zhang, Y., Y.-L. Chen, and K. Kodama, 2005: Validation of the coupled NCEP Mesoscale spectral model and an advanced land surface model over the Hawaiian Islands. Part II: A high wind event. *Wea. Forecasting*, **20**, 873-895.

Zhang, Y., Y.-L. Chen, T. A. Schroeder, and K. Kodama, 2005: Numerical simulations of sea breeze circulations over northwest Hawaii. *Wea. Forecasting*, **20**, 827-846.

Juang, H.-M. H., C.-T. Lee, Y. Zhang, M.-C. Wu, Y.-L. Chen, K. Kodama, and S.-C. Chen, 2005: Applying horizontal diffusion on pressure surface to mesoscale models on terrain-following coordinates. *Mon. Wea. Rev.,* **133**, 1384-1402.

Foster, J., M. Bevis, Y.-L. Chen, S. Businger and Y. Zhang, 2003: The Ka'u Strom (Nov. 2000): Imaging precipitable water using GPS. *J. Geophys. Res*., **108 (D18)**, 4585, doi: 10.1029/2003JD003413.

Yang, Y., and Y.-L. Chen, 2003: Circulations and rainfall in the lee side of the island of Hawaii. *Mon. Wea. Rev*., **131**, 2525-2542.

Frye, J., and Y.-L. Chen 2001: Evolution of downslope flow under strong opposing trade winds and frequent trade-wind rainshowers over the island of Hawaii. *Mon. Wea. Rev*., **129**, 956-977.

Chen, Y.-L., and J. Feng 2001: Numerical simulations of airflow and cloud distributions over the windward side of the island of Hawaii. Part I: The effects of trade-wind inversion. *Mon. Wea. Rev.*, **129**, 1117-1134.

Kwok Fai Cheung

Department of Ocean and Resources Engineering
School of Ocean and Earth Science and Technology
University of Hawai'i
2540 Dole Street, Holmes Hall 403
Honolulu, HI 96822

Professional Preparation

Ph.D. 1991: University of British Columbia, Vancouver, British Columbia.
M.A.Sc. 1987: University of British Columbia, Vancouver, British Columbia.
B.A.Sc. 1985: University of Ottawa, Ottawa, Ontario.

Appointments

1993-present: Assistant Professor, Associate Professor, and Professor of Ocean and Resources Engineering, University of Hawaii, Honolulu, Hawaii.
2004: Visiting Researcher, Naval Surface Warfare Center Carderock Division, West Bethesda, Maryland.
2001: Visiting Researcher, National Institute for Coastal and Marine Management, The Hague, The Netherlands.
1997, 1998: Visiting Researcher, Danish Hydraulic Institute, Hørsholm, Denmark.
1991-1993: Coastal Engineer, Sandwell Engineering Inc., Vancouver, British Columbi

Five Recent Publications

Stopa, J.E., Cheung, K.F., and Chen, Y-L. (2010). Assessment of wave energy resourc in Hawaii. *Renewable Energy*, doi:10.1016/j.renene.2010.07.014.

Roeber, V., Cheung, K.F., Kobayashi, M.H. (2010). Shock-capturing Boussinesq-type model for nearshore wave processes. *Coastal Engineering*, 57(4), 407-423.

Yamazaki, Y., Kowalik, Z., and Cheung, K.F. (2009). Depth-integrated, non-hydrostat model for wave breaking and runup. *International Journal for Numerical Methods in Fluids*, 61(5), 473-497.

Das, S. and Cheung, K.F. (2009). Coupled boundary element and finite element model for fluid-filled membrane in gravity waves. *Engineering Analysis with Boundary Elements*, 33(6), 802-814.

Wu, Y.Y. and Cheung, K.F. (2009). Homotopy solution for nonlinear differential equations in wave propagating problems. *Wave Motion*, 46(1), 1-14.

Synergistic Activities

Science Advisor, Hawaii State Civil Defense
Foreign Advisor, Chilean Navy Tsunami Program
Coordination Committee, National Tsunami Hazard Mitigation Committee

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E-mail: microellis@gmail.com

E D U C A T I O N

Master of Science in Fisheries and Aquaculture (December, 1989), Louisiana State University, Baton Rouge, Louisiana, USA.

Bachelor of Science in Marine Biology with Honors (July 1986), Heriot-Watt University, Edinburgh, Scotland, United Kingdom.

P R O F E S S I O N A L E X P E R I E N C E

University of Hawaii Hilo, Pacific Aquaculture and Coastal Resources Center, Pacific Coordinator based in Kolonia, Pohnpei, FSM. *May 2002 to Present.* Coordinating and managing mariculture and coastal resource management projects throughout the Micronesia region. Design and management of projects to assist sustainable development, especially in aquaculture in the Micronesia region. Species of focus – pearl oysters, giant clams, marine ornamentals and sponges. Active in the U.S. Affiliated Pacific States of Palau, Federated States of Micronesia and Republic of Palau.

Marine and Environmental Research Institute of Pohnpei (MERIP), Pohnpei, FSM. *May 2005 to present.* Director of an NGO dedicated to providing sustainable livelihoods, especially in aquaculture to rural Micronesia communities in the region.

College of the Marshall Islands, *May 2005 to present*. Affiliate Faculty bringing technical assistance and project management for outer island development projects.

Seacology *April 2004 to present*. Micronesia representative for a California based NGO committed to supporting MPA creation in islands around the globe. Identify and fund projects as needed.

College of Micronesia, Kolonia, Pohnpei, Federated States of Micronesia. *January 1997 to May 2002*. Regional aquaculture extension agent providing aquaculture extension and support within the US-Affiliated Pacific Islands. Development of private sector aquaculture of giant clams, pearl oysters, sponges and aquarium species; develop and support aquaculture through site visits, training courses, educational materials and information exchanges.

Can-Am Fisheries Bahamas (Ltd.), Clarence Town, Long Island, Bahamas. *July 1996 to December 1996*. Facilities manager overseeing the operation of pond based larval rearing and cage grow-out sites for commercial production of red drum.

Sea Change Foundation, Vero Beach, Florida, USA. *August 1995 to July 1996.* Research associate involved in all aspects of an ongoing project to establish culture parameters for the summer flounder, *Paralichthys dentatus*.

Caribbean Marine Research Center, Lee Stocking Island, Exuma Cays, Bahamas. *August 1992 to August 1995* ***and*** *January 1991 to February 1992.* Hatchery manager responsible for complete operation of a pilot scale commercial facility for Florida red tilapia, Nassau grouper (*Epinephelus striatus*) and mutton snapper (*Lutjanus analis*).

Pierre Flament

Education: Ph.D., Scripps Institution of Oceanography, University of California San Diego (1986); M.Sc., Theoretical Physics, University of Brussels (1980).

Positions held: professor (2005-), associate professor (1998-2004), assistant professor (1988 1997), University of Hawaii at Manoa; program director, National Science Foundation, Physica Oceanography Program (2004-2005); scientific director, Department of Space Oceanography French Research Institute for Exploitation of the Sea (1997-2000); post-doctoral scholar, Wood Hole Oceanographic Institution (1987-1988); research assistant, Scripps Institution o Oceanography (1982-1986); fellow, Van Buren Foundation (1981-1982); visiting researcher Ecole Normale Supérieure, Paris (1980).

Research interests: air-sea interactions, mesoscale currents, coastal circulation, high frequency and synthetic aperture radars, infrared remote sensing.

Dissertations and theses supervised: Ph.D., R. Lumpkin, S. Kennan, C. Chavanne; M.Sc., J. Cass, T. Hilmer, V. Futch, D. Johnson. M. Sawyer, K. Ozimek, D. Wenzel.

Five Recent publications:

1. Chavanne, C., P. Flament, D. Luther and K.-W. Gurgel, "Observations of vortex Rossby waves associated with a mesoscale cyclone", J. Phys. Ocean., 8 pp., 2010, (in press).

2. Chavanne, C., P. Flament, and K.-W. Gurgel, "Observations of strong submesoscale anticyclone and associated frontogenesis near an island", J. Phys. Ocean., v. 40 pp. 1802-1818, 2010.

3. Chavanne, C., P. Flament, E. Zaron, G. Carter, M. Merrifield, D. Luther and K.-W. Gurgel, "The surface expression of internal tides in the Kauai Channel, Hawai`i. I: observations and numerical models", J. Phys. Ocean., v. 40 pp. 1155-1179, 2010.

4. Chavanne, C., P. Flament, D. Luther and K.-W. Gurgel, "The surface expression of internal tides in the Kauai Channel, Hawai`i. II: interactions with mesoscale currents", J. Phys. Ocean., v. 40 pp. 1180-1200, 2010.

5. Zaron, E.,, C. Chavanne, G. Egbert and P. Flament, "Baroclinic Tidal Generation in the Kauai Channel Inferred from High-Frequency Radar Doppler Currents", Dynamics of Atmospheres and Oceans, vol. 48 pp. 93-120, 2009.

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Education

M.S. Oceanography 2005, University of Hawaii – Manoa
B.A. Geological Sciences 2001, Magna Cum Laude, University of Missouri – Columbia

Employment

2007 – present	Educational Outreach Coordinator, Pacific Islands Ocean Observing System, Honolulu, HI
2007	Marine Science Educator, CMORE, University of Hawaii, Honolulu, HI
2006 – 2007	Nutrient Lab Technician, University of Hawaii, Honolulu, HI
2005	Teaching Assistant, University of Hawaii, Honolulu, HI
2002 – 2005	Research Assistant, University of Hawaii, Honolulu, HI
2001	Research Assistant II, Woods Hole Oceanographic Institution, Woods Hole, MA
2001	Summer Fellow, Woods Hole Oceanographic Institution, Woods Hole, MA
2001, 2000	Sedimentology Laboratory Assistant, University of Missouri – Columbia, Columbia, MO
2000	Research Fellow, Scripps Institute of Oceanography, La Jolla, CA

Publications

- **M.W. Grabowski**, D.M. Karl, M.J. Church. 2008. Nitrogen Fixation Rates and Controls at Station ALOHA. *Aquatic Microbial Ecology* 52:175-183
- K.M. Achillies, K.A. Weersing, **M.W. Grabowski**, B.C. Bruno. 2008. Promoting Education and Outreach Opportunities in Microbial Oceanography. *ASLO/AGU/TOS/ERF Ocean Sciences Meeting*. Orlando, Florida.
- **M.W. Grabowski**, D.M. Karl, M.J. Church. 2006. Iron and Phosphorus as Controls on Nitrogen Fixation at Station ALOHA. *ASLO/TOS/AGU Ocean Sciences Meeting*. Honolulu, Hawaii
- E. Gaidos, B. Deschenes, L. Dundon, K. Fagan, C McNaughton, L. Menviel-Hessler, N. Moskovitz, **M. Workman**. 2005. Beyond the Principle of Plentitude: A Review of Terrestrial Planet Habitability. *Astrobiology* 5: 100 – 126
- H.L. Spalding, **M. Workman**, F.J. Sansone, C.M. Smith. 2004. Macroalgal and Nutrient Dynamics Across a Depth Gradient in a Coral Reef Community in West Maui, Hawaii. *ASLO/TOS Ocean Research Conference*. Honolulu, Hawaii.
- **M. Workman**, C. Herbold, M. Charette. 2001. Utility of Radon-222 as a Tracer of Submarine Groundwater Discharge to Waquoit Bay, MA. *GSA Annual Meeting*. Boston, Massachusetts.

CURRICULUM VITAE

Kim Nicholas Holland

ACADEMIC AFFILIATIONS

Researcher (tenured), Hawaii Institute of Marine Biology
Graduate Faculty, Zoology Dept., University of Hawaii at Manoa.
Senior Research Fellow, Joint Institute of Marine and Atmospheric Sciences, University of Hawaii.

EDUCATIONAL BACKGROUND

Ph.D. (Biology) 1980. University of Pennsylvania
M.S. (Zoology) 1975. University of Hawaii
B.A. Hons. (Zoology) 1971. University of Hawaii

BRIEF OVERVIEW OF AREAS OF PROFESSIONAL INTEREST

My academic interests lie in the areas of marine biology where animal behavior, physiology and ecology intersect. I find reward in applying these disciplines to the development of strategies for sustainable management of living marine resources. This often involves studying the behavior patterns, physiology and habitat preferences of free-ranging marine animals as they move around in their natural environments. To this end, I pioneered the use of small research vessels to conduct acoustic telemetry studies of the movement patterns and physiology of large pelagic marine fishes. Initially, my work targeted species such as tuna and marlin but subsequently I broadened my focus to apply various electronic telemetry and tracking techniques to mobile inshore species such as reef fishes, coastal sharks and turtles

PERTINENT RECENT REFEREED PUBLICATIONS

Meyer, C.G., Papastamatiou, Y. and K.N. Holland. 2010. A multiple instrument approach to quantifying the movement patterns and habitat use of Tiger (Galeocerdo cuvier) and Galapagos sharks (Carcharhinus galapagensis) at French Frigate Shoals, Hawaii. **Marine Biology**. In Press.

Holland, K.N., Meyer C.G., Dagorn L.C. 2010. Inter-animal telemetry: results from first deployment of acoustic 'business card' tags. **Endangered Species Res.**10: 287-293.

Meyer C.G., Clark T.B., Papastamatiou Y.P., Whitney N.M., Holland K.N. 2009. Long-term movements of tiger sharks (*Galeocerdo cuvier*) in Hawaii. **Marine Ecology Progress Series.** 381: 223–235

Holland, K.N and R.D. Grubbs. 2007. Tunas and billfish at seamounts. In: Pitcher, T.J. et al. (Eds.) Seamounts: ecology, fisheries & conservation. **Fish and Aquatic Resources Series**, 12: pp. 189-201. Blackwell Press

Dagorn, L. C., K.N. Holland and D. G. Itano. 2007. Behavior of Yellowfin (Thunnus albacares) and Bigeye (Thunnus obesus) tuna in a network of fish aggregating devices (FADs). **Marine Biology**. 151(2): 595-606.

Douglas S. Luther

Professor of Oceanography
Department of Oceanography, SOEST
University of Hawaii at Manoa
Honolulu, Hawaii 96822
808-956-5875; dluther@soest.hawaii.edu

Professional Preparation

M.I.T.	Geophysics	B.S. (1973)
M.I.T.	Elec. Eng.	B.S. (1973
M.I.T./W.H.O.I.	Oceanography	Ph.D. (1980)
Scripps Inst. Oceanogr.	Phys. Oceanogr.	Postdoc (1980-1982)

Appointments

1993-date	Professor of Oceanography, SOEST, U. Hawaii
1990-1992	Associate Research Oceanographer, Scripps Inst. Oceanogr.
1990-1991	Resident Visitor, Physics Branch, AT&T Bell Labs, Murray Hill, N.J.
1982-1990	Assistant Research Oceanographer, Scripps Inst. Oceanogr.

Recent Synergistic Professional Activities

2010-date:	Project Scientist, NSF Ocean Observatories Initiative (OOI), Regional Scale Nodes component; http://www.interactiveoceans.washington.edu/
2005-2007	Chair, Science & Technical Advisory Committee (STAC) for the Ocean Research Interactive Observatory Networks (ORION; antecedent to OOI)
1999-2006	PI and Steering Committee Member, Hawaii Ocean Mixing Experiment
1997-date	Developed and maintaining the Archive of Rapidly-Sampled Hawaiian Sea Level; http://ilikai.soest.hawaii.edu/arshsl/techrept/arshsl.html
1995-date	Senior Fellow, NOAA/UH JIMAR

Recent Relevant Publications:

Chavanne, C., P. Flament, G. Carter, M. Merrifield, D. Luther, E. Zaron & K.-W. Gurgel, 2010: The surface expression of semi-diurnal internal tides near a strong source at Hawai'i. Part I: Observations and numerical predictions, *J. Phys. Oceanogr.*, **40**, 1155-1179.

Chavanne C., P. Flament, D. Luther and K.-W. Gurgel, 2010: The surface expression of semi-diurnal internal tides near a strong source at Hawai'i. Part II: Interactions with mesoscale currents, *J. Phys. Oceanogr.*, **40**, 1180-1200.

Daly, K., D. Au, S. Gallager, and D. Luther, 2007: Ocean Observatories Initiative - Profiling Mooring Workshop Report, Denver, Colorado, 10-12 July, 2007; Consortium for Oceanographic Leadership, Washington, DC, 2007, 31 pp. (http://www.oceanleadership.org/wp-content/uploads/2009/04/OOI_ProfilingWorkshop2007_Report.pdf)

Luther, D.S., 2003: Physical oceanography from deep ocean submarine cable observatories, *Proc., 3rd International Workshop on Scientific Use of Submarine Cables and Related Technologies*, 25-27 June, 2003, The University of Tokyo, Tokyo, Japan, 6 pp.

Merrifield, M.A., L. Yang & D. Luther, 2002: Numerical simulations of a storm generated island-trapped wave event at the Hawaiian Islands, *J. Geophys. Res.*, 107 (C10), 3169, doi: 10.1029/2001JC001134.

Biographical Sketch – Margaret Anne McManus

(a) Professional Preparation:

Education			
University of Virginia	Environmental Science	BS	1989
Old Dominion University	Biological Oceanography	MS	1991
Old Dominion University Center for Coastal Physical Oceanography	Physical Oceanography	PhD	1996
Post-doctoral Training			
University of Rhode Island	Oceanography	1996-1998	

(b) Appointments:

Associate Professor of Oceanography, University of Hawaii at Manoa	2007-present
Research Associate, University of California Santa Cruz	2007-present
Assistant Professor of Oceanography, University of Hawaii at Manoa	2003-2007
Visiting Assistant Professor, University of California Santa Cruz	2003-2007
Assistant Professor of Ocean Sciences, University of California Santa Cruz	2000-2003
Assistant Marine Research Scientist, University of Rhode Island	1998-2000

(c) Publications (names of students and postdoctoral researchers are underlined)

(i) 9 publications closely related to the proposed project

1. Cheriton OM, MA **McManus**, JV Steinbuck, MT Stacey, JM Sullivan. **2010**. Towed vehicle observations of across-shelf thin layer structure and a low-salinity intrusion in northern Monterey Bay, CA. Continental Shelf Research Special Issue: The Ecology and Oceanography of Thin Plankton Layers. Sullivan JM, MA **McManus** and PL Donaghay (Eds). Vol 30(1): 39-49.
2. Ryan JP, MA **McManus**, JM Sullivan. **2010**. Interacting physical, chemical and biological forcing of phytoplankton thin-layer variability in Monterey Bay, California. Continental Shelf Research Special Issue: The Ecology and Oceanography of Thin Plankton Layers. Sullivan JM, MA **McManus** and PL Donaghay (Eds). Vol 30(1): 7-16.
3. Cheriton OM, MA **McManus**, MT Stacey, JV Steinbuck, and JP Ryan. **2009**. Physical and biological controls on the maintenance and dissipation of a thin phytoplankton layer. Marine Ecology Progress Series. Vol. 378: 55–69.
4. Steinbuck JV, MT Stacey, MA **McManus**, OM Cheriton and JP Ryan. **2009**. Observations of turbulent mixing in a phytoplankton thin layer: Implications for formation, maintenance, and breakdown. Limnology and Oceanography. 54(4): 1353–1368.
5. Woodson CB, L Washburn, JA Barth, DJ Hoover, AR Kirincich, MA **McManus**, JP Ryan, J Tyburczy. **2009**. The northern Monterey Bay upwelling shadow front: Observations of a coastally- and surface-trapped buoyant plume. J. Geophys. Res., 114, C12013, doi:10.1029/2009JC005623.
6. Benoit Bird KJ, MJ Zirbel, MA **McManus. 2008**. Diel variation of zooplankton distribution in Hawaiian waters favors horizontal diel migration by midwater micronekton. Marine Ecology Progress Series. 367:109-123.
7. **McManus** MA, KJ Benoit-Bird, CB Woodson. **2008.** Behavior Exceeds Physical Forcing in the Diel Horizontal Migration of a Midwater Sound-Scattering Layer in Hawaiian Waters. Marine Ecology Progress Series. 365: 91-101.
8. Ostrander CE, MA **McManus,** EH DeCarlo and FT MacKenzie. **2008.** Temporal and spatial variability of freshwater plumes in a semi-enclosed estuarine-bay system. Estuaries and Coasts. 31:192-203.
9. Barth JA, BA Menge, J Lubchenco, F Chan, JM Bane, AR Kirincich, MA **McManus**, KJ Nielson, SD Pierce and L Washburn. **2007**. Delayed upwelling alters coastal ocean ecosystems in the northern California current. Proceedings of the National Academy of Sciences. 104(10) 3719-3724.

BIOGRAPHICAL SKETCH

Mark A. Merrifield

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School of Ocean and Earth Sciences and Technology
University of Hawaii at Manoa
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markm@soest.hawaii.edu

Professional Preparation

University of California, Berkeley	Physics	AB, 1982
University of California, San Diego	Oceanography	PhD, 1989

Appointments

Oceanography, University of Hawaii	Professor	2004-present
Oceanography, University of Hawaii	Associate Professor	1999-2004
Oceanography, University of Hawaii	Assistant Professor	1997-1999
Ocean Engineering, University of Hawaii	Assistant Professor	1994-1997
Scripps Institution of Oceanography	Assist. Res. Oceanographer	1993-1994
Scripps Institution of Oceanography	Project Scientist	1991-1993
Mathematics, Univ. of New South Wales	Research Associate	1989-1991
Scripps Institution of Oceanography	Research Assistant	1982-1989

Recent Publications

Merrifield, M. A., S. T. Merrifield, and G. T. Mitchum, An anomalous recent acceleration of global sea level rise, *J. Clim*., 22, doi:10.1175/2009JCLI2985.1, 2009.

Genz, J., J. Aucan, M. Merrifield, B. Finney, K. Joel, and A. Kelen, Wave transformations in indigenous navigation, *Oceaongraphy*, 22, 234-245, 2009.

Zilberman, N. V., J. M. Becker, M. A. Merrifield, and G. S. Carter, Model estimates of M2 internal tide generation over mid-Atlantic ridge topography, *J. Phys. Oceanogr*., 39, 2635-2651, 2009.

Pequignet, A. C. N., J. M. Becker, M. A. Merrifield, and J. Aucan, Forcing of resonant modes on a fringing reef during tropical storm Man-Yi, *Geophys. Res. Lett.,* 36, L03607, doi:10.1029/2008GL036259, 2009.

Chavanne, C., P. Flament, G. Carter, M. Merrifield, D. Luther, E. Zaron, and K-W Gurgel, Tides and mesoscale interactions in the Kaua'i Channel, Hawai'i, submitted to *J. Phys. Oceanogr*., 2009.

Carter, G. S., M. A. Merrifield, J. Becker, K. Katsumata, M. C. Gregg, D. S. Luther, M. Levine, T. S. Boyd, and Y. L. Firing, Energetics of M2 barotropic to baroclinic tidal conversion at the Hawaiian Islands, *J. Phys. Oceanogr*., 38, doi:10.1175/2008JPO3860.1, 2008.

Synergistic Activities

Director, University of Hawaii Sea Level Center
Chair, Global Sea Level Observing System, Group of Experts
Lead, Waves & Water Level Component, Hawai'i Ocean Observing System (HiOOS)
Member, Jason Science Working Team
Member, NOAA Climate Observations Panel

CURRICULUM VITAE

Name: Darren Kazuo Okimoto

Mailing address: University of Hawaii Sea Grant College Program
School of Ocean & Earth Science & Technology
University of Hawaii at Manoa
2525 Correa Road, HIG 238
Honolulu, Hawaii 96822
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Education:

1984. B. A. Department of Zoology, University of Hawaii at Manoa, Honolulu, Hawaii.
1990. M.S. Department of Zoology, University of Hawaii at Manoa, Honolulu, Hawaii.
1997. Ph.D. Department of Biological Sciences, University of Delaware, Newark, Delaware.

Professional Experience:

September 2006-present. Extension Leader, University of Hawaii Sea Grant College Program, Honolulu, Hawaii.

Selected Funded Proposals

June 2008. Funding Agency: National Oceanic and Atmospheric Administration Coastal Services Center. Title: PacIOOS Regional Association Support 2008-1011. PI: Dr. Brian Taylor, Dean, School of Ocean, Earth Science & Technology. Co-PI's: Dr. Margaret McManus, Associate Professor, Department of Oceanography; Dr. Darren Okimoto, Extension Leader, University of Hawaii Sea Grant College Program; Dr. James Potemra, Assistant Researcher, International Pacific Research Center. Amount awarded: $397,909. Contract period: June 1, 2008-May 31, 2011.

December 2009. Funding Agency: NOAA National Sea Grant College Program and Office of Program Planning and Integration. Title: Pacific Climate Impacts Resource Guide. PI: Dr. Darren Okimoto, Extension Leader, University of Hawaii Sea Grant College Program. Co-PI's: James Weyman, Director/Meteorologist in Charge/Executive Director of the Pacific Climate Information System, NOAA National Weather Service; Eileen Shea, Director/Steering Committee Chair, NOAA Integrated Data and Environmental Applications Center/Pacific Climate Information System; Lynn Nakagawa, Education Outreach Specialist, NOAA Integrated Data and Environmental Applications Center/East West Center. Amount awarded: $25,000. Contract period: December 1, 2009 through November 30, 2010.

CURRICULUM VITAE - GENO PAWLAK
September 2010

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2540 Dole St., Holmes Hall 404 pawlak@hawaii.edu
Honolulu, HI 96822 www.soest.hawaii.edu/OE/pawlak/

Education

1997 Ph.D., Mechanical Engineering, University of California, San Diego

1994 M.S.E., Mechanical Engineering, University of California, San Diego

1991 B.S.E., Aerospace Engineering and Mechanics, University of Minnesota, Minneapolis, MN

Professional History

2007-Present Associate Professor, Dept. of Ocean and Resources Engineering, University of Hawaii; Cooperating Graduate Faculty in Dept. of Oceanography since 2002.

2001-2007 Assistant Professor, Dept. of Ocean and Resources Engineering, University of Hawaii.

1998-2001 Postdoctoral Research Associate, School of Oceanography, University of Washington.

1997-1998 Postdoctoral Research Associate, Scripps Institution of Oceanography, University of California, San Diego.

Selected Publications (5 most related to proposed work)

J. Sevadjian, M.A.McManus, G. Pawlak, "Effects of physical structure and processes on thin zooplankton layers in Mamala Bay, Hawai'i." Marine Ecology Progress Series, 409: 95-106, 2010.

F.J. Sansone, G. Pawlak, T.P. Stanton, M.A. McManus, B.T. Glazer, E.H. DeCarlo, M. Bandet, J. Sevadjian, K. Stierhoff, C. Colgrove, A.B. Hebert, and I.C. Chen, "Kilo Nalu: Physical/Biogeochemical Dynamics Above and Within Permeable Sediments", Oceanography, 21, no. 4, Dec. 2008

N.L Jones, R.J. Lowe, G. Pawlak, D.A. Fong, S.G. Monismith, "Plume dispersion on a fringing coral reef system", Limnology and Oceanography, 53, no.5 pt. 2, pp 2273-2286, 2008

J. D. Bricker, S. Munger, J. R. Wells, G. Pawlak, and K.F. Cheung, 2007, "ADCP observations of edge waves off Oahu in the wake of the November 2006 Kuril Islands tsunami", Geophysical Research Letters, 34, L23617, doi:10.1029/2007GL032015, Dec. 2007.

A. B. Hebert, F. J. Sansone, G. Pawlak, "Tracer dispersal in sandy sediment porewater under enhanced physical forcing", Continental Shelf Research, 27, no. 17, p. 2278-2287, doi:10.1016/j.csr.2007.05.016, Oct. 2007

Synergistic Activities

- Participating in UH Faculty Ambassadors Program: This program takes UH faculty members to local schools with the purpose of giving high school students a personal view of the university academic. The project aims to increase interest in higher education in general.
- Established Environmental Fluid Dynamics Education Laboratory at the University of Hawaii. This lab serves as a center for teaching of fluids phenomena in support of courses within SOEST and available for the general University community. The EFDEL also is a key participant in the biannual SOEST Open House which invites the local schools and community to learn about SOEST research.
- Referee for JFM, J. Fluid Eng., L&O, JPO, JCR, JGR, DSR, J. Wat., Port, Coast. Ocean Eng., Ocean Eng.
- Session Chair, 2000, 2002, 2010 AGU Ocean Sciences Meeting; Session Chair, Oceans 2001 Meeting; APS Division of Fluid Dynamics Meeting; Special Session Convener/Chair, 2006, 2010 AGU Ocean Sciences Meeting; Session Organizer, 2002, 2005, 2007 ASME OMAE Conference; Panelist, Alliance for Coastal Technology, 2006 Seabed Sensor Technology Workshop.

CHRIS E. OSTRANDER
Director, Pacific Islands Ocean Observing System

EDUCATION

The United States Military Academy		1999-2001
Johns Hopkins University	B.A. Political Science	2003
University of Hawaii at Manoa	M.S. Oceanography (Physical)	2007

PROFESSIONAL EXPERIENCE

2010-present Director, Pacific Islands Ocean Observing System, Honolulu, HI
2007-2010 Coordinator, Hawaii Ocean Observing System, Honolulu, HI
2007-2010 Coordinator, Pacific Islands Ocean Observing System, Honolulu, HI
2007 Oceanographic Research Specialist, Department of Oceanography, University of Hawaii, Honolulu, HI.
2005-2007 Graduate Research Assistant, Department of Oceanography, University of Hawaii at Manoa, Honolulu, HI.
2005 Research Assistant, Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, MD.

REFEREED PUBLICATIONS IN SCHOLARLY JOURNALS

Ostrander, CE, H Seim, B Studer, E Smith, A Luscher. **2010**. Contributions of the US Integrated Ocean Observing System to national and regional coastal hazards information, tools and services. *Marine Technology Society Journal*. **Submitted**.

Tomlinson, MS, EH De Carlo, MA McManus, G Pawlak, GF Steward, FJ Sansone, OD Nigro, CE **Ostrander**, RE Timmerman, J Patterson, SJ Uribe. **2010**. Monitoring the Effects of Storms on Coastal Water Quality with the Hawaii Ocean Observing System (HiOOS). *Estuaries and Coasts.* **Submitted**.

Ostrander, CE, MA McManus, EH DeCarlo, FT Mackenzie. **2008.** Temporal and spatial variability of freshwater plumes in a semi-enclosed estuarine-bay system. *Estuaries and Coasts* 31(1): 192-203.

Woodson,CB, DI Eerkes-Medrano, A Flores-Morales, M Foley, S Henkel, M Hessing-Lewis, D Jacinto, L Needles, M Nishizaki, J O'Leary, CE **Ostrander**, M Pespeni, K Schwager, JA Tyburczy, KA Weersing, A Kirincich, J Barth, MA McManus, and L Washburn. **2007**. Local diurnal upwelling driven by sea breezes in northern Monterey Bay. *Continental Shelf Research.* 27(18): 2289-2302.

PROFESSIONAL ACTIVITIES

Convened the Governing Council for the Pacific Islands Ocean Observing System, 2010.
NOAA Regional Collaboration Team, Pacific Islands, 2010
National Leadership Team, NOAA Coastal Storms Program, 2009-present
Board of Directors, National Federation of Regional Associations, 2008-present
Working Group, Hawaii Ocean Resources Management Plan, 2008-present
Education-Outreach Committee, SOEST, University of Hawaii, 2007-2010
Participant: Integrated Ocean Observing System Annual Regional Coordination Workshops, 2007-2010
Reviewer for Hawaii CZM, University of Hawaii Sea Grant College Program, and NOAA Coastal Storms Program proposals

James T. Potemra

International Pacific Research Center (IPRC)
School of Ocean and Earth Science and Technology
University of Hawai'i
1680 East-West Road, POST Bldg., 4th floor
Honolulu, HI 96822

Professional Preparation

Ph.D. 1998: University of Hawaii, Honolulu, HI.
M.S. 1990: Florida State University, Tallahassee, FL.
B.S. 1986: Stevens Institute of Technology, Hoboken, NJ.

Appointments

2008--present: Assistant Faculty Specialist, HIGP/SOEST, University of Hawaii
2008--present: Associate Researcher, IPRC/SOEST, University of Hawaii
2001--present: Assistant Researcher, IPRC/SOEST, University of Hawaii
1999--2001: Research Associate, post-doctoral, School of Oceanography, University of Washington
1998--1999: Post-doctoral researcher, IPRC/SOEST, University of Hawaii

Five Recent Publications

Potemra, J. T., 2010: Numerical modeling with application to tracking marine debris. *Mar. Poll. Bull.*., in review.
Cornillon, P., J. Adams, M. B. Blumenthal, E. Chassignet, E. Davis, S. Hankin, J. Kinter, R. Mendelssohn, J. T. Potemra, A. Srinivasan and J. Sirot 2009: NVODS and the development of OPeNDAP - an integrative tool for oceanographic data systems. *Oceanography*, **22**, 116-127.
Potemra, J. T. and T. Qu 2009: The Seas of Southeast Asia. Encyclopedia of Ocean Sciences, 2nd Edition, J. H. Steele, K. K. Turekian and S. A. Thorpe, Editors. Oxford: Academic Press.
Jochum, M. and J. T. Potemra 2008: Vertical mixing in the Banda Sea. *J. Clim*., in press.
Potemra, J. T. and N. Schneider 2007: Influence of low-frequency Indonesian throughflow transport on temperatures in the Indian Ocean in a coupled model. *J. Clim*., in press.

Synergistic Activities

Manager of Pacific Regional Argo Center
Participant on Argo Data Management Team
Member of Pacific Island Global Ocean Observing System (PI-GOOS) advisory committee
Member of Integrated Ocean Observing System (IOOS) Data Integration Framework working group
Member of Integrated Ocean Observing System (IOOS) Technical Advisory Committee (TAC) for the Ocean Observations Registry

Brian Powell

Education

2005	Ph.D., University of Colorado
2000	M.S., University of Colorado
1993	B.S., University of Colorado

Appointments

2008–Present	Assistant Professor, Department of Oceanography, University of Hawai`i.
2006–2008	Postdoctoral Research Associate, Institute of Marine Science, University of California, Santa Cruz.
2005–2006	Postdoctoral Researcher, Cooperative Institute for Research in Environmental Sciences, University of Colorado.
2001–2005	Graduate Research Assistant, Colorado Center for Astrodynamics Research, University of Colorado.
1997–2001	Founder and President, OS, Inc.
1996–1997	Senior Engineer, InfoNow, Corp.
1994–1996	Algorithms Engineer, TRW Space/Defense Sector.

Five Relevant Publications

Powell, B. S., A. Moore, H. Arango, E. Di Lorenzo, R. Milliff, and R. R. Leben: "Near real-time Assimilation and Prediction in the Intra-Americas Sea with the Regional Ocean Modeling System (ROMS)", *Dynam. Atmos. Oceans*, 48:46–68, 2009.
Broquet, G., C. A. Edwards, A. Moore, B. S. Powell, M. Veneziani, and J. D. Doyle: "Application of 4D-Variational data assimilation to the California Current System", *Dynam. Atmos. Oceans*, 48:69–92, 2009.
Powell, B. S. and A. Moore: "Estimating the 4DVAR Analysis Error of GODAE Products", *Ocean Dynam.*, 59:121–138, 2008.
Powell, B. S., H. Arango, A. Moore, E. Di Lorenzo, R. Milliff, and D. Foley: "4DVAR Data Assimilation in the Intra-Americas Sea with the Regional Ocean Modeling System (ROMS)", *J. Ocean Mod.*, 25:173–188, 2008.
E. D. Lorenzo, A. M. Moore, H. G. Arango, B. D. Cornuelle, A. J. Miller, B. S. Powell, B. S. Chua, and A. F. Bennett: "Weak and Strong Constraint Data Assimilation in the inverse Regional Ocean Modeling System (ROMS): development and application for a baroclinic coastal upwelling system." *J. Ocean Mod.*, 16:160–187, 2007.

People

Postdoctoral	Dr. Dax Matthews, Dr. Ivica Janekovic
Researchers	Dr. Andrei Natarov, Marcia Hsu
Students	Rebecca Baltes, Abby Johnson, Colette Kerry

Awards

2009	ONR Young Investigator Award

Alexander Shor
Associate Dean for Research, SOEST

Appointments
2007-present: Associate Dean for Research, School of Ocean and Earth Science and Technology, University of Hawaii, Honolulu, Hawaii, USA. Position includes responsibility for oversight of University of Hawaii Marine Center and research vessel operations.
1998-2007: Program Director, Oceanographic Instrumentation and Technical Services Program, Division of Ocean Sciences, National Science Foundation, Arlington, Virginia, USA
1986-1998: **Associate (R4) and Full (R5) Researcher**, Hawaii Institute of Geophysics, University of Hawaii, Honolulu, Hawaii, USA. Includes period from 1994-1998, at NSF as Associate Program Director ("rotator") under Intergovernmental Personnel Act assignment in Arlington, Virginia, USA.
1981-1986: **Associate Research Scientist**, Lamont-Doherty Geological Observatory, Columbia University, Palisades, New York, USA.
1979-1980: **Postdoctoral Fellow** of Columbia University, Lamont-Doherty Geological Observatory, Columbia University, Palisades, New York, USA.
1974-1979: **Graduate Research Associate**, Woods Hole Oceanographic Institution and Massachusetts Institute of Technology

Professional Preparation
Ph.D., WHOI/MIT Joint Program in Oceanography, 1980 in Oceanography
B.A., Magna cum laude, Harvard College, 1974 in Geological Sciences

Oceanographic field program experience
Participant in numerous oceanographic research cruises 1969 through 1994 in capacities ranging from oceanographic technician to chief scientist. Total of more than three years at sea on research vessels David Starr Jordan, Alexander Agassiz, Gosnold, Eltanin, Knorr, Atlantis II (and Alvin submersible), Glomar Challenger, CSS Hudson (Canada), Gyre, RMS Discovery (UK), Conrad, Thomas Washington, Endeavor, Oden Finder (Norway), Moana Wave, Pandora (Canada; also Pisces IV submersible), Onnuri (Korea), and Chang Won (Korea). Since 1994, have participated as NSF representative at formal inspections or informal surveys of UNOLS research vessels Calanus, Walton Smith, Seward Johnson, Seward Johnson II, Savannah, Cape Henlopen, Hugh Sharp, Revelle, Point Sur, Barnes, Alpha Helix, Kilo Moana, Gyre, and Pelican.

Selected scientific publications
1. Smith, J.R., A. Malahoff and **A.N. Shor**, 1999. Submarine geology of the Hilina slump and morpho-structural evolution of Kilauea volcano, Hawaii. J. Volcanol. Geotherm. Res., v. 94, p. 59-88.
2. Appelgate, Bruce and **Alexander N. Shor**, 1994. The northern Mid-Atlantic and Reykjanes Ridges: Spreading center morphology between 55°50'N and 63°00'N. J. Geophys. Res., v. 99, p.17,935–17,956.
3. Joseph, Devorah, Brian Taylor, and **Alexander N. Shor**, 1992. New sidescan sonar and gravity evidence that the Nova-Canton Trough is a fracture zone. Geology, v. 20, p. 435-438.
4. Macdonald, K.C., R.M. Haymon and **A.N. Shor**, 1989. A 220 km^2 recently erupted lava field on the East Pacific Rise near 8°S, Geology 17: 212-216.
5. Piper, David J.W., **Alexander N. Shor** and John E. Hughes Clarke. 1988. The 1929 "Grand Banks" earthquake; slump and turbidity current. Geological Society of America, Special Paper on Catastrophic Events in Geology, No. 229, pp. 77-92.

Appendix 10:

National Environmental Policy Act (NEPA)
In complying with the requirements of NOAA Funding Opportunities Title: FY2011 Integrated Ocean Observing System Implementation, Funding Opportunity Number: NOAA-NOS-IOOS-2011-2002515, the following information is provided concerning our proposal.

Species and Habitat
No marine species or habitat will be affected by the observing system development.

Possible Construction Activities
No offshore construction activities will be initiated by this proposal and program.

Any Environmental Concerns
There are no specific environmental concerns that this proposal will generate. No hazardous or toxic chemicals will be used, no invasive species of marine organisms will be introduced, there will not be any impact on marine organisms, endangered, threatened and otherwise, and there will not be any impact on any coral reef system.

Question C1: Is the proposed activity going to be conducted in partnership with NOAA or would the proposed activity require NOAA's direct involvement, activity, or oversight? If yes, describe NOAA's involvement, activity, or oversight, including the name of the office or program that is involved.
Yes, this award will be made as a cooperative agreement between NOAA and the University of Hawaii. Employees and contractors of the University of Hawaii and the Research Corporation of the University of Hawaii will carry out the work described in this proposal in collaboration with the NOAA IOOS Program. The NOAA Pacific Islands Fisheries Science Center, Coral Reef Ecosystem Division serves on the PacIOOS Governing Council and will be involved in the oversight and planning of system development. Other NOAA offices in the region contribute to PacIOOS development by providing input as regional stakeholders.

Question C2: Would the proposed activity involve any other federal agency(ies) partnership, direct involvement, activity, or oversight? If yes, provide the name(s) of the agency(ies) and describe its involvement, activity, or oversight.
Yes. In addition to NOAA the United States Army Corps of Engineers and the United States Coast Guard serve as members of the PacIOOS Governing Council and provide planning guidance and program oversight. Other federal agencies listed in Section 2.f. contribute to PacIOOS development as part of the larger stakeholder community.

Question D1: Provide a brief description of the location of the proposed activity.
Proposed activity will occur in the State of Hawaii, Territories of Guam and American Samoa, the Commonwealth of the Northern Mariana Islands, the Republic of Palau, the Republic of the Marshall Islands, and the Federated States of Micronesia. A more detailed description of specific activities is presented in Section 3.d.

Question E1: List any federal, state, or local permits, authorizations, or waivers that would be required to complete the proposed activity. Provide the date the permit, authorization, or waiver

was obtained or will be obtained. Provide copies of permits, authorization, or waiver as appropriate. Was a NEPA analysis prepared for the permit, authorization, or waiver? If yes, state the title of the NEPA analysis and provide copies of the NEPA analysis.

Kilo Nalu operates under a Conservation District Use Permit (CDUA OA-11/20/86-1941) obtained for the Look Lab test range in 1987. It has been recently extended this to cover the broader area used by the observatory - this was done via DLNR site plan approval OA 06-40 (May 2, 2006). There is also an Army Corps Nationwide 5 permit issued originally on 2/2/2004 (#200400117). There is also Army Corps permit "Coastal Zone Management Federal Consistency Determination" (issued 1/30/2004). The nearshore sensors operate under a DLNR DAR Special Activities Permit issued 19 August 2009 (#SAP-2010-17). The harbor monitoring instrumentation in Kalaeloa Harbor operates under a State of Hawaii, Department of Transportation Right of Entry permit issued October 24, 2008 (#H-08-2). The water quality buoys operated under USACE permit (POH-2008-54) and are supplemented by USCG private aids to navigation permits issued June 1, 2008 (S/N 14-08-0012 and S/N 14-08-005). The pelagic tagging component operates under an Institutional Animal Care and Use Committee permit (#05-053-4). The HF Radios operate under the following permits/authorizations: FAA Determination of No Hazard to Air Navigation issued May 20, 2008 (ASN 2008-AWP-2482-OE); FCC Experimental License (#WA2XXL); Hawaii DLNR Site Plan Approval issued April 6, 2009 (SPA-OA-09-27); City and County of Honolulu Special Management Area Permit (2009/SMA-12); Hawaii State Waiver from Chapter 343 HRS issued February 5, 2009; City and County of Honolulu Non-Exclusive License Agreement signed May 1, 2009; Hawaii Community Development Association Right of Entry issued July 24, 2009: USFW Special Use Permit issued December 5, 2008 (#ORC-PK4-08); USAF Space Command Right of Entry agreement issued July 28, 2009; Hawaii DLNR Site Plan Approval issued July 14, 2009 (SPA OA-09-50); Hawaii DLNR Right of Entry issued September 8, 2009 (09OD-081).

Proposed HFR deployments would require County of Maui and Hawaii Department of Land and Natural Resources permits. All proposed moorings and nearshore sensors in Hawaii would require U.S. Army Corps of Engineers, U.S. Coast Guard, Hawaii Department of Transportation, State Department of Land and Natural Resources, and local county permits. Proposed moorings and nearshore sensors outside of Hawaii would require U.S. Army Corps of Engineers, U.S. Coast Guard, and Territorial government permits as well as permission from village chiefs (American Samoa). Deployments outside of the United States would require local government permits as required by each jurisdiction. PacIOOS instruments are already permitted in all jurisdictions and procurement of additional permits for FY11 deployments will occur in FY10 and will not inhibit the deliverables proposed herein.

A NEPA analysis was not performed for any of the listed permits and authorizations.

Question F1: Is there the potential for the proposed activity to cause changes that would be different from normal ambient conditions (e.g., temperature, light, turbidity, noise, other human activity levels, etc.)? If yes, describe the changes and the circumstances that would cause these changes.

No

Appendix 11: Approved Rate Agreement

COLLEGES AND UNIVERSITIES RATE AGREEMENT

EIN #: .

DATE: May 5, 2009

INSTITUTION:
University of Hawaii
2530 Dole Street
Sakamaki D-200
Honolulu HI 96822

FILING REF.: The preceding Agreement was dated February 28, 2006

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: FACILITIES AND ADMINISTRATIVE COST RATES*

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

TYPE	EFFECTIVE PERIOD FROM	TO	RATE(%)	LOCATIONS	APPLICABLE TO
PRED.	07/01/08	06/30/09	38.4	On-Campus	Organized Research
PRED.	07/01/09	06/30/12	36.7	On-Campus	Organized Research
PRED.	07/01/08	06/30/12	20.6	Off-Campus	Organized Research
PRED.	07/01/08	06/30/09	27.4	On-Campus	Instruction
PRED.	07/01/09	06/30/12	27.5	On-Campus	Instruction
PRED.	07/01/09	06/30/12	20.0	Off-Campus	Instruction
PRED.	07/01/08	06/30/09	26.9	On-Campus	Other Spon Act
PRED.	07/01/09	06/30/12	25.0	On-Campus	Other Spon Act
PRED.	07/01/08	06/30/12	19.0	Off-Campus	Other Spon Act
PRED.	07/01/08	06/30/09	25.4	On-Campus	Inst. for Astronomy
PRED.	07/01/09	06/30/12	34.2	On-Campus	Inst. for Astronomy
PRED.	07/01/08	06/30/12	19.5	Off-Campus	Inst. for Astronomy
PRED.	07/01/08	06/30/09	3.1	(A)	Direct Projects
PRED.	07/01/09	06/30/12	2.7	(A)	Direct Projects
PRED.	07/01/08	06/30/09	8.9	(B)	(C)
PRED.	07/01/09	06/30/12	8.6	(B)	(C)
PRED.	07/01/08	06/30/09	53.5	(D)	Organized Research
PRED.	07/01/09	06/30/12	50.0	(D)	Organized Research
PROV.	07/01/12	UNTIL AMENDED	Use same rates and conditions as those cited for fiscal year ending June 30, 2012.		

(A) Research Corp. of U.H.
(B) Applied Research Laboratory
(C) University Affiliated Research Center
(D) Kaka'ako campus including Gold Bond Building

*BASE:
Modified total direct costs, consisting of all salaries and wages, fringe benefits, materials, supplies, services, travel and subgrants and subcontracts up to the first $25,000 of each subgrant or subcontract (regardless of the period covered by the subgrant or subcontract). Modified total direct costs shall exclude equipment, capital expenditures, charges for patient care, tuition remission, rental costs of off-site facilities, scholarships, and fellowships as well as the portion of each subgrant and subcontract in excess of $25,000.

Appendix 12: Letters of Support

MADELEINE Z. BORDALLO
GUAM

427 CANNON HOUSE OFFICE BUILDING
WASHINGTON, DC 20515-5301
(202) 225-1188
FAX: (202) 226-0341

DISTRICT OFFICE:
120 FATHER DUENAS AVENUE
SUITE 107
HAGÅTÑA, GUAM 96910
(671) 477-4272
FAX: (671) 477-2587

http://www.house.gov/bordallo

Congress of the United States
House of Representatives

NATURAL RESOURCES COMMITTEE
CHAIRWOMAN, SUBCOMMITTEE ON INSULAR AFFAIRS, OCEANS AND WILDLIFE
SUBCOMMITTEE ON NATIONAL PARKS, FORESTS AND PUBLIC LANDS

ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON READINESS
SUBCOMMITTEE ON MILITARY PERSONNEL

September 10, 2010

Christopher Ostrander
Director
Pacific Islands Ocean Observing System
University of Hawaii at Manoa
Post Building, Room 105b
Honolulu, Hawaii 96822

Dear Mr. Ostrander,

I write to support the work of the Pacific Islands Ocean Observing System (PacIOOS) and their proposal to continue their work in the Pacific Region. This program which is one of eleven regional observing programs established around the country provides a vital resource of marine environmental information utilized by the U.S. Department of Defense, U.S. Coast Guard, local government agencies, educational institutions, community organizations, and citizens. As a program activity funded by the National Oceanic and Atmospheric Administration (NOAA), PacIOOS allows for the timely sharing and coordination of important ocean information across a large region of the Pacific, spanning six time zones.

As the Chairwoman of the Subcommittee on Insular Affairs, Oceans and Wildlife and the elected Congressional representative from Guam, I acknowledge and appreciate the resources and support that the PacIOOS provides for the Pacific Region. The ocean data collected and shared by PacIOOS with other regional partners and entities provides a scientific and fact-based context to make informed navigational, logistical, emergency response and policy decisions. The work and data provided by PacIOOS also helps to better inform policy makers, scientists, educators and other stakeholders on the importance of environmental stewardship. This data is vital to the economic success of the Pacific jurisdictions, as the region relies heavily on ocean resources for tourism, fisheries and recreation.

I continue to work to ensure that federal resources support institutions that work to study and preserve our oceans and coastal environment. Earlier in the 111th Congress, I sponsored H.R. 365, the "Ocean and Coastal Mapping Integration Act." This legislation authorized a long-term framework for new investments to existing entities that engage in ocean observing technologies. H.R. 365 was included in the Omnibus Public Land Management Act of 2009 and signed into law by President Obama on March 30, 2009.

The fragile ecosystems of Pacific Islands make this region particularly sensitive to the threat of global climate change which is intrinsically linked to the ocean environment. For this reason the work of PacIOOS is essential. As our region continues to develop environmental and ocean policy, the work of PacIOOS will play a central role in informing decision-makers, scientists, resource managers, shippers and others throughout the process. I recommend a favorable consideration of their application for continued funding. Thank you for your attention to this request.

Sincerely,

Madeleine Z. Bordallo

MADELEINE Z. BORDALLO
Member of Congress

GREGORIO KILILI CAMACHO SABLAN
NORTHERN MARIANA ISLANDS

COMMITTEE ON EDUCATION AND LABOR
SUBCOMMITTEE ON EARLY CHILDHOOD, ELEMENTARY AND SECONDARY EDUCATION
SUBCOMMITTEE ON WORKFORCE PROTECTIONS

COMMITTEE ON NATURAL RESOURCES
SUBCOMMITTEE ON INSULAR AFFAIRS, OCEANS AND WILDLIFE
SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

Congress of the United States
House of Representatives
Washington, DC 20515

423 CANNON HOUSE OFFICE BUILDING
(202) 225-2646
TOLL FREE: 1 (877) 446-3465
P.O. BOX 504879
SAIPAN, MP 96950
(670) 323-2647/8
P.O. BOX 1361
ROTA, MP 96951
(670) 532-2647
GENERAL DELIVERY
TINIAN, MP 96952
(670) 433-2647
www.Sablan.house.gov
kilili@mail.house.gov

September 7, 2010

Mr. Chris E. Ostrander
Director
Pacific Islands Ocean Observing System (PacIOOS)
1680 East-West Road
c/o CMMED, POST 105
Honolulu, Hawaii 96822

Dear Mr. Ostrander:

I am writing in support of the Pacific Islands Ocean Observing System (PacIOOS) proposal to continue the development of the PacIOOS program under the National Oceanic and Atmospheric Administration (NOAA) Integrated Ocean Observing System (IOOS) program. The work PacIOOS proposes will expand current ocean observation network which will result in strengthening ongoing efforts in the Commonwealth of the Northern Mariana Islands to promote a safe, healthy, productive ocean and a resilient coastal zone.

Such improvements will allow for substantive development of capacity in the Marianas Archipelago through the deployment of current meters, coastal cameras, LIDAR (light detection and ranging) mapping, and the development of wave, ocean, and atmospheric numerical models. PacIOOS proposes to continue the promotion of outreach, education, and extension of ocean information by supporting student participation in research and field activities, providing material for the development of curriculum in public school systems, and extending timely, relevant, and accurate information on the open and coastal ocean to the public within the Pacific Islands region.

I support and strongly recommend favorable consideration of this project for continued and sustained funding.

Sincerely,

Kilili

GREGORIO KILILI CAMACHO SABLAN
Member of Congress

EXECUTIVE CHAMBERS

HONOLULU

LINDA LINGLE
GOVERNOR

September 2, 2010

Mr. Chris E. Ostrander, Director
Pacific Islands Ocean Observing System
1680 East-West Road
c/o CMMED, POST 105
Honolulu, Hawaii 96822

Dear Mr. Ostrander:

I am writing in support of the Pacific Islands Ocean Observing System (PacIOOS) grant submission proposal that will continue the development of the PacIOOS system under the NOAA Integrated Ocean Observing System (IOOS) program. The PacIOOS work strengthens the effort of Hawaii and the Insular Pacific to promote a safe, healthy, productive ocean and resilient coastal zones.

The PacIOOS effort has provided real-time and forecast ocean information in addition to outreach, education, and extension of ocean information through student participation in research and field studies. These activities have supported the development of K-12 curriculum in public school systems and provided timely, relevant and accurate information on the open and coastal ocean to Hawaii, the US territories, and US-affiliated nations in the Pacific Islands region.

Continuing the work of the PacIOOS program will aid in improving the health of our ocean resources; assist businesses and developers on ways to minimize adverse environmental impacts; enhance the conservation of protected species, unique habitats, sustain biological diversity; support ocean science and technology, including alternative energy and local ocean observation capability.

I commend PacIOOS and their Governing Council for their work in educating and informing the public about our ocean and the care we must use to assure the perpetual care of this critical natural resource.

In this regard, I wholeheartedly support your effort to seek additional grants and funding that will enable the continuation of this important effort.

Sincerely,

LINDA LINGLE

EMBASSY OF THE UNITED STATES OF AMERICA
MAJURO • REPUBLIC OF THE MARSHALL ISLANDS • 96960

August 17, 2010

Mr. Chris E. Ostrander
Director
Pacific Islands Ocean Observing System (PacIOOS)
1680 East-West Road
c/o CMMED, POST 105
Honolulu, Hawaii 96822

Dear Mr. Ostrander:

I am writing in support of the Pacific Islands Ocean Observing System (PacIOOS) proposal to continue the development of the PacIOOS program under the NOAA Integrated Ocean Observing System (IOOS) program. The work PacIOOS proposes will continue to strengthen ongoing efforts in the Republic of the Marshall Islands to promote a safe, healthy, productive ocean and a resilient coastal zone.

PacIOOS currently provides real-time and forecasted ocean information in the Marshall Islands and through the Insular Pacific region. Further, it promotes outreach, education, and extension of ocean information by supporting student participation in research and field activities, providing material for the development of curriculum in public school systems, and extending timely, relevant, and accurate information on the open and coastal ocean to the public within the Pacific Islands region. Such a project will continue to improve the health of our ocean resources; enhance conservation of protected species, unique habitats, and biological diversity; encourage cutting edge and appropriate ocean science and technology; and build local ocean observing capacity through training, extension, and the creation of jobs.

I support the commitment of PacIOOS and their Governing Council to the elucidation and distribution of ocean information for the benefit of the community as a whole. In this regard, I wholeheartedly support and strongly recommend favorable consideration of this project for continued and sustained funding.

Sincerely,

Martha L. Campbell
U.S. Ambassador
Republic of the Marshall Islands

REPUBLIC OF PALAU

OFFICE OF THE MINISTER
MINISTRY OF NATURAL RESOURCES, ENVIRONMENT & TOURISM
P.O. Box 100 Koror, Republic of Palau 96940

Harry R. Fritz
Minister

Telephone: (680) 767-5435/3125
Fax: (680) 767-3380
E-mail: mnret@palaugov.net

Mr. Chris E. Ostrander
Director
Pacific Islands Ocean Observing System (PacIOOS)
1680 East-West Road
c/o CMMED, POST 105
Honolulu, Hawaii 96822

Director Ostrander:

I am writing in support of the Pacific Islands Ocean Observing System (PacIOOS) proposal to continue the development of the PacIOOS system under the NOAA Integrated Ocean Observing System (IOOS) program. The work PacIOOS proposes will continue to strengthen efforts within the Republic of Palau to promote a safe, healthy, productive ocean and a resilient coastal zone.

PacIOOS currently provides not only real-time and forecasted ocean information, but also promotes outreach, education, and extension of ocean information by supporting student participation in research and field activities, providing material for the development of K-12 curriculum in public school systems, and extending timely, relevant, and accurate information on the open and coastal ocean to the public of Hawaii, the US territories, and US-affiliated nations in the Pacific Islands region. Such a project has and will continue to improve the health of our ocean resources; assist businesses and developers to minimize adverse environmental impacts of their operations; enhance conservation of protected species, unique habitats, and biological diversity; encourage cutting edge and appropriate ocean science and technology, including alternative energy; and build local ocean observing capacity through training, extension, and the creation of jobs.

I support the commitment of PacIOOS and their Governing Council to the elucidation and distribution of ocean information for the benefit of the community as a whole. In this regard, I wholeheartedly support and strongly recommend favorable consideration of this project for continued and sustained funding.

Sincerely,

Harry R. Fritz
Minister
Ministry of Natural Resources, Environment and Tourism

cc: PICRC Board of Directors

1026 CABRAS HIGHWAY
STE 114
PITI
GUAM
96925

PORT USERS GROUP GUAM

Mr. Chris E. Ostrander
Director
Pacific Islands Ocean Observing System (PacIOOS)
1680 East-West Road
c/o CMMED, POST 105
Honolulu, Hawaii 96822

Director Ostrander:

I am writing in support of the Pacific Islands Ocean Observing System (PacIOOS) proposal to continue the development of the PacIOOS system under the NOAA Integrated Ocean Observing System (IOOS) program. The work PacIOOS proposes will continue to strengthen efforts within the Territory of Guam to promote a safe, healthy, productive ocean and a resilient coastal zone.

PacIOOS currently provides not only real-time and forecasted ocean information, but also promotes outreach, education, and extension of ocean information by supporting student participation in research and field activities, providing material for the development of K-12 curriculum in public school systems, and extending timely, relevant, and accurate information on the open and coastal ocean to the public of Hawaii, the US territories, and US-affiliated nations in the Pacific Islands region. Such a project has a will continue to improve the health of our ocean resources; assist businesses and developers to minimize adverse environmental impacts of their operations; enhance conservation of protected species, unique habitats, and biological diversity; encourage cutting edge and appropriate ocean science and technology, including alternative energy; and build local ocean observing capacity through training, extension, and the creation of jobs.

I support the commitment of PacIOOS and their Governing Council to the elucidation and distribution of ocean information for the benefit of the community as a whole. In this regard, I wholeheartedly support and strongly recommend favorable consideration of this project for continued and sustained funding.

Sincerely,

Paul Blas

Paul Blas
Chairman

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

Benigno R. Fitial
Governor

Eloy S. Inos
Lt. Governor

SEP 09 2010

Mr. Chris E. Ostrander, Director
Pacific Islands Ocean Observing System (PacIOOS)
1680 East-West Road
c/o CMMED, POST 105
Honolulu, Hawaii 96822

Dear Director Ostrander:

On behalf of the people of the Commonwealth of the Northern Mariana Islands, this is to express my support of the proposal of the Pacific Islands Ocean Observing System (PacIOOS), empowered under the NOAA Integrated Ocean Observing System (IOOS) research initiative, to enhance and expand the research presence of PacIOOS in the Northern Mariana Archipelago and the surrounding Pacific islands community. We welcome PacIOOS efforts to optimize the benefits inherent in complex ocean processes and mitigate the risks associated with myriad interactive ocean variables.

As an island people, we know intuitively that oceans are the fundamental life support system for the planet; that ocean systems are central to the quality of both ocean and terrestrial life; and, that the systems of the ocean change rapidly and heretofore unpredictably. To really "know" the ocean it must be studied pragmatically. PacIOOS does this, and thereby increases our capacity to interact more intelligently with the ocean.

I have been told that as one of the most recent and boldest scientific approaches to ocean study, discovery and understanding, PacIOOS uses interactive telepresence to gather real-time data that are revolutionizing the perceptions and management of climate change, ocean acidification, coastal upwelling, seismic activity, dissolved oxygen, and bathymetric forcing, strengthening our efforts to promote a safe, healthy, productive ocean and a sustainable and resilient coastal zone. PacIOOS proposes to expand that real-time capability by deploying robotic techniques and employing new technologies of digital imaging, ecogenomics, and grid/cloud computing.

In my opinion, the new mind set of discovery launched by PacIOOS will enhance conservation of protected species, unique habitats, and biological diversity. It posits making available a potential wealth of information about what might be termed the earth's next and newest rain forest in terms of seeing in a new way the vast reservoirs of ocean activity, including the biomass of microbes living deep below the sea floor, a possibility which we have only just discovered and have heretofore had no way to study.

My support of the commitment and mission of PacIOOS was signified earlier this year when I appointed my Senior Policy Advisor to represent me and the people of the CNMI on the PacIOOS Governing Council. I wholeheartedly support the vision of the NOAA IOOS and strongly recommend favorable consideration of the PacIOOS proposal for continued and sustained funding.

Sincerely,

BENIGNO R. FITIAL

Zdenka S. Willis
Director, U.S. IOOS Program Office
1100 Wayne Avenue, Ste. 1225
Silver Spring, Maryland 20910

Director Willis:

We are writing in support of the Pacific Islands Ocean Observing System (PacIOOS) proposal to continue the development of the PacIOOS system under the NOAA Integrated Ocean Observing System (IOOS) program. The work PacIOOS proposes will continue to strengthen efforts within the Pacific Islands region to promote a safe, healthy, productive ocean and a resilient coastal zone.

The PacIOOS Governing Council was established to provide stakeholder oversight, guidance, and support for the growth of the observing, modeling, data management, and product development subsystems of the PacIOOS regional effort. We, the undersigned Members of the Governing Council, represent a diverse group of constituents throughout the Pacific Islands region directly invested in the growth and development of PacIOOS. We use PacIOOS data and information products regularly in our individual planning, operations, and decision-making and request full and sustained support to PacIOOS for the continued development, enhancement, and provision of these services.

Sincerely,

Dr. Brian Taylor
Dean, SOEST

Mr. Todd Barnes
Chief, Engineering and Construction Division
Honolulu District, U.S. Army Corps of Engineers

Dr. Rusty Brainard
Division Chief, NOAA-PIFSC CRED

Dr. Charles Kelley
VP KF Development, Outrigger Enterprises, Inc.

Ms. Donna Brown
Chair, Marine and Coastal Zone Advocacy Council

Mr. Justin Manley
Dir. of Scientific and Com. Bus., Liquid Robotics

Mr. Donald Hess
VP, College of the Marshall Islands

Mr. Abbey Seth Mayer
Director, State Office of Planning

Mr. Fabian Iyar
CEO, Palau Int. Coral Reef Center

Mr. Gary North
Executive Director, Hawaii Harbror's User's Group

Dr. John Joyner
Senior Advisor to the Governor of the CNMI

Mr. Davis Yogi
Administrator, Dept. of Trans.—Harbors Div.

Dr. Philip Wiles
Research Scientists, American Samoa EPA

Mr. Sean Martin
Chairman, Western Pacific Regional Fishery Management Council

Mr. Chris E. Ostrander
Director
Pacific Islands Ocean Observing System (PacIOOS)
1680 East-West Road
c/o CMMED, POST 105
Honolulu, Hawaii 96822

Dear Mr. Ostrander:

We are writing in support of the Pacific Islands Ocean Observing System (PacIOOS) proposal to continue the development of the PacIOOS program under the NOAA Integrated Ocean Observing System (IOOS) program. The work PacIOOS proposes will continue to strengthen ongoing efforts in the Republic of the Marshall Islands to promote a safe, healthy, productive ocean and resilient coastal zone.

PacIOOS currently provides not only real-time and forecasted ocean information in the Marshall Islands and through the Insular Pacific region, but also promotes outreach, education, and extension of ocean information by supporting student participation in research and field activities, providing material for the development of curriculum in public school systems, and extending timely, relevant, and accurate information on the open and coastal ocean to the public within the Pacific Islands region. Such a project will continue to improve the health of our ocean resources; enhance conservation of protected species, unique habitats, and biological diversity; encourage cutting edge and appropriate ocean science and technology; and build local ocean observing capacity through training, extension, and the creation of jobs.

We support the commitment of PacIOOS and their Governing Council to the elucidation and distribution of ocean information for the benefit of the community as a whole. In this regard, we wholeheartedly support and strongly recommend favorable consideration of this project for continued and sustained funding.

Sincerely,

Kenneth Woodbury
President
College of the Marshall Islands

Deborah Barker-Manase
General Manager
RMI Environment Protection Authority

Jeffery Zebedy
Acting Director
Marshall Islands Conservation Society

Glen Joseph
Executive Director
Marshall Islands Marine Resources Authority