

I. AOOS OVERALL APPROACH & PRIORITIES

Goals: The goals of the Alaska Ocean Observing System (AOOS), as identified through stakeholder engagement, adopted by the AOOS Board and reflected in this proposal, are to 1) increase access to existing coastal and ocean data; 2) package information and data in useful ways to meet the needs of stakeholders; and 3) increase observing and forecasting capacity in all regions of the state, with a priority on the Arctic and the northern Gulf of Alaska.

Background: Developing an integrated ocean observing system at high latitudes creates unique challenges. In addition to the harsh environment, the region encompassed by AOOS is made up of nearly 44,000 miles of coastline, larger than the marine systems in the rest of the United States combined. No other observing system in the United States has such climate extremes, significant geographic distances, and limited observing infrastructure. Although the population of Alaska is small (about 735,000), 80% of the residents live on the coast, including a large indigenous population that relies on the ocean for survival.

Approach: This proposal builds upon existing efforts, takes into account the challenges of providing real-time observations in Alaska, places a premium on access to and integration and synthesis of existing data and data sources, and relies extensively on collaborations. The proposal leverages funding with other programs and provides coordination and synthesis services to better integrate and add value to existing research and monitoring activities. It also draws upon the 2011 AOOS Preliminary Build-out Plan and the 2013 AOOS Arctic Build-out Plan as guidance, as well as the plethora of regional and national plans, especially those for the U.S. Arctic (see Appendix B).

Geographic approach: The Board has placed a priority on expanding observation capacity in the Arctic (Beaufort and Chukchi Seas) and in the northern portion of the Gulf of Alaska (GOA). The GOA includes Prince William Sound and Cook Inlet, two regions with high vessel traffic, including oil and gas tankers, large commercial fisheries critical to the state's economy and dynamic and complex circulation systems that border the main population centers of Alaska.

The Arctic as a national priority: One of the priority objectives in the National Ocean Policy (NOP) highlights changing conditions in the Arctic and specifically calls upon the nation to: "Address environmental stewardship needs in the Arctic Ocean and adjacent coastal areas in the face of climate-induced and other environmental changes." AOOS has used the NOP Implementation Plan, NOAA's Arctic Vision & Strategy, the U.S. Navy Arctic Roadmap, the U.S. Coast Guard and Arctic Strategy, the U.S. Arctic Research Commission Goals & Objectives, the Arctic Marine Shipping Assessment, the Alaska Arctic Policy Commission Report, and other recent documents in developing its Arctic monitoring activities. With local, regional and national needs in mind, AOOS also completed an Arctic Build-out Plan in 2013 to map out an approach to accomplish collective Arctic observing goals that increases the environmental intelligence and infrastructure needed for Arctic Marine Domain Awareness.

Approach to funding scenarios: Although the original proposal seeks \$4 million a year over a five-year period, the activities described here in the most detail are for \$2,771,480 in Year 1 and a \$2.5 million a year scenario for Years 2-5, which is similar to the current award.

Key focus areas: AOOS focuses its efforts on four major thematic areas: marine operations; coastal hazards and inundation; ecosystems, fisheries and climate trends; and water quality.

II. KEY FOCUS AREAS

A. Marine Operations

Goal: To improve safety of marine operations (including search and rescue and oil spill response), AOOS will focus on sustaining weather and sea state observations, more effectively disseminating weather

information to users, and developing related information and decision support tools for stakeholders, especially related to the emerging Arctic Marine Highway.

Audience and Benefits: Alaska's marine operations and stakeholders are diverse, ranging from oil tankers and container ships to ferries, commercial and charter fishing boats, recreation vessels and marine subsistence users. Weather conditions change quickly, are locally specific, and are not always captured by Alaska's limited coastal and marine weather stations. The state is home to a \$6 billion fishing industry, offshore oil exploration in Cook Inlet and the Arctic, a Marine Highway System serving local and visitor traffic, and cruise ships carrying a million passengers per year. Ninety-five percent of Alaska's goods cross Cook Inlet, navigating through dynamic sea ice and extreme tidal and circulation variation, to arrive at the Port of Anchorage. As Arctic sea ice retreats and the Northwest and Northern Route passages stay ice-free for longer periods, more vessels will pass through Alaskan waters, take shipments to international destinations or tour the Arctic for recreation. Representative stakeholders include commercial fishermen and recreational boaters, subsistence users, port and harbor managers, local citizen advisory groups and communities, regional research institutes, federal and state agencies and industrial interests including offshore oil and gas companies.

B. Coastal Hazards and Inundation

Goal: To improve the ability to forecast and plan for changing storm and sea ice conditions and their impacts on coastal communities and habitats, AOOS will focus on increasing water level and wave observations and related products for stakeholder decision-making.

Audience and Benefits: The impacts of climate change have become readily apparent in Alaska. As our nation's only Arctic state, Alaska is experiencing dramatic reductions in sea ice cover, increased storm surge, thawing coastal permafrost, and consequent coastal erosion and infrastructure damage. These conditions are endangering coastal communities, most of which are home to Alaska Natives. In a statewide assessment by the Government Accounting Office in 2003, flooding and erosion affects 184 out of 213 Native villages, 31 of which are considered to be in imminent danger. Many may require expensive engineering fixes or community relocation. Meanwhile, better forecasting for storm surge and inundation is needed to help local people prepare for dangerous storm events. The need for wave buoys and water level sensors has been loudly voiced and documented in both state and national plans. Despite this, NOAA's National Data Buoy Center (NDBC) has struggled to maintain existing buoys in Alaska, and several key buoys are no longer operational. Stakeholders include coastal subsistence communities including the Yukon-Kuskokwim, Bering Strait, Northwest Arctic and North Slope regions, as well as oil and gas companies active in offshore drilling and exploration, agency managers, the U.S. Army Corps of Engineers, National Weather Service forecasters, shippers, fishermen, and the U.S. Coast Guard.

C. Ecosystems, Fisheries and Climate Trends

Goal: To understand marine climate variability and ecosystem change in the long term, as well as how local conditions affect ocean circulation and ecosystem productivity in the short term, AOOS will build upon and leverage existing programs to develop an integrated network of physical, chemical, biological and community-based ocean observations and a synthesized State of Alaska's Coasts and Oceans Report.

Audience and Benefits: Alaska's coastal waters support a rich and diverse ecosystem, home to one of the world's largest fisheries, as well as abundant populations of pelagic and migratory seabirds and protected marine mammals. Ecosystem change in Alaska has direct social and economic implications that are likely to be more profound with the advances of climate change. Representative stakeholders include the fishing industry (commercial and recreational), federal and state management entities, subsistence-based communities, and academic and agency researchers.

D. Water Quality

Goal: To understand and respond to current and future changes to Alaska's marine waters, AOOS will support monitoring of ocean acidification and marine debris and explore opportunities for providing data products and decision-support tools for contaminants and watershed/ocean linkages.

Audience and Benefits: Ocean acidification (OA) has emerged as a potentially high impact issue in Alaska, with the relatively shallow shelf seas in the northern Gulf of Alaska, the Bering Sea, and the Chukchi Sea already experiencing seasonal OA manifestations. Given the productivity of the Alaskan marine environment, increased acidity could lead to significant ecosystem effects, with wide-reaching environmental and economical impacts. There is also increasing concern over industrial activities affecting Alaska's freshwater and marine ecosystems, including potential mercury contamination of Alaska fish. In Southeast Alaska, neighboring Canadian mining activities have raised worries about the impacts of a mine-waste breach on transboundary waters that pass through Alaska. Representative stakeholders include the fishing industry, federal and state management entities, policy makers, emergency responders, academic and agency researchers, and local residents.

III. REGIONAL GOVERNANCE & MANAGEMENT SUBSYSTEM

The Alaska Ocean Observing System (AOOS) is the regional association for Alaska as part of the national Integrated Ocean Observing System (IOOS). Within AOOS are three geographically, culturally and economically diverse regional coastal and ocean observing sub-systems (Gulf of Alaska, Bering Sea/Aleutian Islands and Arctic). AOOS began in July 2003 as a consortium of partners operating under a Memorandum of Agreement (adopted in 2005, and revised 2009, see www.aos.org). It is the intent of AOOS to become formally certified in 2016 as the Regional Association for Alaska. All of the activities described below will be conducted in Year 1.

- *Board:* AOOS is governed by a Board of Directors, currently made up of 19 federal and state agencies, research entities, and private sector organizations (see www.aos.org for members). Once the membership reaches 25 or more members, the Board may choose to elect a subset of members to serve as directors. An Executive Committee, made up of the AOOS officers and a representative of the fiscal sponsor, acts on behalf of the AOOS Board between meetings.
- *Committees and Advisory Groups:* AOOS uses one standing committee and numerous ad hoc committees and working groups for guidance. The Data Management Advisory Committee (DMAC) is composed of technical experts, including both data users and providers, and provides technical advice to the AOOS Data Team and program staff. Ad hoc advisory groups are topic or regionally specific and convened as needed.
- *Program staff:* AOOS currently employs three full-time staff: an Executive Director, a Director of Operations and Development, and a Program Coordinator. A fourth half-time staff member is the Director of Special Projects. AOOS is also contributing FY 2015 funds in to support a full-time Alaska Sea Grant coastal resilience position, and future funding may be desirable. Staff members manage all program components, engage with stakeholders to identify program requirements, implement the observing system with contractors to meet stakeholder needs, work with the data team to develop products for users, and collaborate with other regional, national and international ocean observing initiatives, including the national IOOS office and other IOOS Regional Associations.
- *Fiscal sponsor:* The Alaska SeaLife Center, an incorporated nonprofit, acts on behalf of AOOS as its fiscal sponsor, and performs all its legal, financial and administrative functions. The fiscal sponsor fee is based on the direct costs of those services.
- *Alaska regional partnerships and collaborations.* Numerous collaborative initiatives have begun in Alaska designed to inform or guide science or resource management issues, particularly in the face of

climate change. These include the North Slope Science Initiative (NSSI), the Alaska Climate Change Executive Roundtable (ACCER), the Alaska Center for Climate Assessment and Policy Steering Team (ACCAP is the NOAA RISA for Alaska), Alaska Sea Grant and its advisory group, the U.S. Fish and Wildlife Service (FWS) Alaska Landscape Conservation Cooperatives, and NOAA's regional collaboration team. AOOS will continue to be an active participant in all of these initiatives.

- *Process for identifying user needs.* Due to the vast geographic size with limited transportation corridors, and the diversity of coastal and marine issues in the state, the AOOS board determined it would be more effective to use existing communication pathways and forums (advisory committees, professional organizations, conferences and workshops), as well as specific stakeholder engagement events, to provide input to AOOS rather than maintain a standing "stakeholder committee". These activities are summarized in Section IV below and described in more detail in Appendix C.

IV. OUTREACH, STAKEHOLDER ENGAGEMENT & EDUCATION

Goal: Our goal is to increase awareness of ocean issues in Alaska and engage with stakeholders to identify and respond to their needs for ocean observations and information products.

Background: The AOOS Board has made stakeholder outreach, facilitation, coordination, and partnership building one of the cornerstones of the AOOS program, and the Executive Director and staff devotes significant time to these efforts. AOOS has a strong reputation in Alaska as one of the few multi-agency, multi-disciplinary organizations whose mission includes facilitating and coordinating marine-related efforts. More details can be found in Appendix C. All of the activities described below will be conducted in Year 1.

Objectives and Approaches:

1. *AOOS website and publications.* AOOS uses its website as its primary outreach tool to feature ocean observing news and highlight data resources and new user products. The site archives all meeting documents and reports, and connects users with the data tools developed by the AOOS data team. AOOS also maintains an active Facebook page, disseminating news and resources to a broad audience, and uses blogs as an outreach tool (see the AOOS Blob Tracker for an example, linked from the AOOS homepage). Hard copy documents continue to make up a central part of the outreach approach, including an AOOS primer, data tools brochures, bi-monthly newsletter, and topic-specific handouts that are widely circulated.

2. *Stakeholder interaction.* Stakeholder activities include hosting AOOS meetings on specific topics, providing demonstrations of the AOOS data portal to targeted user groups around the state, and circulating online surveys to get input on projects and observing gaps. AOOS receives consistent user feedback about the AOOS data portal through a feedback tab on the website, and systematically responds to the submitters, documents and reviews their recommendations, and implements the top priorities.

3. *Stakeholder working groups.* AOOS will continue to facilitate four informal working groups made up of scientific and technical experts and impacted stakeholders. These are: 1) ocean acidification research, monitoring and outreach leading to a statewide OA Network; 2) integrated water level observations network; 3) impacts of the Blob (Pacific anomalies) in Alaska; and 4) long-term observing system coordination and integration. AOOS may respond to other needs as they develop.

4. *Education activities.* Now that COSEE Alaska has ended, AOOS will continue to partner with marine education and outreach entities such as the Sitka Science Center, Prince William Sound Science Center, Alaska SeaLife Center, Kachemak Bay National Estuarine Research Reserve, and the Kasitsna Bay Laboratory to promote virtual field trips, educator lessons plans and other activities.

5. *AOOS Short Film Contest.* AOOS will continue its annual Ocean Film Contest, begun in 2014, to promote ocean issues and awareness of AOOS. The short films showcase a variety of captivating stories to hundreds of viewers in venues around the state, as well as through the AOOS website and Facebook page.

6. *Alaska Marine Policy Forum*. Co-hosted with Alaska Sea Grant, AOOS supports bi-monthly teleconferences with participants from across the state interested in marine funding, legislation and state and federal policy issues. Speakers include congressional and state staff, as well as other contributors discussing timely topics.

7. *IOOS Outreach Committee*. AOOS continues to serve on the volunteer IOOS Outreach Committee, which provides a forum for discussing effective outreach strategies and techniques, sharing products and coordinating efforts among the 11 RAs and the IOOS Program Office. AOOS continues to work with other RAs to communicate its impact through shared success stories, training and shared experiences with social media and other tools. The committee intends to meet in person once during the next five years to develop common outreach materials that reflect the federal-regional IOOS partnership, and to develop a strategy for shared outreach (conferences, exhibitions, etc.) and user engagement.

V. OBSERVING SYSTEM SUBSYSTEM

A. Overall Approach

Given Alaska's immense geographic scope, remoteness and harsh environmental conditions, as well as the paucity of existing observations, AOOS is not able to create or sustain the ideal ocean observing system with its current resources. For that reason, the AOOS Board, based on stakeholder and local and scientific expert input, has chosen largely to augment existing observation programs, contribute to observing consortia and fill in key observation gaps with new assets until additional and sustainable funding becomes more readily available.

B. Marine Operations

1. *Sustain weather observations in the Gulf of Alaska (GOA)*. AOOS will continue its efforts to provide accurate, real-time weather observations in Prince William Sound and Cook Inlet. In partnership with the Oil Spill Recovery Institute, the Prince William Sound Science Center (PWSSC) and the Cook Inlet and Prince William Sound Regional Citizens Advisory Councils, AOOS will provide funding in Year 1 to the PWSSC to maintain eight Snotel weather stations providing real-time web accessible data. Webcam images from these stations are accessed through the AOOS real-time sensor map by pilots, boaters, lodge owners, fishermen, and recreationists, and are one of the most popular resources on the AOOS website. The weather data are used in both real-time and for modeling and forecasting. *If additional funds become available in Years 2-5, more stations will be added, including a site at the Valdez Marine Terminal in Port Valdez and one near Naked Island and Hinchinbrook Entrance in Prince William Sound. Additionally, three land-based anemometers will be installed to monitor barrier jet winds at Hinchinbrook Entrance, Cape Suckling and Icy Cape.*

2. *Increase access to weather observations using AIS*. AOOS will continue its partnership with the Marine Exchange of Alaska (MXAK) in Year 1 to disseminate real-time weather data and forecasts to vessels using Automatic Identification System (AIS) transmitters. By establishing joint weather/AIS stations at existing AIS locations, and installing new stations in remote areas, real-time weather information can be displayed on a vessel's AIS display in a more reliable and clear manner and at greater distances than the method in which weather information is presently disseminated (via VHF radio voice broadcasts). With most commercial vessels required to be equipped with AIS by the International Maritime Organization (IMO) treaties, AIS is one of the most reliable means of communicating weather and other environmental information (e.g., weather, ice reports) to vessels operating in coastal waters out to 50 miles offshore. When complete, the technological solutions will be shared with other IOOS members for nationwide application of this new capability. Overall, this

will enhance maritime safety throughout all the IOOS regions. In Year 1, at least 2 new stations will be added and maintained, *and in Years 2-5 up to 4 new stations will be added and maintained each year depending on funding levels.*

3. *Sustain critical wave buoys for navigation safety.* Continued funding in Year 1 will support operation and maintenance of the Coastal Data Information Program (CDIP) buoy in Cook Inlet, jointly sponsored by AOOS and the U.S. Army Corps of Engineers, and the wave buoy in Norton Sound, jointly sponsored by AOOS and the Norton Sound Economic Development Council. Both provide essential real-time sea state conditions for recreational, commercial and subsistence mariners. *With full funding in Years 2-5, up to two additional CDIP wave buoys would be purchased for deployment in Bristol Bay, Prince William Sound or Southeast Alaska, all of which would contribute to implementation of the NOAA National Wave Plan in Alaska.*

4. *Mapping surface currents with high frequency radars (HFRs).* Current funding in Year 1 contributes to the operation and maintenance by the University of Alaska Fairbanks of four HFR sites on the Chukchi and Beaufort Sea coasts (Point Lay, Wainwright, Point Barrow and Cape Simpson). These sites are operational during the open water season, July through mid-November. The project is a joint collaboration with Bureau of Ocean Energy Management (BOEM) and Shell Oil Company conducted in a region of offshore oil exploration. Data are used to guide the development and evaluation of oil spill trajectory models, ocean research, and in real-time for operational applications. *Full funding in Years 2-5 could leverage development of two new HFR sites at key shipping transit areas, including the Bering Strait, Unimak Pass in the Aleutian Islands and Cook Inlet.*

5. *Port of Anchorage observations.* AOOS is initiating collaborations with port managers, barge and cargo companies and the Marine Exchange of Alaska to enhance observations at the Port of Anchorage, which handles 95% of the consumer goods for 85% of Alaska and is one of 19 national strategic seaports for the U.S. Department of Defense. The port's expansion and modernization has the potential of modifying adjacent nearshore ocean conditions, increasing the need for more observations. No funds are available in Year 1 for this activity, but *with full funding in Years 2-5, additional observations in the form of current meters, web cameras, wave buoys and weather stations will make the port safer and more efficient.*

C. Coastal Hazards and Inundation

1. *Increase water level observations in western and northern Alaska.* Accurate water level observations are key for a number of purposes: 1) to operationally forecast in real-time for storm surge and coastal inundation warning systems; 2) to monitor seasonal changes in river mouth entrances used by tugs and barges delivering fuel and other cargo to Alaska's river-based villages; 3) to establish baseline sea level data for shoreline mapping and tracking sea level trends; and 4) to improve nearshore ocean models for coastal planning, infrastructure development (harbors, airports, etc.) and resource habitat management (e.g., waterfowl), as well as for research purposes. Permanent water level gauges north of the Aleutian Islands are operated at Nome on the Bering Sea, Red Dog at the Kivalina River on the southern Chukchi Sea, and Prudhoe Bay on the North Slope. A fourth gauge is being installed in 2016 in Unalakleet, south of Nome in Norton Sound. These four sea level stations are responsible for providing coverage for almost half of Alaska's coastline. AOOS is partnering with the National Weather Service, NOAA's Center for Operational Oceanographic Products and Services (CO-OPS), Alaska Department of Natural Resources (ADNR), U.S. Army Corps of Engineers, Western and Arctic Landscape Conservation Cooperatives, U.S. Geological Survey (USGS), the University of Alaska Anchorage Arctic Domain Awareness Center (U.S. Department of Homeland Security), and others to develop and implement an Integrated Water Level

Observing Network. AOOS is coordinating the ad hoc water levels working group to help set priorities for various types of water level sensors. Based on the priorities established by this group and AOOS funding, AOOS will support ADNR and the University of Alaska Anchorage to install sensors at village and coastal sites most vulnerable to inundation, flooding and erosion. In Year 1, additional funds have been provided to AOOS by the National Weather Service to continue these activities.

2. *Increase wave observations for water level forecasting and planning.* Wave observations provide real-time sea state conditions and also support water level forecasting and planning. Key gaps remain in implementing the IOOS National Operational Waves Observation Plan in Alaska. No new buoys will be deployed in Year 1, but *with full funding in Years 2-5, AOOS will purchase and install additional 3-5 wave buoys for deployment in key gap regions including the Chukchi Sea, Bristol Bay in the Bering Sea, and in the Gulf of Alaska.*

3. *Pilot new program for coastal vessel traffic.* No funds are available for this in Year 1, but with full funding in Years 2-5, AOOS will develop a proof-of-concept program to field test the use of remote water level sensors at the mouths of key river systems for transmission to tug and barge operators using the Internet and the AIS network. The unpredictable nature of river mouths increasingly interferes with vessel traffic due to natural variations in channels. Water level patterns are modified by long-term environmental factors, such as permafrost thaw, increased coastal erosion from higher frequency storms, and changes in precipitation. All of these factors put shipping activities at increased risk of grounding and escalates the chances of oil/fuel spills.

4. *Crowd-source non-NOAA hydrographic (water depth) survey data to improve navigation safety.* The recent incident involving a vessel near Dutch Harbor Alaska serves as a reminder that the Alaska coastal and shelf bathymetry data are insufficient in many locations for navigation and maritime safety. This has become a red flag issue for the state. AOOS has already been exploring a collaboration with NOAA's Office of Coast Survey and Integrated Ocean and Coastal Mapping Program, the U.S. Coast Guard, Alaska state agencies and the maritime industry to facilitate the collection, aggregation, sharing and reuse of hydrographic survey data by non-NOAA partners. *No funds are available in Year 1 for this, but with full funding in Years 2-5, this project team will develop ways to facilitate third-party data provision, including potential web-based crowd-sourcing tools that enable selection and display of a planned route, online training in minimum standards for calibration and data acquisition, trackline survey guidance, and data storage and archive.*

D. Ecosystems, Fisheries and Climate Trends

D. 1 Sustained Observation Network

The 2011 AOOS Preliminary year Build-out Plan includes support for a long-term sustained observing network to track climate trends and support ecosystem-based management of fisheries and endangered and threatened species. The goal is to unite these observations – made with moorings, ship and glider transects, instrumented fish and marine mammals, passive acoustic sampling, community observers and other platforms - into a unified system. AOOS is partnering with management agencies, academic partners and the Distributed Biological Observatory (DBO) program to help maintain long time series data collection, develop consistent data collection protocols, synthesize new and existing data, and ensure that data are accessible and usable.

1. *Sustain ship-based sampling along the Seward Line.* AOOS will contribute in Year 1 to a consortium led by University of Alaska Fairbanks (UAF) to support two cruises a year along the Seward Line, the most comprehensive long-term multidisciplinary sampling program in the coastal Gulf of Alaska. This line has been sampled continuously since October 1997, with some measurements dating back to late 1970s. Observations over the past 17 years have fundamentally revised our understanding of the coastal

Gulf of Alaska ecosystem, which is critical to Alaska's fisheries and subsistence and coastal community economies. *With full funding in Years 2-5, a glider could be purchased to improve spatial and temporal monitoring of this line, and use for opportunistic ecosystem sampling during El Nino and La Nina events in the GOA.*

2. *Support ecosystem moorings in Alaska's Large Marine Ecosystems.* AOOS is building a network of fully instrumented ecosystem moorings in the Chukchi, Beaufort and Bering Seas and the Gulf of Alaska to serve as year-round anchors for the Distributed Biological Observatory (DBO). AOOS began the ecosystem mooring program with a consortium led by UAF with the first mooring deployed in 2014 in the central Chukchi Sea offshore of Wainwright. This is a critical region for observing the through-flow of water between the northern Bering Sea and the interior Arctic, and a location of large primary productivity in an Arctic shelf sea. AOOS funding in Year 1 will add sensors to this mooring, as well as begin to establish an additional mooring in the Beaufort Sea, with spare moorings and sensors to aid in annual turnaround and maintenance. AOOS funds are used for equipment purchases, with data analysis and operational costs covered by other partners. *With full funding in Years 2-5, additional sensors will be added to existing moorings that are not fully instrumented in the Bering Sea (M8 and M2, supported by NOAA's Pacific Marine Environmental Laboratory) and the Gulf of Alaska (GAK 1, supported by the Exxon Valdez Oil Spill Trustee Council).*

3. *Pilot use of glider surveys to monitor ocean conditions and marine mammals.* AOOS will continue in Year 1 supporting the pilot implementation of a real-time marine mammal detection system deployed on a Slocum buoyancy controlled glider currently operating in the northeastern Chukchi Sea. This pilot project is testing the capabilities of an AOOS-funded autonomous marine mammal detection and classification system (DMON/LFDCS), designed specifically for sub-Arctic and Arctic species. The pilot project is now in its third year with additional support from the North Pacific Research Board (NPRB), to allow for purchase of a backup glider, refinement of the call library, and support for some of the deployment costs. The glider will operate for six weeks in a biological hot spot in the Chukchi Sea that coincides with Shell Oil Company's oil and gas exploration area. The data are documenting oceanographic conditions and monitoring, and the habitats of bowhead, fin, humpback, North Pacific right, beluga, and killer whales, as well as walrus and bearded seals. All of these species could be impacted by increased human activities in the region, as well as by climate change. *As funding allows in Years 2-5, additional flights could supplement the ecosystem moorings and the DBO surveys.*

4. *Support community based monitoring.* This project combines a key set of standardized geophysical and local expert-driven observations to improve the understanding of interannual to decadal-scale change in coastal ice conditions and their impact on human activities. The methodology for advancing these goals has already been developed with strong community engagement and development of a database. Data entry is web-based through a public access portal developed through the Exchange for Local Environmental Knowledge in the Arctic (ELOKA), a project funded by the National Science Foundation. *No funds are available in Year 1, but with full funding in Years 2-5, AOOS will increase the collection of coastal sea ice information at additional villages along the western and northern coasts of Alaska, as part of a community-based coastal ice observation program already piloted by UAF scientists.*

5. *Use of telemetered animals.* Animal telemetry data are currently being piloted for incorporation into the AOOS Ocean Explorer Portal, and telemetered animals equipped with sensors are increasingly being used to provide broader spatial coverage for ocean monitoring where other platform logistics are not feasible or are too expensive. In Year 1, AOOS will host a regional ATN workshop and build on the data tools developed under VI.6. *With full funding in Years 2-5, AOOS will seek to incorporate additional animal telemetry data into its data portal as it becomes available.*

D.2. Regional sentinel observations

The AOOS Build-out Plan includes supporting more intensive, shorter-term monitoring activities at key sites around the state, especially in regions with local scientific capacity. AOOS has already begun hosting collaborations among these entities to better coordinate and integrate such efforts. AOOS provides small amounts of funding to these local efforts, which are then leveraged by our partners to develop larger programs. *With full funding, AOOS will be able to provide more support to these and potentially other projects.*

1. *Sentinel monitoring in Prince William Sound (PWS).* AOOS seeks to meet short-term and long-term fisheries and ecosystem-based management needs by contracting with the PWS Science Center and partnering with the PWS Regional Citizens Advisory Council and the Oil Spill Recovery Institute, to maintain intensive sentinel monitoring in PWS as a Prince William Sound Observing System. Partners are seeking additional funding for glider transects, moorings and ship cruises, and additional sensors and equipment. Priorities for AOOS in Year 1 are to support:

a. *Weather stations:* AOOS will continue to fund the six SNOTEL stations deployed at sea level in PWS since 2005, and two stations at alpine elevations. Each station measures temperature, wind velocity, precipitation, and solar radiation, and includes a webcam. The main mission is to provide real-time weather observations, but also to provide information for hydrological and circulation models, as well as oil spill trajectory modeling.

b. *PWS Ocean Tracking Network:* AOOS will continue to support a partnership with Dalhousie University's Ocean Tracking Network to operate and maintain six acoustic arrays across the major entrances to PWS (Hinchinbrook Entrance, Montague Strait, and the four Southwest Passages). The array is used to document the movements and survival of marine animals and fish (salmon, sharks, and whales) carrying acoustic tags and how both are influenced by oceanographic conditions.

2. *Sentinel monitoring in Cook Inlet.* AOOS will continue to partner in Year 1 with NOAA/UAF's Kasitsna Bay Laboratory, Cook Inlet Regional Citizens Advisory Council, the Kachemak Bay NERR and the Gulf Watch Alaska long-term monitoring program funded by the *Exxon Valdez* Oil Spill Trustee Council to collect oceanographic data along repeated transects in Kachemak Bay and lower Cook Inlet. Data are used to improve a harmful algal bloom risk assessment tool; support development of risk assessment tools for ocean acidification, pathogens (vibrio) and invasive species; assess estuarine responses to climate change; and provide validation for development of the National Ocean Service's Cook Inlet ocean circulation model and transition of the model to an operational forecast system. *With full funding in Years 2-5, acoustic Doppler current profiler surveys and current meter moorings will be used to measure depth-dependent flow in Kachemak Bay and lower Cook Inlet and leverage additional moorings in the inlet.*

3. *Sentinel monitoring in Southeast Alaska.* *No funds are available in Year 1, but with full funding in Years 2-5, AOOS will initiate a new partnership with the Sitka Sound Science Center to enhance its capacity to serve as a sentinel station for Southeast Alaska.* This would include support for oceanographic buoy observations and long-term monitoring of kelp forests and pinto abalone populations as sentinels of climate change.

4. *Sentinel monitoring in other regions.* AOOS will continue to seek opportunistic funding to develop and enhance sentinel monitoring in other regions of the state that have local science capacity and resources to support such operations, such as Kodiak, Pribilof Islands, Kotzebue and Barrow. We will also seek out opportunities to add sensors to existing platforms around the state to enhance local observing capacity, such as adding conductivity sensors to tide stations (that already have temperature measurements) along the coast to better understand large-scale oceanographic changes in salinity.

E. Water quality

1. *Ocean acidification (OA) monitoring.* AOOS will continue to partner in Year 1 with the UAF Ocean Acidification Center and the NOAA OA Program to maintain OA sampling along the Seward Line in the northern Gulf of Alaska during May and September. The data will help quantify the physical and biogeochemical controls on OA in the region, including the influence of glacial runoff, meteorological forcing (upwelling) and longer-term trends caused by climatological forcing. Samples of dissolved inorganic carbon, total alkalinity, partial pressure of CO₂, pH, carbonate mineral saturation states, particulate organic carbon, dissolved organic carbon, and oxygen isotopes will be analyzed and combined with observations of specific pelagic and benthic calcifying organisms to monitor how keystone species in the food web are responding to increased intrusion of atmospheric CO₂. AOOS will also contribute to the consortium that supports two moorings (Bering Sea and Gulf of Alaska) equipped with a surface and bottom sensor package to measure pCO₂, pH, temperature, salinity, nitrate, oxygen, chlorophyll, and turbidity to quantify the seasonal and interannual variability in the ocean carbonate system. The surface package contains a meteorological and atmospheric monitoring station and transmits both surface water and atmospheric parameters in real-time via satellite telemetry. With funding from the OA Program and the IOOS Marine Sensor Technology Transfer program, “Burkolator” instruments equipped with sensors that measure these parameters have been installed in Seward at the Alutiiq Pride Shellfish Hatchery.

AOOS held an OA technology workshop in winter 2016 to develop a coordinated Integrated Ocean Acidification Monitoring Strategy for Alaska with the multiple partners currently monitoring OA. The goals of the workshop were to identify preferred technologies and methodologies for making accurate and meaningful OA measurements, and to develop a phased approach to a coordinated network. Best practices for sampling and data sharing were also defined to the best state of the technology. *Based on that workshop, we identified priorities for any additional AOOS and partner funding. In Year 1 this included instrumenting a state ferry that routinely transits the Gulf of Alaska and adding an additional Burkolator in Ketchikan. In Years 2-5 we could add OA measurements to cruises, a profiling mooring in Prince William Sound, or additional measurements to coastal sites.*

AOOS also received funds from the NOAA OA Program in Year 1 to establish an Alaska Ocean Acidification Network and support a suite of activities including hosting an Alaska OA website, list serve, State of OA Science workshop, OA expert network, and stakeholder outreach.

2. *Support monitoring of marine debris.* If funds become available in Year 1 from other sources, or with additional funding in Years 2-5, AOOS could partner with Gulf of Alaska Keeper to monitor the annual accumulation of marine debris on 14 Prince William Sound (PWS) beaches and three beaches in the Gore Point region of the Kenai Peninsula. This effort is part of a long-term study to determine the annual accumulation of marine debris in PWS and the northern Gulf of Alaska shoreline. Debris from container spills and the 2011 Fukushima earthquake are now being tracked.

3. *Support for monitoring for contaminants.* Contaminants in Alaska’s waters may be an increasing problem in the future, especially as industrial activities continue to develop in the watersheds that feed into Alaskan waters, and with increased shipping activities throughout the state. ADEC is currently testing for mercury concentrations in marine fish and identifying any potential public health risks due to consumption of effected species. The Alaska Department of Natural Resources is concerned about watershed and local impacts of large-scale mines. Contaminant monitoring is very expensive, so these efforts are limited. The AOOS Board has asked staff to monitor current activities and consider ways to provide data integration or supportive data for these agency efforts.

VI. DATA MANAGEMENT & COMMUNICATIONS SUBSYSTEM

Goal: The goals of the AOOS Data Management and Communications Subsystem are to serve as the Alaska regional data assembly center (DAC) for Alaska coastal and ocean data collected by AOOS as

well as other federal, state, local, private and tribal entities; leverage collaborations with other IOOS regional associations; and develop data and information products to meet stakeholder needs.

Background: AOOS supports a data management system that allows a complex array of oceanographic data types to be well organized, accessible, and understandable. Working on behalf of AOOS with AOOS staff and other partners, Axiom Data Science has developed the AOOS data system to be a scalable, open source platform that uses existing and emerging software resources, high performance compute clusters and interoperability services consistent with IOOS standards and protocols (see Appendix D for more details). In its current capacity, the AOOS regional Data Assembly Center is the largest data management service in this region.

Developing functional standalone DMAC systems is laborious, time consuming and expensive. IOOS regional associations are similar to one another in that their DMAC systems must meet IOOS DMAC requirements and each regional association must support the local needs of their constituents. The AOOS data framework is now able to directly leverage and benefit from the systems, capabilities and lessons learned through Axiom's contractual support for data management and communications (DMAC) activities for the Southeast Coastal Ocean Observing System (SECOORA, which began summer 2015), Central and Northern California Ocean Observing System (CeNCOOS) and the Integrated Ocean Observing System (IOOS). These relationships will increase access to and use of data by all user groups, allow AOOS data management staff to rapidly develop new capabilities and tools to meet a variety of user needs, and reduce costs and increase performance. In Year 1, all of the activities below will be continued.

Objectives and Approaches:

1. *Support the cyberinfrastructure that underpins the AOOS Data Assembly Center.* The AOOS data contractor, Axiom Data Science, will ensure that the AOOS data system is healthy, secure and monitored, respond to system problems, and map out future upgrade and expansion strategies. This task includes the support, cultivation and expansion of both the hardware and software, which enable the AOOS data management system to function. Axiom staff will also focus on extending the capabilities of the existing AOOS cyberinfrastructure by exploring and implementing new software server technology. Physical hardware configurations will be optimized and additional server resources deployed to power applications and functionality that are requested by the user community and required for the multiple, integrated-research efforts that AOOS supports. Axiom will work with the broader IOOS community to implement protocols for applying Quality Assurance of Real Time Ocean Data (QARTOD) checks to existing real-time data feeds. This is a database-level enhancement that will ensure quality control is performed on all real-time data being archived and served out of the AOOS data system.

2. *Maintain and enhance the Ocean Data Explorer.* The Ocean Data Explorer is the flagship statewide data portal for AOOS and includes tools to visualize and explore oceanographic and coastal data across Alaska. The custom-built tools allow for dataset cataloging, elastic searches, automated and custom visualization, time-series exploration and extraction, data downloading using static files and multiple interoperable web services, map representation of multiple data layers, and more. This objective focuses on maintaining the portal's backend data storage as well as the front-end user interface. Activities consist of monitoring and documenting the use of the portal, and integrating user feedback and emerging technologies into future system iterations. These include further implementation of AOOS lite (useful for mobile phone and low bandwidth AOOS Web access), and "myAOOS" personalized functions. Future development activities range from visualizing more complex data types (gliders, animal telemetry, CTDs) to providing next generation visualization capabilities to users (e.g., Ocean in 4D).

3. *Maintain and provide access to existing and new products.* Existing products supported by AOOS include the AOOS Real-time Sensor Map, Research Assets Map, Model Explorer, Sea Ice Atlas, and the Cook Inlet Response tool. AOOS is also supporting development of a smart phone application

targeted at users in remote Arctic communities. Based on input from the AOOS Data Management Advisory Committee, new products could also include specialized data portals, products or tools for particular subregions or unique Alaska stakeholder groups (e.g., recreational or commercial fisheries, emergency planners, etc.), or topical issues such as Arctic shipping, ocean acidification, and community based monitoring.

4. *Maintain and provide access to existing and new data sets.* As the regional Data Assembly Center for Alaska, AOOS has prioritized ingestion of valuable physical, biological and chemical data sets collected primarily by federal and state agencies, academic partners and large ecosystem research programs. AOOS provides data management services for many of those programs, including the Russian American Long Term Census of the Arctic, Marine Arctic Research Ecosystem Study, Arctic Marine Biodiversity Observing Network, Arctic Ecosystem Integrated Study, components of the Distributed Biological Observatory, and Gulf Watch Alaska and Herring Research and Monitoring Program. By providing these services (with costs reimbursed) through use of the Research Workspace (a cloud-based data management application designed for storing, documenting and sharing data among members of scientific communities), AOOS has access to all data for inclusion in the AOOS Ocean Data Explorer. We will continue to pursue other funding to ingest other priority data sets.

5. *In collaboration with other IOOS regional associations (RAs), develop cross-regional and US-wide data products.* AOOS will work with the other IOOS RAs over the course of the funding cycle to enhance and standardize stakeholder access to data, services and interfaces. This will be done by collaborating with other RA staff to agree on common access methods to existing data services through the use of Application Programming Interface (APIs) and interoperability systems (WMS, WFS, WCS and SOS). It will also include discussing standardized interfaces for exploring and downloading data that focus on data and products common to all regions (e.g., glider data, model nowcasts and forecasts, key climate variables). AOOS spearheaded the development of the data portal and catalog interfaces currently used by AOOS and CeNCOOS and soon by SECOORA, and converging on common data interfaces is one step in providing a consistent "look and feel" for IOOS stakeholders that use data from more than one region.

5. *Collaborate with other state, regional, national and international data management programs.* Axiom Data Science will work closely with the AOOS Data Management Committee and actively participate in national IOOS data management committees and teams. They will also participate in Alaska's Federal-State Data Integration Working Group and develop partnerships with other existing data management systems in Alaska and the Arctic, including those for the USGS Oceanographic Biological Information System (OBIS), the Arctic Observing Network (AON) and the Sustained Arctic Observing Network (SAON).

6. *Provide support to national IOOS Data Management and Communications Program.* In Year 1, AOOS will augment and maintain the i52n SOS server and supporting software packages; continue enhancements to the Environmental Sensor Map and its integration with the IOOS Catalog; develop tools for users producing animal telemetry data sets which streamline the data management process and accelerate integration into relevant data assembly centers (ATN DAC); develop a scalable methodology for storing and querying the national AIS data set assembled by the NOAA Office of Coast Survey; improve tools for preserving High Frequency Radar (HFR) output and allowing for reprocessing HFR data; and support and enhance USGS Coastal and Marine Geology Program portals.

VII. MODELING, ANALYSIS & PRODUCT DEVELOPMENT SUBSYSTEM

Goal: The goals of this component are to increase the accuracy, reliability and scope of operational ocean products and services for Alaska, add value to existing data and models and develop new products based on stakeholder needs.

Background: AOOS originally proposed to expand ocean modeling efforts initiated in Prince William Sound into a statewide modeling and forecasting framework. Because of the extensive geographic area, paucity of *in situ* observations, limited AOOS resources and lack of support from other potential funders, this has not proven to be a realistic approach. Depending on the amount of funding available, we now propose instead to focus on three main objectives described below:

Objectives and Approaches:

1. *Support in Year 1 existing models and data products developed with prior AOOS funding.*

- a. Continue annual updates to the Historical Sea Ice Atlas, the Research Assets Map, and the Yukon-Kuskokwim Chinook Run Timing Forecast.
- b. Continue development of a prototype *AIS Vessel Tracking Tool*. The Marine Exchange of Alaska's Automatic Identification System (AIS) data archive is a valuable source of information that tracks shipping trends across several dimensions (space, time, ship velocity and type). However, the extensive data archive with over 1 billion records prohibits expedient analysis of the entire time series. Raw data are accessed by users either through one-off data requests or a subscription service from the Marine Exchange, but exhaustive processing is required to produce tangible products that, for example, reveal ship route trends in the region. Axiom is working on increasing the accessibility and re-use of this data resource by developing an advanced spatial/temporal analytic interface powered by high performance computing techniques. The continued effort will significantly increase the accessibility of the AIS data archive by resource management, scientific and policy communities. Products will include output from advanced graphical analytics, such as dynamic heat maps, which show density of shipping routes. It will also allow for user-enabled inputs, and offer interactive graphics that display regional spatial and temporal trends, as well as data overlay capabilities (e.g., mapping vessel traffic patterns over marine mammal migration routes).
- c. *Continue to assess long-term support for operating the ROMS model for Prince William Sound (PWS) and Gulf of Alaska (GOA).* AOOS may continue supporting the PWS and GOA real-time nowcast/forecast operational Regional Ocean Modeling System (ROMS). The model consists of a 3-level nested configuration covering PWS at 1-km resolution, the northeastern GOA at 3-km, and the northeastern Pacific Ocean at 9-km. Nowcasts and forecasts are produced daily, and images, analysis and model output are published daily on the AOOS Model Explorer.
- d. *Continue support for AOOS Model Explorer and increase capabilities.* The AOOS data team is exploring methods for serving four-dimensional (4-D) and higher datasets via THREDDS, ncWMS and other NetCDF data management and interoperability systems.

2. *Develop select new modeling and data products that are priorities for stakeholders. With full funding in Years 2-5, AOOS would:*

- a. *Develop a "State of Alaska's Coasts and Oceans Report".* Building upon the existing Arctic Report Card, National Marine Fisheries Service (NMFS) Ecosystem Report Cards, Alaska Climate Assessment, the developing Integrated Ecosystem Assessments, and the PICES Status of the North Pacific Ocean, AOOS will work with partners to produce an annual status report that is electronic and web accessible, but also includes a brief summary document in hard copy. This would be a signature AOOS product and complement the existing AOOS Ocean Data Explorer, providing a comprehensive annual assessment of the state of Alaska's oceans and coast.
- b. *Develop new products prioritized by stakeholders.* Stakeholders have identified numerous product needs. AOOS will focus on these priorities for new product development efforts, including a higher

resolution historical sea ice atlas, additional fishery run timing forecasts, ocean climatologies, a particle trajectory tool, and spatial analysis tools to analyze vessel traffic corridors for planning purposes.

- c. *Develop new web-based model evaluation tools.* Sophisticated model evaluation tools will better enable managers, scientists, educators and stakeholders to assess model output quality. Advanced tools could be developed to compare these outputs against each other through model-to-model comparisons, and assess model framework utility through model observation comparisons. The AOOS data system currently allows users to place a virtual sensor to extract time series data at a point and specific depth within a numerical modeling grid. AOOS plans to expand upon this capability by developing tools that extract virtual transects (depth curtain profile over a line at a specific time instance) and virtual profiles (changing depth profile over time at a specific location). Users will also be able to directly compare *in situ* observational data from sensors, buoys, gliders and profiling instruments (ADCPs and CTDs) against modeling outputs.

3. *Initiate the Alaska Modeling Testbed.* In Year 1 we will continue to seek partner funding for this initiative, and if the decision to eliminate funding support for the PWS ROMS model is made, contribute funding to its implementation. Similar to the IOOS Coastal Ocean Modeling Testbed (COMT), the mission of the AOOS Modeling Testbed effort will be to accelerate the transition of advances from the coastal ocean modeling research community to improved operational ocean products and services for Alaska, and thereby increase the accuracy, reliability, and scope of Alaska operational coastal and ocean forecasting products. For AOOS, a modeling team will be assembled to develop the program’s mission, objectives, and criteria for proposals (e.g., must solve a specific modeling problem, validate an existing model, add operational value to an existing model, etc.). The criteria will be used to select candidate projects, considering a number of factors, including the current status of model in question (e.g., existence and functionality of a model versus building a model from the ground up). Model status will be balanced with stakeholder-identified needs, model priorities and potential for leveraging. Preliminary discussions have been held between AOOS and NOAA National Weather Service on the new Arctic Testbed, and there is the potential for future collaborations on that effort. Two potential modeling needs have already been identified for Year 1 with potential funding partners:

- a. National Ocean Service (NOS): Add value to the NOS Coast Survey Development Laboratory (CSDL) circulation model for Cook Inlet by using hindcast model runs to develop decision support tools. Tools could include particle trajectory analysis (oil spill response planning, larval transport for shellfish), residence time (harmful algal blooms, oil spills), resource management (current/future environmental conditions for crab and groundfish distribution and herring spawning) and climate change scenario testing (impact of snowpack melt and precipitation changes, timing of seasonal changes).
- b. Improve existing circulation models (AOOS ROMS, NOAA GNOME, and Alyeska ATOM) to include surface and subsurface currents in Port of Valdez, home to the Valdez Marine Terminal and tanker loading activities. This would improve our understanding of how oil may move and disperse in confined regions.

VIII. PROJECT BUDGET

Program Components	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Management & Outreach	632,853	640,668	657,856	675,563	693,853	3,291,886
Observing	1,020,549	1,983,300	1,980,366	1,962,684	1,945,354	13,711,422

Data Management	540,000	600,000	600,000	600,000	600,000	3,000,000
Modeling & Products	465,538	587,937	573,683	573,658	572,698	2,956,217
Fiscal Support Fee	112,540	188,095	188,095	188,095	188,095	940,475
Total	2,771,480	4,000,000	4,000,000	4,000,000	4,000,000	18,771,480

Detailed budget information. Appendix A includes an overall project budget and budget narrative, as well as budget information for all subawards. A holdback of \$25,000 in Year 1 is requested for NOAA Kasitsna Bay Laboratory (Holderied) to perform activities described above. AOOS wishes for NOAA to retain these funds and have them used by the specified NOAA office. No equipment described in this proposal is available for lease. All items require a direct purchase.

Base capacity and enhancements. AOOS has submitted a budget request for \$2,771,480 for Year 1, and \$4 million a year for Years 2-5, which would minimally meet the need for ocean observing activities in Alaska. Appendix E describes the activities that would occur under the three funding scenarios (\$1.5M, \$2.5M, and \$4M). This proposal focuses on the \$2.5M scenario since that is closest to our current funding level. Under all three funding scenarios, program staff and the data management team would stay roughly the same since these are AOOS Board priorities. The primary difference is in the extent of proposed observations and equipment purchases, and resources devoted to modeling.

IX. MILESTONES & DELIVERABLES

MILESTONES & DELIVERABLES (\$2.5M)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
REGIONAL GOVERNANCE & MANAGEMENT SUBSYSTEM					
<i>Ongoing board, committee and partnership activities</i>	*	*	*	*	*
<i>Finalize AOOB certification as AK IOOS RA</i>	*				
OUTREACH, STAKEHOLDER ENGAGEMENT & EDUCATION					
<i>Ongoing activities (website, publications, communications)</i>	*	*	*	*	*
<i>Work with partners to develop Ocean Acidification Network</i>	*	*	*	*	*
<i>Develop IOOS-wide materials with IOOS Outreach Committee</i>	*	*	*	*	*
OBSERVING SYSTEM					
Marine Operations					
<i>Sustain weather observations in the GOA</i>	*	*	*	*	*
<i>Increase access to weather observations using AIS</i>	*	*	*	*	*
<i>Sustain critical wave buoys for navigation safety</i>	*	*	*	*	*
<i>Map surface currents with high frequency radars (HFRs)</i>	*	*	*	*	*
<i>Enhance observations at Port of Anchorage</i>	no	*	*	*	*
Coastal Hazards & Inundation					
<i>Increase water level observations in western & northern Alaska</i>	*	*	*	*	*
<i>Increase wave observations for water level forecasting & planning</i>	no	*	*	*	*
Ecosystems, Fisheries & Climate Trends					
Sustained Observation Network					
<i>Sustain Seward Line sampling</i>	*	*	*	*	*
<i>Support ecosystem moorings in Alaska's LMEs</i>	*	*	*	*	*
<i>Glider monitoring of ocean conditions and marine mammals</i>	*	*	*	*	*
<i>Host regional ATN workshop</i>	*				
Regional sentinel observations					
<i>Support sentinel monitoring in Prince William Sound</i>	*	*	*	*	*
<i>Support sentinel monitoring in Cook Inlet</i>	*	*	*	*	*
<i>Initiate sentinel monitoring in Southeast Alaska</i>	no	*	*	*	*
Water Quality					
<i>Sustain Ocean acidification (OA) monitoring</i>	*	*	*	*	*
<i>Support Alaska OA Network</i>	*	*	*	*	*
<i>Support monitoring of marine debris</i>	no	*	*	*	*
DATA MANAGEMENT & COMMUNICATIONS					
<i>Support AOOB Data Assembly Center cyber infrastructure</i>	*	*	*	*	*
<i>Maintain and enhance Ocean Data Explorer</i>	*	*	*	*	*
<i>Maintain existing data products</i>	*	*	*	*	*
<i>Develop new data products</i>	*	*	*	*	*
<i>Develop Products for National IOOS Program</i>	*				
MODELING, ANALYSIS & PRODUCTS					
<i>Support existing models & data products</i>	*	*	*	*	*
<i>Continue development of AIS Vessel Tracking Tool</i>	*	*	*	*	*
<i>Continue support for ROMS forecasts for PWS and GOA</i>	*	*	*	*	*
<i>Support and enhance AOOB Model Explorer</i>		*	*	*	*
<i>Develop State of Alaska's Coasts and Oceans Report</i>		*	*	*	*
<i>Initiate and maintain AOOB Modeling Testbed</i>	*	*	*	*	*
<i>Explore Arctic Marine Highway decision tools</i>					16

Alaska Regional Coastal and Ocean Observing System
H2400 FY2016-2020

	Salary	FTE	FY2016	Descoped	FY2017	FY2018	FY2019	FY2020	FY16-FY20
			Year 1		Year 2	Year 3	Year 4	Year 5	Total Request
a. Personnel									
PI (McCammon)	\$ 145,058.00	100%	145,058	145,060	149,410	153,892	158,509	163,264	770,135
Program Coordinator (Kent)	\$ 61,808.24	100%	61,808	70,000	63,662	65,572	67,540	69,566	336,340
Deputy/Operations Director (Janzen)	\$ 103,000.00	100%	103,000	103,000	106,090	109,273	112,551	115,927	546,841
Program Manager (Dugan)	\$ 81,600.00	50%	40,800	20,400	42,024	43,285	44,583	45,921	196,213
Total Personnel			350,666	338,460	361,186	372,022	383,182	394,678	1,849,528
b. Fringe Benefits: PI @ 16%, others @ 28%									
PI (McCammon)		16%	23,209	23,210	24,138	25,103	26,107	27,152	125,710
Program Coordinator (Kent)		28%	17,306	19,600	17,999	18,719	19,467	20,246	96,030
Deputy/Operations Director (Janzen)		28%	28,840	28,840	29,994	31,193	32,441	33,739	156,207
Program Manager (Dugan)		28%	11,424	5,712	11,881	12,356	12,850	13,364	56,164
Total Fringe Benefits			80,780	77,362	84,011	87,371	90,866	94,501	434,111
c. Travel and Per Diem									
Program Staff Travel			40,000	30,000	40,000	40,000	40,000	40,000	190,000
Total Travel and Per Diem			40,000	30,000	40,000	40,000	40,000	40,000	190,000
d. Equipment/software >\$5000									
Equipment			409,800	0	454,550	447,400	425,405	416,600	1,743,955
Total Equipment->5000			409,800	0	454,550	447,400	425,405	416,600	1,743,955
e. Supplies/commodities/equipment<5000									
Program Supplies			2,000	2,000	2,101	2,152	2,189	2,259	10,701
Computer software & Supplies			5,000	5,000	5,150	5,305	5,464	5,628	26,544
Meeting Food & Supplies			3,000	8,131	3,090	3,183	3,278	3,377	21,058
Office Supplies			2,000	2,000	2,060	2,122	2,185	2,251	10,618
Total Supplies/commodities< 5000			12,000	17,131	12,401	12,761	13,116	13,514	68,923
f. Contracts/Services:									
Services									
Fiscal Sponsor Fee			188,095	112,540	188,095	188,095	188,095	188,095	864,920
Audits: A-133, Financial Statements			16,500	18,000	17,000	17,500	18,000	18,500	89,000
Graphic design			6,000	8,000	6,180	6,365	6,556	6,753	33,855
Venue rental			0	920	0	0	0	0	920
Maintenance of Cook Inlet and Norton Sound buoys			15,000	15,000	15,000	15,000	15,000	15,000	75,000
Deployment of new wave buoys			20,000	0	20,000	20,000	20,000	20,000	80,000
Install/maint. water level sensors			100,000	0	100,000	100,000	100,000	100,000	400,000
Axiom Consulting and Design: AOS Data Services			600,000	540,000	600,000	600,000	600,000	600,000	2,940,000
Total Services			945,595	694,460	946,275	946,960	947,651	948,348	4,483,695
Sub-Award									
UAF/IARC sea ice atlas (Walsh/Trainor)			48,652	6,000	48,572	48,924	49,630	48,152	201,278
ACCAP/SNAP Climatologies (Walsh)			59,589	0	29,365	29,759	29,028	29,546	117,698
UAF/ CBO Ice (Eicken)			98,975	0	97,185	98,479	99,854	87,361	382,879
UAF/SFOS OA (Cross)			95,000	95,000	95,000	95,000	95,000	95,000	475,000
UAF/SFOS Seward Line (Hopcroft)			100,000	100,000	100,000	100,000	100,000	100,000	500,000
PWSSC OTN & snotels (Pegau)			94,904	75,000	94,904	94,904	94,904	94,904	454,616
MXAK WX/AIS (Page)			90,925	64,980	93,500	95,700	97,900	101,100	453,180
SSSC SE Sentinel (Bell)			50,000	0	50,000	50,000	50,000	50,000	200,000
UAF HFRs (Weingartner)			306,000	156,000	306,000	306,000	306,000	306,000	1,380,000
ADNR DGGs water levels (Overbeck) SOW pending			49,114	25,000	49,114	49,114	49,114	49,114	221,456
UAF/SFOS ecosystem mooring (Danielson)			150,000	100,000	150,000	150,000	150,000	150,000	700,000
WHOI glider survey (Baumgartner)			100,000	99,969	98,047	98,769	99,507	100,275	496,567
Axiom special projects (Bochenek)			140,000	409,538	110,000	95,000	95,000	95,000	804,538
UW/JISAO OA Ferry (contract pending)			0	14,600	0	0	0	0	14,600
TBD State of AK Coasts Report			150,000	0	150,000	150,000	150,000	150,000	600,000
TBD Sentinel Observing Sites			40,000	0	40,000	40,000	40,000	40,000	160,000
TBD Marine Debris			20,000	0	20,000	20,000	20,000	20,000	80,000
TBD ATN regional workshop			0	25,000	0	0	0	0	25,000
TBD modeling test bed & tools or RSS ROMS (Chao)			350,000	50,000	350,000	350,000	350,000	350,000	1,450,000
TBD water level observations (NWS)			0	250,000	0	0	0	0	250,000
Total Sub-Awards			1,943,159	1,471,087	1,881,687	1,871,649	1,875,937	1,866,452	8,966,812
h. Other									
Symposium & Conferences			20,000	30,000	20,000	20,000	20,000	20,000	110,000
Non-staff Travel									
<i>Board & committee travel</i>			5,000	5,000	5,000	5,000	5,000	5,000	25,000
<i>Stakeholder & user group travel</i>			5,000	13,980	5,000	5,000	5,000	5,000	33,980
Rent/parking			54,000	60,000	55,620	57,289	59,007	60,777	292,693
Insurance			3,000	3,000	3,090	3,183	3,278	3,377	15,927
Telephone/Internet			6,000	6,000	6,180	6,365	6,556	6,753	31,855
Postage/Publications/printing			10,000	10,000	10,000	10,000	10,000	10,000	50,000
Memberships/dues			15,000	15,000	15,000	15,000	15,000	15,000	75,000
Total Other			118,000	142,980	119,890	121,837	123,842	125,907	634,456
TOTAL GRANT REQUEST			3,900,000	2,771,480	3,900,000	3,900,000	3,900,000	3,900,000	18,371,480
NOAA holdback: Cook Inlet obs (Holderied)			50,000	25,000	50,000	50,000	50,000	50,000	225,000
TOTAL FUNDING REQUEST			3,950,000	2,796,480	3,950,000	3,950,000	3,950,000	3,950,000	18,596,480

FY2016 AOOS BUDGET NARRATIVE

Recipient Institutions in AOOS Budget

Alaska SeaLife Center on behalf of Alaska Ocean Observing System, PO Box 1329, Seward, AK 99664

Alaska Department of Natural Resources, 550 W 7th Ave #1260, Anchorage, AK 99501

Axiom Data Science, 1016 W. 6th Ave., Ste 105, Anchorage, AK 99501

Marine Exchange of Alaska, 1000 Harbor Way Suite 204, Juneau AK 99801

Prince William Sound Science Center, 300 Breakwater Ave, Cordova, AK 99574

Remote Sensing Solutions, 3179 Main St, Barnstable, MA 02630

University of Alaska Fairbanks, 505 S Chandlar Drive, Fairbanks, AK 99775

Woods Hole Oceanographic Institution, 86 Water St, Woods Hole, MA 02543

University of Washington, 3737 Brooklyn Ave., Seattle, WA 98105

Holdback to NOAA: \$25,000 is requested to be held back from this proposal to NOAA's Kasitsna Bay Laboratory (Kris Holderied) for Cook Inlet oceanographic support. Funds for supplies are included for \$6,833 for boat/field supplies and fuel. Contractual funds (\$14,000) are included for data analysis. Indirect costs are reimbursed at 20%.

a) Personnel (\$338,460) Salaries for the 12-month grant period are provided for three full-time employees (Executive Director, Operations Director, and Program Coordinator) and 50% of one half-time employee (Program Manager). A 3% annual salary increase is included.

b) Fringe Benefits (\$77,362) Fringe Benefits rate is 16% for the Executive Director and 28% for the other three positions.

c) Travel and Per Diem (\$30,000) Travel costs in Alaska are extraordinarily high, especially for trips to the Bering Sea and Arctic communities, or for residents of those communities to participate in meetings in Anchorage. Trips to Washington D.C. can cost between \$2000 and \$3000 a trip, depending on airfare and hotel costs. Trips to Alaska communities outside Anchorage range from \$500 to Juneau to \$1000 to Dutch Harbor and Barrow.

\$30,000 is requested for travel expenses for the three full-time and one half-time programmatic staff. This includes five trips to Washington DC or a similar national venue to participate in national IOOS and IOOS Association activities (\$12,500 total based on \$2500 per trip - \$1200 airfare, \$900 hotel, and per diem); eight trips to Fairbanks, Juneau or other Alaska community to participate in user meetings and workshops and state and regional collaborations (\$10,000 total based on approximately \$1,250 per trip - \$550 air fare, \$500 hotel, and per diem); one trip to an international Arctic meeting (approximately \$3,500 - \$1500 air fare, \$1200 hotel, and per diem); and two trips to national ocean observing related conferences and workshops (\$4,000 total based on approximately \$2,000 per trip - \$1000 air fare, \$700 hotel, and per diem). These cost estimates assume a four-day trip with three nights hotel.

d) Equipment (\$0) No funds are requested for equipment except those being requested by individual sub-awards which are detailed below. None are available for lease.

MXAK/Page (\$19,500)

Funding is requested to purchase electronics, renewable power systems (batteries and solar power), weather sensors, AIS transmitters and cell modems.

UAF/Danielson (\$96,990)

Funds will be used to purchase the following sensor instruments for the mooring: one SeaBird-Satlantic SeaPhOx sensor \$23,490, one Contros HydroC pCO₂ sensor \$34,000 and one Sequoia LISST sensor: \$39,500.

UAF/Cross (\$15,000)

Funds would be used to purchase a SAMI pCO₂ sensor.

WHOI/ Baumgartner (\$18,000)

Funds (\$18,000) are requested for one complete AUV glider lithium pack.

e) Supplies and Commodities (\$17,131) Supplies cover basic office, program and computer supplies and meeting expenses.

f) Contracts/Services

Services (\$694,460)

Service costs include those for the fiscal sponsor services provided by the Alaska SeaLife Center, which include grant administration, legal, personnel and human resources (\$112,540); graphic design services (\$8,000) for newsletters, reports, other publications, etc; an annual audit at \$18,000; \$15,000 to maintain the Cook Inlet and Norton Sound wave buoys; \$920 room rental for the ocean acidification workshop; and the primary contract with Axiom Data Science for AOOS core data management services (\$540,000).

Axiom Data Science will maintain the core data management and communication services required to provide consistently available data storage, delivery and visualization tools integral to the AOOS program. Personnel costs include salary for several investigators working an average of 29% FTE with a fringe rate of 30% covering 401K, health insurance, and paid leave. Supplies include the purchase of replacement hard drives and server components. The facilities rate of 21% of salary costs is used to cover typical facilities costs.

Subawards (\$1,471,087)

Funds are included for directed contractual services with Prince William Sound Science Center, Marine Exchange of Alaska, University of Alaska Fairbanks, Woods Hole Oceanographic Institute, University of Washington and Axiom Data Science. At least 5 additional contracts are pending. These are 1) an award to either continue the ROMS model (RSS-Chao) for one more year or initiate the Alaska Modeling Testbed; 2) an award to the Alaska Department of Natural Resources for coastal erosion decision-support services to be determined based on summer 2016 field season; 3) an award to support a regional Animal Telemetry workshop; 4) an award to the University of Washington/JISAO to install ocean acidification monitoring equipment on an Alaska State Ferry to monitor conditions along the ferry route; and 5) one or more contracts to

install additional water level sensors on behalf of the National Weather Service pending results of summer 2016 field projects.

University of Alaska Fairbanks was selected for the following 5 direct subawards:

Alaska Sea Ice Atlas Update (Walsh/Trainor) will keep the atlas up-to-date by adding new data in six-month increments as soon as such data are available from the National Snow and Ice Data Center. Subcontractor will also respond to user requests for information about the database and for assistance in using the database. Personnel costs are included for the PI working 16 hours to oversee the updates and verify that the updating results in a homogeneous product and is user accessible and for the reporting and other project management tasks at UAF and a Research Programmer working 51.5 hours on the programming required to perform the updates including the retrieval of recent data from the National Snow and Ice Data Center. Fringe benefits are charged at 9.7% for the PI and 68.3% for the Research Programmer. Indirect costs are included at a rate of 28.8% of the combined salary and leave benefits.

Time Series Monitoring of Ocean Acidification (Cross) will continue an eight-year time-series in the Gulf of Alaska along the Seward Line as well adjacent to the oceanographic sampling line supporting the statewide OA research monitoring program, and making data available to the public through the AOOS website. Travel costs cover one trip per year for the PI to travel from Fairbanks to Seward for sampling and mooring deployment at \$350 in airfare, \$100 in ground transportation, and \$183 in per diem. A Supplies cost of \$1,439 will be used for general supplies. Contractual costs include \$1,900 for shipping, \$4,000 for nutrient analysis and \$45,000 for DIC/TA analysis. Indirect costs are included at a negotiated 50.5% MTDC rate.

The Seward Line Monitoring (Hopcroft) will continue the 18-year sentinel long-term monitoring of the Gulf of Alaska over the Alaskan shelf. A contractual cost of \$100,000 covers a ten-day vessel charter for the USFWS Tiglax.

High Frequency Radar Operations & Maintenance (Weingartner) will maintain long-range CODAR HFR field sites on the northwest Alaska coast at Icy Cape, Wainwright, Point Barrow, and Cape Simpson. Salaries include 87 hours (0.5 mo.) for the PI to supervise and 348 hours (2 mos.); for one staff performing HFR field logistics, deployments, maintenance, and reporting; and another staff member at 348 hours (2 mos.) for HFR operations and maintenance. Benefits are applied at a negotiated rate of 28.7% for faculty (PI) and 41% for staff. Travel will consist of 2 trips per year for 2 people to Barrow, Wainwright, and Point Lay, to conduct fieldwork. Supplies will include cables, conduit, fuses and housings, UPS component replacements and upgrades, guy line, tools, and Arctic field safety gear. Contractual costs include logistical support, data communications, air freight, honoraria for field guides, space or land use fees and permitting fees. Indirect costs are included at a negotiated 50.5% MTDC rate.

Chukchi Ecosystem Mooring (Danielson) will continue the incremental build-out of the Chukchi Sea Ecosystem Mooring, a multi-instrument physical/biological/chemical/geological oceanographic mooring that will be deployed in the NE Chukchi Sea. Supplies costs will be used to purchase batteries. Contractual costs will be used for instrument calibrations, data services and shipping. Indirect costs are included at a negotiated 50.5% MTDC rate.

Prince William Sound Science Center (Pegau) – The PWSSC was selected as a directed subaward to support operation and maintenance of the most critical snotel weather stations in

Prince William Sound and Cook Inlet, an acoustic array at the entrances of the sound to track marine mammals and fish and a conductivity sensor at the Cordova tide station. Personnel costs are included for the lead investigator to supervise the project and work on project design at 0.15 months, as well as a deployment technician at 1.1 months to prepare all equipment and coordinate field operations including acoustic receiver array maintenance. Fringe benefits are calculated at a 44-44.5% rate depending on employee. There is no travel for the project. Supplies include those necessary to support the array maintenance. Contractual costs include vessel charter costs included at \$18,000 for 6 days, welding services at \$400, communication costs of \$600, conductivity sensor maintenance costs of \$1,600 and the sub-contract for Snotel station maintenance at \$25,000. Indirect costs are calculated at 30% on direct costs.

Marine Exchange of Alaska (Page) – The MXAK was selected as a directed subaward to enhance maritime safety in Alaska through providing real time, environmental information to vessels over the AIS (Automatic Identification System). Personnel costs of \$21,013 include salaries for the P.I., the data base programmer/technician, and Marine Exchange field personnel who will design, build the units, and install the equipment. Benefit costs of \$1,891 include the standard applicable state and federal taxes. Travel of \$14,100 includes the costs incurred by technicians to travel to the sites to install the integrated sensor/power/transmission packages and service the equipment. The indirect costs of \$5,650 cover admin support, office and shop space, boat maintenance, and tool costs incurred in supporting this project.

Woods Hole Oceanographic Institution – WHOI was selected as a directed subaward to support a simultaneous marine mammal and oceanographic survey of the Chukchi Sea using a Slocum autonomous underwater glider. Total labor and benefits costs are \$10,686 and include 0.67 months for the lead researcher to prepare and pilot the glider and analyze data. Travel costs of \$2,279 are requested for travel from Boston, Massachusetts to the 2018 Alaska Marine Science Symposium in Anchorage, Alaska. Funds include airfare (\$900), lodging (6 nights at \$130 per night), ground transportation (\$200), and per diem (7 days at \$57 per day). Two subawards would go to University of Washington to refine the call libraries and assist with data analysis (\$35,000) and to a collaborator at University of Alaska Fairbanks to deploy and recover the glider and participate in data analysis (\$45,000). Indirect lab costs and general administrative costs are \$7,004.

Axiom Data Science – Axiom Data Science was selected for a directed subaward to support 6 special projects in support of the national IOOS Program Office and its partners: augment and maintain the i52n SOS server and supporting software packages; continue enhancements to the Environmental Sensor Map and its integration with the IOOS Catalog; develop tools for users producing animal telemetry data sets which streamline the data management process and accelerate integration into relevant data assembly centers (ATN DAC); develop a scalable methodology for storing and querying the national AIS data set assembled by the NOAA Office of Coast Survey; improve tools for preserving High Frequency Radar (HFR) output and allowing for reprocessing HFR data; and support and enhance USGS Coastal and Marine Geology Program portals. Personnel costs include the project PI at 12% FTE and other Axiom staff from 15-30% FTE. Benefits cover 401K, health insurance, and paid leave for staff salaries. Supplies include the cost of several replacement hard drives and server components. A facilities charge is calculated at 21% for facilities and ancillary operating costs.

h) Other (\$142,980) Other costs include \$30,000 a year in contributions to symposiums and conferences (e.g., annual Alaska Marine Science Symposium - \$5000 per year, Alaska Forum on the Environment - \$3000 per year, Week of the Arctic - \$5000 per year, Arctic Forum - \$3000 per year); rent at \$60,000 per year (office plus joint space including conference room plus parking); insurance for staff, officers and equipment at \$3,000 per year; telephone and internet at \$6,000 a year, which includes conference call costs; postage and publication printing at \$10,000 per year; memberships and dues at \$15,000 per year (\$10,000 for annual IOOS Association dues, \$1500 for Consortium for Ocean Leadership membership dues, and other conference registration fees). The budget reflects inflation increases for most items.

\$5,000 per year is requested for Board, Data Management Committee and data team travel. Board travel includes airfare for two board members for two one-day meetings per year since most other board members are either located in Anchorage, attend by teleconference, or cover their own costs (\$2,000 total based on \$500 per ticket, no hotel or per diem). Data Committee travel includes airfare, hotel and per diem for two committee members to attend two one-day meetings per year (\$2,000 based on \$500 per ticket, no hotel or per diem). Funds are included for data team staff to participate in two trips to attend user meetings in Alaska communities (\$1,000 total based on \$500 per trip).

\$13,980 is requested for stakeholder and user group travel. This includes support for a Kotzebue Marine Resiliency workshop (\$5,000 total based on travel for six to seven participants at an average cost of \$750 per trip - \$500 air fare, \$150 hotel, and per diem) and an Ocean Acidification workshop (\$8,980 total based on travel for scientists to speak on this topic to communities in Alaska - \$5,200 air fare, \$3,300 hotel, and per diem).

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		Total (g)
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	
1. AOS IOOS 2016 - 2021: Main Grant NA16NOS0120027 Descops	11.012	\$	\$	\$ 2,771,480.00	\$	\$ 2,771,480.00
2.						
3.						
4.						
5. Totals		\$	\$	\$ 2,771,480.00	\$	\$ 2,771,480.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1)	(2)	(3)	(4)	
	AOOS IOOS 2016 - 2021: Main Grant NA16NOS0120027 Descope				
a. Personnel	\$ 338,460.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 338,460.00
b. Fringe Benefits	77,362.00	0.00	0.00	0.00	77,362.00
c. Travel	30,000.00	0.00	0.00	0.00	30,000.00
d. Equipment	0.00	0.00	0.00	0.00	
e. Supplies	17,131.00	0.00	0.00	0.00	17,131.00
f. Contractual	2,165,547.00	0.00	0.00	0.00	2,165,547.00
g. Construction	0.00	0.00	0.00	0.00	
h. Other	142,980.00	0.00	0.00	0.00	142,980.00
i. Total Direct Charges (sum of 6a-6h)	\$ 2,771,480.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 2,771,480.00
j. Indirect Charges	0.00	0.00	0.00	0.00	
k. TOTALS (sum of 6i and 6j)	\$ 2,771,480.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 2,771,480.00
7. Program Income	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00

SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program		(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8.	AOOS IOOS 2016 - 2021: Main Grant NAI6NOS0120027 Deascope	\$ 0.00	0.00	\$ 0.00	0.00
9.					
10.					
11.					
12.	TOTAL (sum of lines 8-11)	\$	\$	\$	\$

SECTION D - FORECASTED CASH NEEDS

		Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13.	Federal	\$ 2,771,480.00	\$ 692,870.00	\$ 692,870.00	\$ 692,870.00	\$ 692,870.00
14.	Non-Federal	\$				
15.	TOTAL (sum of lines 13 and 14)	\$ 2,771,480.00	\$ 692,870.00	\$ 692,870.00	\$ 692,870.00	\$ 692,870.00

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.	AOOS IOOS 2016 - 2021: Main Grant NAI6NOS0120027 Deascope	\$	\$	\$	\$
17.					
18.					
19.					
20.	TOTAL (sum of lines 16 - 19)	\$	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION

21.	Direct Charges:	2,771,480	22. Indirect Charges:	0
23.	Remarks:	Alaska Ocean Observing System does not have a federally negotiated indirect cost rate.		

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		Total (g)
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	
1. UAF IARC Subaward - Walsh	11.012	\$	\$	\$ 6,000.00	\$	\$ 6,000.00
2.						
3.						
4.						
5. Totals		\$	\$	\$ 6,000.00	\$	\$ 6,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1)	(2)	(3)	(4)	
	UAF IARC Subaward - Walsh				
a. Personnel	\$ 3,534.00	\$	\$	\$	\$ 3,534.00
b. Fringe Benefits	1,124.00				1,124.00
c. Travel	0.00				
d. Equipment	0.00				
e. Supplies	0.00				
f. Contractual	0.00				
g. Construction	0.00				
h. Other	0.00				
i. Total Direct Charges (sum of 6a-6h)	4,658.00				4,658.00
j. Indirect Charges	1,342.00				1,342.00
k. TOTALS (sum of 6i and 6j)	\$ 6,000.00	\$	\$	\$	\$ 6,000.00
7. Program Income					

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. IAF IARC Subaward - Walsh	\$	\$	\$	\$
9.				
10.				
11.				
12. TOTAL (sum of lines 8-11)	\$	\$	\$	\$

SECTION D - FORECASTED CASH NEEDS

Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal \$ 6,000.00	\$ 2,000.00	\$ 2,000.00	\$ 1,000.00	\$ 1,000.00
14. Non-Federal \$				
15. TOTAL (sum of lines 13 and 14) \$ 6,000.00	\$ 2,000.00	\$ 2,000.00	\$ 1,000.00	\$ 1,000.00

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. IAF IARC Subaward - Walsh	\$	\$	\$	\$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	\$	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: 4658	22. Indirect Charges: 1342
23. Remarks:	

AOOS SUBAWARD STATEMENT OF WORK (SOW) FOR NOAA GRANT #NA16NOS0120027

PROJECT NAME: Alaska Sea Ice Atlas Update

PI NAME & CONTACT INFO: John Walsh
International Arctic Research Center
University of Alaska, Fairbanks
Phone: 970-474-2677
Email: jwalsh@iarc.uaf.edu

PERIOD OF PERFORMANCE: 1 June 2016 to 31 May 2017

PROJECT GOAL/PURPOSE:

Update the Alaska Sea Ice Atlas (constructed under previous AOOS funding) and facilitate use of the atlas.

BACKGROUND:

The Alaska Sea Ice Atlas was constructed in a two-year project funded by AOOS. The original atlas covered the period 1850-2013. In order to keep the atlas up-to-date, we add new data in six-month increments as soon as such data are available from the National Snow and Ice Data Center. We also respond to user requests for information about the database and for assistance in using the database.

PROJECT OBJECTIVES:

- 1) Ensure user access to up-to-date information on sea ice in Alaskan waters; the information includes digital data for download by users as well as a user interface that enables interactive exploration of the dataset.
- 2) Promote use of the dataset, monitor user feedback and queries, and trouble-shoot any problems that may arise in users' experience with the database.

PROJECT ACTIVITIES

- 1) The database will be updated at six-month increments using the satellite passive microwave data provided by the National Snow and Ice Data Center (NSIDC). The updating includes regridding of the NSIDC data to our $0.25^{\circ} \times 0.25^{\circ}$ latitude-longitude grid, as well as removal of spurious coastal ice using an algorithm developed under a past funding increment. The data for the updates generally becomes available from NSIDC about two months after the end of the six-month period (e.g., data for January-June 2016 will become available in early September 2016).

- 2) The updated data will be added to the downloadable file containing all the data, and the user interface will be updated by extending the timeline of the various “point and click” options and associated displays.
- 3) Usage of the database will be monitored, including downloads of the digital data and access via the user interface. The monitoring will include responding to user inquiries and trouble-shooting any reports of problems with actual data as well as the user interface.

PLAN FOR DATA DELIVERY:

A copy of the Alaska Sea Ice Database is included in the AOOS web-accessible archive. We will send AOOS the database with updates after the addition of each calendar year’s data (i.e., after the July-December data for each year.

TIMELINE AND MILESTONES:

Data for the first six months of 2016 will be added in early September; Data for July-December 2016 will be added in March 2017. The database updated through 2016 will be delivered to AOOS in March 2017.

We anticipate using the database in a diagnostic evaluation of Alaska temperature variations over the past several years. A manuscript addressing the role of sea ice loss in the recent Alaskan warming will be compiled in early 2017 and will acknowledge AOOS support.

DELIVERABLES (MUST INCLUDE THE FOLLOWING):

- The updated database will be delivered to AOOS and will be made available to users via download and/or visualization using the ACCAP/SNAP web portal at the University of Alaska.
- A paper examining the role of sea ice reduction in the recent Alaskan warming will be prepared and submitted in early 2017.
- AOOS and IOOS will be acknowledged in all publications and presentations using your project’s data.
- Pictures from the field sites will be provided to AOOS and/or IOOS upon request for web sites, publications, and outreach presentations.
- A semi-annual report will be submitted to AOOS December 2016.
- A semi-annual report will be submitted to AOOS June 2017.
- If available, we will participate in an AOOS-sponsored stakeholder scientist workshop, which may include the Alaska Marine Science Symposium.
- Presentations will be made to the AOOS board upon request.
- A story for the AOOS newsletter will be provided upon request.

ACCAP - AOOB John Walsh
 G7872
 336875-66900
 June 1, 2016 - May 30, 2017

	FW	XR	Leave %	Leave Crg	Benefit %	Benefit Crg	Loaded Labor	Hours
John Walsh	87.67763	0	0	0	9.70%	8.50472963	96.18235463	16
Michael Lindgren	33.94	21.90%	7.43286	41.37286	46.40%	19.197007	60.56986704	51.5
F&A	28.80%							
			Walsh	Salary only:	1402.842	Benefits:	F&A	28.80%
			Lindgren		2130.702	988.645863		Total:
								5,999.85
								4,658.27

Salary
 Walsh 16 hrs 1,403.00
 Lindgren 51.5 hrs 2,131.00

Benefits
 Walsh 136.00
 Lindgren 988.00

F&A 1,342.00
Total: 6,000.00

AOOS SUBAWARD BUDGET JUSTIFICATION FOR NOAA GRANT #NA16NOS0120027

PROJECT NAME: Alaska Sea Ice Atlas Update

PI NAME & CONTACT INFO: John Walsh
International Arctic Research Center
University of Alaska, Fairbanks
Phone: 970-474-2677
Email: jwalsh@iarc.uaf.edu

PERIOD OF PERFORMANCE: 1 June 2016 to 31 May 2017

Budget Justification:

The ^6000 award amount will be spent on salaries of John Walsh (PI, 16 hours) and Michael Lindgren (Research programmer, 51.5 hours). Walsh will oversee the updates and verify that the updating results in a homogeneous product and is user accessible; Walsh will also be responsible for the reporting and other project management tasks at UAF. Lindgren will be responsible for the programming required to perform the updates, including the retrieval the recent data from the National Snow and Ice Data Center. Lindgren's updates will have two components: (1) temporal extension of the digital file available for user download, and (2) addition of the new data (annually) to the user interface accessible at <http://seaiceatlas.snap.uaf.edu/>

Leave and benefit rates are different for Walsh and Lindgren, as Walsh is a part-time adjunct employee while Lindgren is a full-time employee. The combined leave and benefit rates are 9.7% for Walsh and 68.3% for Lindgren. F&A is 28.80% of the combined salary and leave + benefits.

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		Total (g)
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	
1. UAF Subaward - Cross - OA	11.012	\$	\$	\$ 95,000.00	\$	\$ 95,000.00
2.						
3.						
4.						
5. Totals		\$	\$	\$ 95,000.00	\$	\$ 95,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1) UNF Subaward - Cross - OA	(2)	(3)	(4)	
a. Personnel	\$ 0.00	\$	\$	\$	
b. Fringe Benefits	0.00				
c. Travel	817.00				817.00
d. Equipment	15,000.00				15,000.00
e. Supplies	1,439.00				1,439.00
f. Contractual	50,900.00				50,900.00
g. Construction	0.00				
h. Other	0.00				
i. Total Direct Charges (sum of 6a-6h)	68,156.00				68,156.00
j. Indirect Charges	25,844.00				25,844.00
k. TOTALS (sum of 6i and 6j)	\$ 95,000.00	\$	\$	\$	\$ 95,000.00
7. Program Income	\$ 0.00	\$	\$	\$	

SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. UAF Subaward - Cross - OA	\$	\$	\$	\$
9.				
10.				
11.				
12. TOTAL (sum of lines 8-11)	\$	\$	\$	\$

SECTION D - FORECASTED CASH NEEDS

Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal \$ 95,000.00	\$ 40,000.00	\$ 20,000.00	\$ 25,000.00	\$ 10,000.00
14. Non-Federal \$				
15. TOTAL (sum of lines 13 and 14) \$ 95,000.00	\$ 40,000.00	\$ 20,000.00	\$ 25,000.00	\$ 10,000.00

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. UAF Subaward - Cross - OA	\$	\$	\$	\$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	\$	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: 68156	22. Indirect Charges: 26844
23. Remarks:	



School of Fisheries and Ocean Sciences Proposal

TO: Holly Kent
Program Coordinator
Alaska Ocean Observing System
1007 W. 3rd Ave Suite 100
Anchorage, AK 99501

FROM: Dr. Jessica Cross
School of Fisheries and Ocean Sciences
Ocean Acidification Research Center
University of Alaska Fairbanks
905 N. Koyukuk Dr.
P.O. Box 757220
Fairbanks, AK 99775-7220

CONTACT: Office of Grants and Contracts Administration
PO Box 757880
Fairbanks, AK 99775-7880

TITLE: Time- Series Monitoring of Ocean Acidification in Alaska

PRINCIPAL INVESTIGATORS: Dr. Jessica Cross

NEW/CONTINUATION: New

DURATION: 1 Year

PROPOSED START DATE: June 1, 2016

AMOUNT REQUESTED: \$95,000

AOOS SUBAWARD STATEMENT OF WORK (SOW) FOR NOAA GRANT #NA16NOS0120027

PROJECT NAME: Time- Series Monitoring of Ocean Acidification in Alaska

PI NAME & CONTACT INFO:

Dr. Jessica Cross, PI
jncross@alaska.edu

PERIOD OF PERFORMANCE:

June 1, 2016 to May 31, 2017

PROJECT GOAL/PURPOSE:

The Ocean Acidification (OA) monitoring program will continue a nine-year time-series in the Gulf of Alaska along the Seward Line as well as support the deployment of OA moorings adjacent to the oceanographic sampling line. When combined, these two data streams provide unprecedented resolution to better understand the seasonal dynamics of the carbonate chemistry around Alaska.

BACKGROUND:

Ocean acidification has emerged as a new and potentially high impact issue in Alaska, due to its relatively shallow shelf seas, cold water temperatures and high rates of primary production, which had already led to seasonal manifestations of OA through suppressed carbonate mineral concentrations. Because of Alaska's remoteness and the high cost of ship time, consortia are forming to maintain support of long-term time-series of physical, biological and chemical oceanographic conditions to understand climate variability and ecosystem change, including funding for equipment replacement.

OA is now recognized as a perennial threat to the global marine environment and recent and ongoing studies have shown that the high latitudes regions of the Gulf of Alaska, the Bering Sea, and the western Arctic Ocean are more susceptible to decreased pH.

PROJECT OBJECTIVES:

AOOS will partner with the Ocean Acidification Research Center (OARC) and NOAA to support the statewide OA research monitoring program, and make data available to the public through the AOOS website.

PROJECT ACTIVITIES

1. AOOS will maintain OA sampling of an existing, ongoing oceanographic time-series transect (Seward Line) in the northern Gulf of Alaska two times per year to quantify the physical and biogeochemical controls on OA. Each year, the OARC will conduct two oceanographic cruises along the Seward Line and make measurements of ocean acidification as well as the associated carbon biogeochemistry of the region. During each bi-annual (May and September), 450 samples will be collected for dissolved inorganic carbon (DIC), total alkalinity (TA), partial pressure of CO₂ gas in the water (*p*CO₂), pH, carbonate mineral saturation states (Ω), oxygen isotopes (δ O¹⁸), dissolved oxygen (DO), and nutrients. This will fund the completion of ten years of monitoring on the Seward Line, the minimum amount of time necessary to capture definitive changes in ocean carbonate chemistry. OA data will be combined with observations of

specific pelagic and benthic calcifying organisms to monitor how keystone species in the food web are responding to increased intrusion of atmospheric CO₂.

2. AOOS will contribute \$15,000 as part of a consortium to maintain an OA buoy network (\$45k annually needed) that will make continuous measurements of *p*CO₂, *p*H, temperature, salinity, DO, and florescence at the surface and near the bottom. AOOS will contribute funding to a consortium to support maintenance of existing OA sensors on moorings in the Bering Sea and the Gulf of Alaska. Previous AOOS funds were used to add additional OA sensors to a mooring in the Chukchi Sea, funded through NSF, which enabled it to collect OA data year-round. Data from all moorings, as well as along the Seward Line, will be made available on the AOOS website under an agreement to be established between Mathis and AOOS.

PLAN FOR DATA DELIVERY:

Cross will provide data, graphical products, and synthesis information from the OARC to AOOS on a bi-annual basis (November and March).

Milestones

Jan 2016-May 2016: Support of the maintenance of the Alaska Ocean Acidification Buoy Network; mooring sites: GAKOA, M2, and Kodiak

May 2016: Support OA Sampling along Seward Line

September 2016: Support OA Sampling along Seward Line

October 2016: Support equipment maintenance and turnaround for M2 mooring site

TIMELINE AND MILESTONES:

DELIVERABLES (MUST INCLUDE THE FOLLOWING):

- AOOS and IOOS will be acknowledged in all publications and presentations using your project's data.
- Pictures from the field sites will be provided to AOOS and/or IOOS upon request for web sites, publications, and outreach presentations.
- A semi-annual report will be submitted to AOOS December 2016.
- A semi-annual report will be submitted to AOOS June 2017.
- If available, we will participate in an AOOS-sponsored stakeholder scientist workshop, which may include the Alaska Marine Science Symposium.
- Presentations will be made to the AOOS board upon request.
- A story for the AOOS newsletter will be provided upon request.

AOOS SUBAWARD BUDGET & BUDGET JUSTIFICATION FOR NOAA GRANT #NA16NOS0120027

PROJECT NAME: Time- Series Monitoring of Ocean Acidification in Alaska

PI NAME & CONTACT INFO:

Dr. Jessica Cross, PI
jncross@alaska.edu

PERIOD OF PERFORMANCE:

June 1, 2016 to May 31, 2017

Personnel:

No salary or benefits are requested for the completion of project objectives.

Equipment:

\$15,000 is requested for the purchase of SAMI pCO₂.

Supplies/commodities:

Funds (\$1,439) are requested for general program/project supplies. Funds will be used to purchase sample vials, sample labels, tubing, chemicals, valves, and batteries

Travel:

Domestic: One trip is requested for one individual to travel to Seward, AK (at \$350/trip for airfare + \$100/trip in ground shuttle from Anchorage to Seward) for OA sampling and mooring deployment. Per Diem (meals/incidentals/lodging) is \$183/day for Seward

An inflation rate of 10% per year has been included for all transportation costs. All airfare cost data is based on Internet research from www.kayak.com. All Per Diem is in accordance with GSA/JTR Regulations.

Contracts/services:

\$1,900 is included for shipping. \$4,000 is included for nutrient analysis. \$45,000 is included for DIC/TA analysis (<http://www.uaf.edu/sfos/research/major-research-programs/oarc/policies-1/>).

Indirect (overhead):

Facilities and Administrative (F&A) Costs are negotiated with the Office of Naval Research. The predetermined rate for sponsored research at UAF is calculated at 50.5% (FY17–FY18 predetermined agreement) of Modified Total Direct Costs (MTDC). MTDC includes Total Direct Costs minus tuition and associated fees, scholarships, participant support costs, subaward amounts over \$25,000, and equipment. A copy of the rate agreement is available at: <http://www.alaska.edu/cost-analysis/negotiation-agreements/>.

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		Total (g)
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	
1. UAF Subaward - Hopcroft - Seward Line	11.012	\$	\$	\$ 100,000.00	\$	\$ 100,000.00
2.						
3.						
4.						
5. Totals		\$	\$	\$ 100,000.00	\$	\$ 100,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1)	(2)	(3)	(4)	
	UAF Subaward - Bopcroft - Seward Line				
a. Personnel	\$ 0.00	\$	\$	\$	\$
b. Fringe Benefits	0.00				
c. Travel	0.00				
d. Equipment	0.00				
e. Supplies	0.00				
f. Contractual	100,000.00				100,000.00
g. Construction	0.00				
h. Other	0.00				
i. Total Direct Charges (sum of 6a-6h)	100,000.00				100,000.00
j. Indirect Charges	0.00				
k. TOTALS (sum of 6i and 6j)	\$ 100,000.00	\$	\$	\$	\$ 100,000.00
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. UAF Subaward - Hopcroft - Seward Line	\$	\$	\$	\$
9.				
10.				
11.				
12. TOTAL (sum of lines 8-11)	\$	\$	\$	\$

SECTION D - FORECASTED CASH NEEDS

Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	\$ 100,000.00	\$	\$	\$
14. Non-Federal	\$			
15. TOTAL (sum of lines 13 and 14)	\$ 100,000.00	\$	\$	\$

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. UAF Subaward - Hopcroft - Seward Line	\$	\$	\$	\$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	\$	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: 100,000	22. Indirect Charges: 0
23. Remarks:	

AOOS SUBAWARD STATEMENT OF WORK (SOW) FOR NOAA GRANT #NA16NOS0120027

PROJECT NAME: Seward Line Monitoring

PI NAME & CONTACT INFO: Russell R Hopcroft

Institute of Marine Science
University of Alaska Fairbanks
Fairbanks, AK 99775-7220
(907) 474-7842 Fax (907) 474-7204

PERIOD OF PERFORMANCE: June 1, 2016 – May 31 2017

PROJECT GOAL/PURPOSE:

The goal of the AOOS ecosystem/climate trends component is to build upon and leverage existing activities to develop an integrated network of physical, chemical and biological observations off Alaska to meet short- and long-term needs. Alaska has a need to understand marine climate variability and ecosystem change in the long term, as well as how conditions affect ocean circulation and productivity in the short term. Because of Alaska's remoteness and the high cost of ship time, consortia are forming to maintain support of long-term time series of physical, biological and chemical oceanographic conditions to understand climate variability and ecosystem change.

BACKGROUND:

Long times-series are required for scientists to tease out pattern (and cause) from simple year-to-year variability. Like other regions, the Northern Pacific undergoes significant inter-annual variability, driven partially by variations in major climatic indices (e.g. El Niños, the Pacific Decadal Oscillation). Larger longer-term variations referred to as "regime shifts" have occurred in the past, and will likely occur again. Regime shifts are expressed as fundamental shifts in ecosystem structure and function, such as the 1976 regime shift that resulted in a switch within the Gulf of Alaska from a shrimp-dominated fishery to one dominated by pollock, salmon and halibut. Given the potential for such profound climatic impact, the Seward Line Long-term Observation Program (<http://www.sfos.uaf.edu/sewardline/>) provides critical observations on the current state of the Northern Gulf of Alaska ecosystem, and a basis for understanding the mechanisms responsible for such changes.

The Seward Line represents the most comprehensive long-term multidisciplinary sampling program in the Coastal Gulf of Alaska that allows observation of changes in the oceanography of this region that is critical to Alaska's fisheries, subsistence and tourist economies. Seward Line observations over the past 19 years have fundamentally revised our understanding of the coastal Gulf of Alaska ecosystem and allow us an appreciation of its major properties, and inter-annual variability. To date, we have observed both unusually warm and cold years, which influence the timing of the planktonic communities, but not necessarily their ultimate abundance and biomass. The quantity and composition of both late spring and summer zooplankton, appear to be significantly correlated with PWS hatchery Pink Salmon survival in this region: relationships to herring have yet to be fully explored. Thus, springtime abundance of zooplankton along the Seward Line appears to be an index of generally favorable years for higher trophic levels throughout the Gulf of Alaska. The Seward Line and associated projects are providing an oceanographic foundation to explore broader regional patterns as well as searching for relationships between oceanography and other species of forage and commercial fish.

PROJECT OBJECTIVES:

Time series datasets. AOOS will partner with others to maintain long time series in the Gulf of Alaska, Bering Sea, and Chukchi/Beaufort Seas and to ensure that data from the sampling efforts are accessible to all researchers and the public, as well as marine spatial planning efforts.

AOOS will contribute to a consortium led by UAF SFOS to support sampling along the Seward Line, the longest multidisciplinary time series in Alaska. The line provides a critical long-term data series on oceanographic conditions in the GOA and how the region may be changing with climate impacts. It has been sampled continuously since October 1997, with some measurements going back to late 1970's. Funding supports the cost of two cruises a year (May and September), sample/data processing and analysis.

PROJECT ACTIVITIES:

Support ship transects along the Seward Line twice per year. Sampling activities will:

1. Determine thermohaline, velocity, and nutrient structure of the Seward Line across the Gulf of Alaska shelf, and at stations throughout Prince William Sound.
2. Determine phytoplankton biomass distribution, and estimate primary production.
3. Determine the distribution, abundance and biomass of zooplankton.
4. Support determination of Carbonate Chemistry (i.e. Ocean Acidification)
5. *Provide at-sea experience for graduate students within the UAF system*

PLAN FOR DATA DELIVERY:

- Data from Seward Line made available to AOOS workspace, typically within 6 months and always less than one year from the time of collection.

TIMELINE AND MILESTONES:

- **June 10 2016:** provide status report to include in AOOS semi-annual report to NOAA.
- **September 2016:** Support Seward Line ship transect.
- **December 10, 2016:** provide status report to include in AOOS semi-annual report to NOAA.
- **May 2017:** support Seward Line ship transect
- **June 10 2017:** provide status report to include in AOOS semi-annual report to NOAA.
- Release of QA/QC'd data to AOOS public Ocean Data Explorer (see below)

DELIVERABLES:

- December 2016 Semi-annual report
- June 2017 Semi-annual report
- Participation in one AOOS-sponsored stakeholder-scientist workshop (if available)
- Presentation to AOOS Board (upon request)
- 1 story for AOOS newsletter (upon request)

Standard Seward Line datasets are:

- Underway temperature and salinity (with GPS position & Time Stamp)
- CTD station profiles: temperature, salinity, depth, PAR, fluorescence, light transmission, dissolved oxygen
- Macro-nutrients (Bottle-casts, all depths): Nitrate, Nitrite, Ammonium, Phosphate, Silicate
- Pigments (Bottle-casts, upper 50m): Chlorophyll a, phaeopigments: size-fraction on a subset
- Zooplankton (Calvet – 150 µm): abundance, biomass, composition
- Zooplankton (Multinet – 500 µm): abundance, biomass, composition, vertical distribution.

UNIVERSITY OF ALASKA FAIRBANKS

PROJECT TITLE: Seward Line Monitoring
 PI: Russel Hopcroft
 START DATE: 6/1/16
 END DATE: 5/31/21
 TOTAL BUDGET: \$500,000
 DEPT #: OPDafos 16-653
 BANNER #: 300022795

	FY17 6/1/16	FY18 6/1/17	FY19 6/1/18	FY20 6/1/19	FY21 6/1/20	END 5/31/21
	Year 1	Year 2	Year 3	Year 4	Year 5	Total Project
A. MTDC (total costs subject to F&A)	\$0	\$0	\$0	\$0	\$0	\$0
B. Facilities and Administration (F&A)						
Sponsored Research 50.5%	\$0	\$0	\$0	\$0	\$0	\$0
SUBAWARD COSTS OVER \$25,000						
Subaward #1						
USFWS Tiglax Charter	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$500,000
TOTAL SUBAWARDS EXEMPT FROM F&A	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$500,000
C. Total Costs Exempt from F&A	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$500,000
D. Total Direct Costs (A+C)	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$500,000
E. Total Sponsor Request (B+D)	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$500,000

**AOOS SUBAWARD BUDGET & BUDGET JUSTIFICATION
FOR NOAA GRANT #NA16NOS0120027**

PERSONNEL: N/A

EQUIPMENT: N/A

SUPPLIES/COMMODITIES: N/A

TRAVEL: N/A

CONTRACTS/SERVICES: \$100,000 per year is requested to support biannual ship transects (5 days per transect) along the Seward Line as described in the statement of work. The current (2016) day rate for the USFWS Tiglax is \$10,411 plus an annual inflation increase of 4%.

INDIRECT COSTS (overhead): Facilities and Administrative (F&A) Costs are calculated at 50.5% of the Modified Total Direct Costs (MTDC), as per the proposal guidelines. MTDC includes Total Direct Costs minus tuition, scholarships, subaward amounts over \$25,000, and equipment. A copy of the agreement is available at: <http://www.alaska.edu/cost-analysis/negotiation-agreements/>. Due to the nature of this project, UAF will be treating requested contractual service funds as subaward costs over \$25,000. Thus, no F&A is requested.

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		Total (g)
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	
1. IWSSC Subaward - Pegau - 50	11.012	\$	\$	75,000.00	\$	75,000.00
2.						
3.						
4.						
5. Totals		\$	\$	75,000.00	\$	75,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1)	(2)	(3)	(4)	
	PRSSC Subaward - Pegau - SO				
a. Personnel	\$ 5,548.00	\$	\$	\$	\$ 5,548.00
b. Fringe Benefits	2,464.00				2,464.00
c. Travel	0.00				
d. Equipment	0.00				
e. Supplies	4,080.00				4,080.00
f. Contractual	45,600.00				45,600.00
g. Construction	0.00				
h. Other	0.00				
i. Total Direct Charges (sum of 6a-6h)	57,692.00				\$ 57,692.00
j. Indirect Charges	17,308.00				\$ 17,308.00
k. TOTALS (sum of 6i and 6j)	\$ 75,000.00	\$	\$	\$	\$ 75,000.00
7. Program Income	\$ 0.00	\$	\$	\$	\$

SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program		(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8.	FMSSC Subaward - Pegau - SO	\$	\$	\$	\$
9.					
10.					
11.					
12.	TOTAL (sum of lines 8-11)	\$	\$	\$	\$

SECTION D - FORECASTED CASH NEEDS

	Total for 1st Year	FUTURE FUNDING PERIODS (YEARS)			
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	\$ 75,000.00	\$ 20,000.00	\$ 20,000.00	\$ 25,000.00	\$ 10,000.00
14. Non-Federal	\$				
15. TOTAL (sum of lines 13 and 14)	\$ 75,000.00	\$ 20,000.00	\$ 20,000.00	\$ 25,000.00	\$ 10,000.00

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. FMSSC Subaward - Pegau - SO	\$	\$	\$	\$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	\$	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges:	57692	22. Indirect Charges:	17308
23. Remarks:			

AOOS SUBAWARD BUDGET & BUDGET JUSTIFICATION FOR NOAA GRANT # NA16NIS0120027

These can be provided on your institution's regular documents or you can use the AOOS budget template (attached). In any event, the following must be itemized in a table, with narrative justification and detail provided.

PROJECT NAME: Prince William Sound Sentinel Observations

PI NAME & CONTACT INFO:

W. Scott Pegau
PWSSC
Box 705
Cordova, AK 99574
ph907-424-5800 x222
wspgau@pwssc.org

PERIOD OF PERFORMANCE: June 1, 2016 – May 31, 2017

BUDGETS:

Personnel (salary and fringe broken out)

Salaries

Title/Name	Annual rate	Time requested	Personnel cost
Dr. M. A. Bishop	\$91,872	0.15 mo	\$1,148
Technician	\$48,000	1.1 mo	\$4,400
Total			\$5,548

Dr. Mary Anne Bishop will dedicate 0.15 mo in FY16. For this project Bishop will work on project design. She will also supervise overall the acoustic array network maintenance. The technician will prepare all equipment, coordinate field operations including acoustic receiver array maintenance. They will also manage the acoustic tag metadata and database.

Fringe Benefits

Title/Name	Annual rate	Fringe rate	Fringe cost
Dr. M. A. Bishop	\$91,872	0.441	\$506
Technician	\$48,000	0.445	\$1,958
Total			\$2,464

Equipment (anything over \$5k)

There is no equipment associated with this project.

Supplies/commodities (less than \$5k)

Miscellaneous supplies necessary to support array maintenance (lines, hardball floats acoustic release pins, batteries for acoustic releases & acoustic receivers)	\$2,630
Vemco VR2W acoustic receiver (1 @ \$1450)	<u>\$1,450</u>
Total	\$4,080

Travel (airfare, per diem (including hotel), mileage, other must be broken out)

There is no travel associated with this project.

Contracts/services (services or subawards)

Vessel charter 6 d @ \$3,000/d	\$18,000
Welding – mooring chains	\$400
Communication	\$600
<i>Internet 1.35 mo @ \$100/mo = 135</i>	
<i>Local & long distance Phone 1.35 mo @ 74 = \$100</i>	
<i>Postage/Shipping = \$365</i>	
Conductivity sensor maintenance	\$1,600
Snotel Station maintenance	<u>\$25,000</u>
Total	\$45,600

Indirect (overhead):

<u>PWSSC indirect is 30% of the total direct cost</u>	Total	\$17,308
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Total costs	\$75,000
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AOOS SUBAWARD BUDGET & BUDGET JUSTIFICATION FOR NOAA GRANT # NA16NIS0120027

These can be provided on your institution's regular documents or you can use the AOOS budget template (attached). In any event, the following must be itemized in a table, with narrative justification and detail provided.

PROJECT NAME: Prince William Sound Sentinel Observations

PI NAME & CONTACT INFO:

W. Scott Pegau
PWSSC
Box 705
Cordova, AK 99574
ph907-424-5800 x222
wspgau@pwssc.org

PERIOD OF PERFORMANCE: June 1, 2016 – May 31, 2017

BUDGETS:

Personnel (salary and fringe broken out)

Salaries

Title/Name	Annual rate	Time requested	Personnel cost
Dr. M. A. Bishop	\$91,872	0.15 mo	\$1,148
Technician	\$48,000	1.1 mo	\$4,400
Total			\$5,548

Dr. Mary Anne Bishop will dedicate 0.15 mo in FY16. For this project Bishop will work on project design. She will also supervise overall the acoustic array network maintenance. The technician will prepare all equipment, coordinate field operations including acoustic receiver array maintenance. They will also manage the acoustic tag metadata and database.

Fringe Benefits

Title/Name	Annual rate	Fringe rate	Fringe cost
Dr. M. A. Bishop	\$91,872	0.441	\$506
Technician	\$48,000	0.445	\$1,958
Total			\$2,464

Equipment (anything over \$5k)

There is no equipment associated with this project.

Supplies/commodities (less than \$5k)

Miscellaneous supplies necessary to support array maintenance (lines, hardball floats acoustic release pins, batteries for acoustic releases & acoustic receivers)	\$2,630
Vemco VR2W acoustic receiver (1 @ \$1450)	<u>\$1,450</u>
Total	\$4,080

Travel (airfare, per diem (including hotel), mileage, other must be broken out)

There is no travel associated with this project.

Contracts/services (services or subawards)

Vessel charter 6 d @ \$3,000/d	\$18,000
Welding – mooring chains	\$400
Communication	\$600
<i>Internet 1.35 mo @ \$100/mo = 135</i>	
<i>Local & long distance Phone 1.35 mo @ 74 = \$100</i>	
<i>Postage/Shipping = \$365</i>	
Conductivity sensor maintenance	\$1,600
Snotel Station maintenance	<u>\$25,000</u>
Total	\$45,600

Indirect (overhead):

<u>PWSSC indirect is 30% of the total direct cost</u>	Total	\$17,308
---	--------------	-----------------

Total costs	\$75,000
--------------------	-----------------

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		Total (g)
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	
1. MODAK Subaward - Page - AIS	11.012	\$	\$	62,154.40	\$	62,154.40
2.						
3.						
4.						
5. Totals		\$	\$	62,154.40	\$	62,154.40

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1) FOUAK Subaward - Page - AIS	(2)	(3)	(4)	
a. Personnel	\$ 21,013.00	\$	\$	\$	21,013.00
b. Fringe Benefits	1,891.00				1,891.00
c. Travel	14,100.00				14,100.00
d. Equipment	19,500.00				19,500.00
e. Supplies	0.00				
f. Contractual	0.00				
g. Construction	0.00				
h. Other	0.00				
i. Total Direct Charges (sum of 6a-6h)	56,504.00				56,504.00
j. Indirect Charges	5,650.40				5,650.40
k. TOTALS (sum of 6i and 6j)	\$ 62,154.40	\$	\$	\$	62,154.40
7. Program Income	\$ 0.00	\$	\$	\$	

SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program		(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8.	MOJAK Subaward - Page - AIS	\$	\$	\$	\$
9.					
10.					
11.					
12.	TOTAL (sum of lines 8-11)	\$	\$	\$	\$

SECTION D - FORECASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	\$ 62,154.40	\$ 20,000.00	\$ 20,000.00	\$ 10,000.00	\$ 12,154.40
14. Non-Federal	\$				
15. TOTAL (sum of lines 13 and 14)	\$ 62,154.40	\$ 20,000.00	\$ 20,000.00	\$ 10,000.00	\$ 12,154.40

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. MOJAK Subaward - Page - AIS	\$	\$	\$	\$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	\$	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges:	56504	22. Indirect Charges:	5650.40
23. Remarks:			

AOOS SUBAWARD STATEMENT OF WORK (SOW) MARINE EXCHANGE AIS/WX FY2016

PROJECT NAME: AIS/WX: Transmitting Environmental Information Over AIS Stations

PI NAME & CONTACT INFO: Bill Benning, Marine Exchange of Alaska
billbenning@mxak.org (907) 463-3937

PERIOD OF PERFORMANCE: 1 July 2016 – 30 June 2017

PROJECT GOAL/PURPOSE: This project will enhance maritime safety and environmental protection in Alaska through providing real time, environmental information to vessels over the AIS (Automatic Identification System) and other emerging technological tools used by mariners (apps, web sites, etc.) The wide variances in environmental conditions presents a threat to mariners that can be averted by having access to real time weather information. This project builds on and complements the tools and efforts undertaken by the National Weather Service.

This project comports to the AOOS missions and goals that state in part that AOOS strives to;

1. Increase access to existing coastal and ocean data;
2. Package information and data in useful ways to meet the needs of stakeholders; and
3. Increase observing and forecasting capacity in all regions of the state

AOOS programmatic focus areas include “safe marine operations”. Accurate, real time weather information provided to mariners plays an important role in aiding safe maritime operations.

BACKGROUND: An extensive AIS network has been established in Alaska with over 120 AIS receiving stations in place throughout the State. AIS technology was designed to track vessels as well as communicate safety and environmental information to mariners. This project applies AIS technology towards attaining the following AOOS goal: “Support navigation safety, weather, climate, and marine forecasting, marine commerce” The Marine Exchange has worked with the U.S. Coast Guard in a Cooperative Research and Development Agreement (CRADA) to develop the Arctic Next Generation Navigational Safety Information System that utilizes AIS transmitters to send environmental and safety information to mariners to aid safe and environmentally sound maritime operations.

With AOOS funding, the Marine Exchange has tested and developed the technology to obtain and transmit environmental information to mariners via AIS and the internet accessible by smart phones, computers. All information is also provided to the National Weather Service that uses the information to aid forecasting and the dissemination of real time weather information via their VHF broadcast and web notification system.

PROJECT OBJECTIVES: Provide additional weather stations that are co-located with AIS stations and/or installed in other areas where environmental data is desired by mariners and provides data into the AIS communications network. Additionally, these additional environmental stations will provide a means of transmitting this information via the cell network using apps and web sites.

PROJECT ACTIVITIES: Based on input received from pilots, recreational vessel operators, fishing vessel operators, ports and other mariners, install weather/environmental sensors tied into the AIS network at the following locations:

- Point Gardner (Admiralty Island): Weather sensor with data dissemination incorporated into an AIS transmitter station for this region of Southeast Alaska
- Nome: Weather sensor at Port breakwater with data dissemination incorporated into an AIS transmitter station for this region.
- Ketchikan: Weather sensor in port area and AIS transmitter station
- Akutan: Weather sensor in port area with data dissemination incorporated into an AIS transmitter station for this region.
- Fire Island (Port of Anchorage): Weather sensor with data dissemination incorporated into an AIS transmitter station for this region.

PLAN FOR DATA DELIVERY: As in the past, all data received by the weather sensors is directly linked and provided to the National Weather Service and to the AOOS data contractor (Axiom) for inclusion in the public AOOS Ocean Data Explorer. Additionally, the data is posted on the Marine Exchange web site and accessible by cell phones.

MILESTONES:

- Submission of semi-annual report December 10, 2016
- Submission of semi-annual report June 10, 2017
- Delivery of weather data real time to AOOS data contractor (Axiom) for inclusion in public AOOS Ocean Data Explorer.
- Participation in one AOOS-sponsored stakeholder-scientist workshop (if available)
- Presentation to AOOS Board (upon request)
- 1 story for AOOS newsletter (upon request)

The installation schedule for these sites is subject to change due to several factors, including but not limited to obtaining required permits, receipt of ordered materials, weather, hosts' availability and scheduling with other Marine Exchange projects that allows for amortization of travel, personnel and other costs.

Fabrication and installation of the units will be performed by MXAK field/shop personnel while design and software engineering will be done by the P.I., Bill Benning, and Ed Mayer.

The projects in Southeast Alaska will require the use of the Marine Exchange's boat, the CLEAT and will incur fuel costs.

The projected installation schedule is as follows;

- Point Gardiner WX sensor install- August 2016
- Nome: WX sensor install – October 2016
- Ketchikan: WX sensor install – November 2016
- Akutan: WX sensor install – June 2017
- Anchorage: WX sensor install – June 2017

The projected costs for completing the above listed work are summarized below. The operating costs which internet fees for cell modems, servicing, and repair will all be paid with Marine Exchange funds.

Personnel Costs: Salary including Taxes: \$21,013

This includes salaries for the P.I., the data base programmer/technician, and Marine Exchange field personnel who will design, build the units, and install the equipment.

Personnel Costs: Fringe 401k: \$1891.00

Travel Costs: \$14,100

Travel costs include airline tickets, lodging and per diem costs for traveling to the site locations that will entail 5 trips.

Equipment Costs: \$19,500

Equipment required to support the weather station sites includes electronics, renewable power systems (batteries and solar power), weather sensors, AIS transmitters and cell modems.

Overhead: \$5650.40

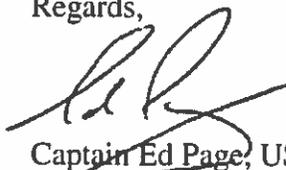
This includes the admin support, office and shop space, boat maintenance, and tool costs incurred in supporting this project. 10% rate

Total Budget: \$62154.40

The budget is attached as enclosure 1.

For additional information regarding this project contact the lead technician, Bill Benning of the Marine Exchange of Alaska at billbenning@mxak.org or phone (907) 463-3937.

Regards,



Captain Ed Page, USCG (Ret)
Executive Director, Marine Exchange of Alaska

Marine Exchange - AOOS AIS/WX Project FY 2017 BUDGET

1. Personnel

Bill Benning - Project Manager/Tech		\$3,457.00
Ed Mayer - Database Programmer/Tech		\$3,356.00
Field Staff - Mauldin, Hatch, Hinderberger		\$14,200.00
Total Personnel		\$21,013.00

2. Benefits

Bill Benning - Project Manager/Tech		\$311.00
Ed Mayer - Database Programmer/Tech		\$302.00
Field Staff -Mauldin, Hatch, Hinderberger		\$1,278.00
Total Fringe Benefits		\$1,891.00

3. Travel/Per Diem/Shipping/Fuel

Estimated Vessel Fuel Costs		\$1,500.00
Estimated Airfare		\$6,000.00
Estimated Per Diem (\$60 per person/day)	35 person days	\$2,100.00
Estimated Shipping		\$1,500.00
Other Travel Costs (Lodging)		\$3,000.00
Total Travel		\$14,100.00

3. Equipment

WX sensors		\$7,500.00
Electronics, power units, enclosures, hardware		\$12,000.00
Total Equipment		\$19,500.00

Sub Total **\$56,504.00**

4. Overhead

10% Funding Total		\$5,650.40
Total Overhead		\$5,650.40

Project Budget **\$62,154.40**

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		Total (g)
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	
1. UAF Subaward - Reingartner - BFR	11.012	\$	\$	\$ 156,000.00	\$	\$ 156,000.00
2.						
3.						
4.						
5. Totals		\$	\$	\$ 156,000.00	\$	\$ 156,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1)	(2)	(3)	(4)	
	DAF Subaward - Reingartner - HFR				
a. Personnel	\$ 41,735.00	\$	\$	\$	41,735.00
b. Fringe Benefits	16,285.00				16,285.00
c. Travel	17,156.00				17,156.00
d. Equipment	0.00				
e. Supplies	7,878.00				7,878.00
f. Contractual	20,600.00				20,600.00
g. Construction	0.00				
h. Other	0.00				
i. Total Direct Charges (sum of 6a-6h)	103,654.00				\$ 103,654.00
j. Indirect Charges	52,346.00				\$ 52,346.00
k. TOTALS (sum of 6i and 6j)	\$ 156,000.00	\$	\$	\$	\$ 156,000.00
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.	UAF Subaward - Weingartner - HFR	\$	\$					\$	
9.									
10.									
11.									
12.	TOTAL (sum of lines 8-11)	\$	\$					\$	

SECTION D - FORECASTED CASH NEEDS

		1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
13.	Federal	\$ 156,000.00	\$ 50,000.00	\$ 50,000.00	\$ 50,000.00	\$ 33,000.00	\$ 33,000.00	\$ 23,000.00	\$ 23,000.00
14.	Non-Federal	\$							
15.	TOTAL (sum of lines 13 and 14)	\$ 156,000.00	\$ 50,000.00	\$ 50,000.00	\$ 50,000.00	\$ 33,000.00	\$ 33,000.00	\$ 23,000.00	\$ 23,000.00

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.	UAF Subaward - Weingartner - HFR	\$	\$	\$	\$	\$	\$	\$	\$
17.									
18.									
19.									
20.	TOTAL (sum of lines 16 - 19)	\$	\$	\$	\$	\$	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION

21.	Direct Charges: 103655	22. Indirect Charges: 52346
23.	Remarks:	

HFR Operations and Maintenance

Principal Investigator
Thomas Weingartner
School of Fisheries and Ocean Sciences
University of Alaska Fairbanks
P.O. Box 757220
Fairbanks, AK 99775-7220

Phone: 907-474-7993

FAX: 907-474-7204

Email: tjweingartner@alaska.edu

Project Status: New
Project Duration: 2016 - 2017
Proposed Start Date: June 1, 2016

Statement of Work

This Statement of Work is in response to the Alaska Ocean Observing System (AOOS) NOAA award #NA16NOS0120027 wherein \$156,000 is designated to fund operation and maintenance of High Frequency Radars (HFRs).

HF Radar Operation & Maintenance in the Arctic

1. Project Goal/Purpose

The goal of this statement of work is to assist in funding one year of operation and maintenance of four long-range high-frequency radar (HFR) sites on the northwest coast of Alaska located in Icy Cape, Wainwright, Point Barrow, and Cape Simpson that are operational during the open water season, July through mid-November (Figure 1). Site run time and longevity is dependent upon additional partner funding. Data collected will be available for real-time for operational applications including spill response, weather forecasting, search and rescue, etc.

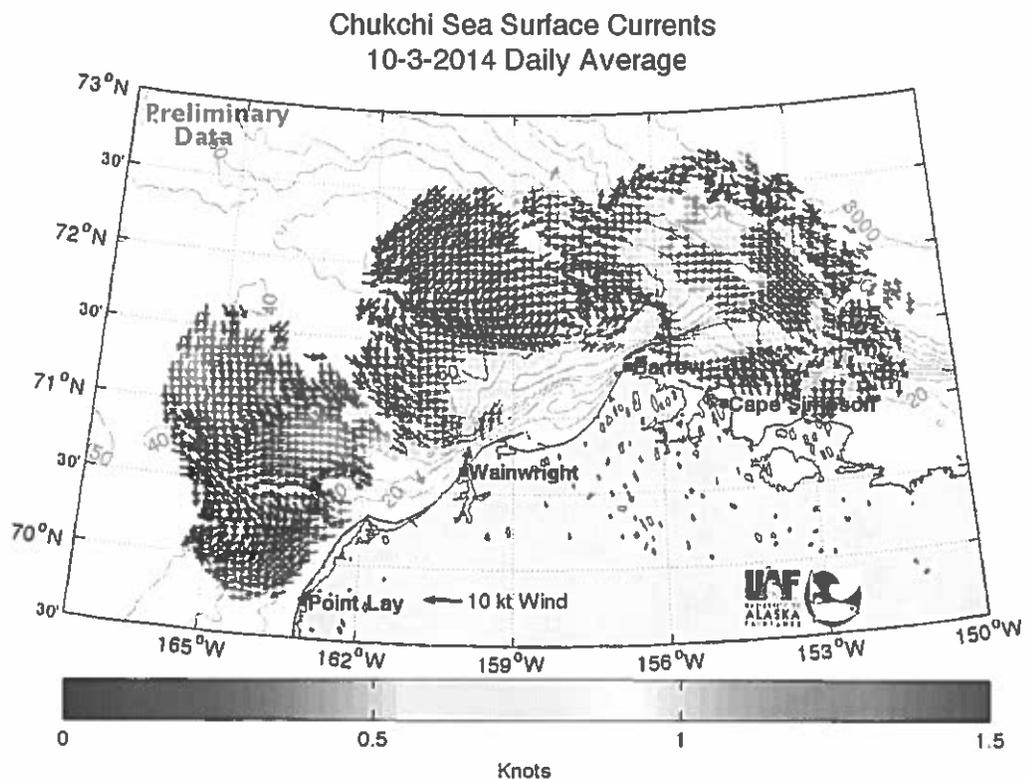


Figure 1. Daily mean surface currents obtained from HFR field sites in Point Lay, Wainwright, Point Barrow, and Cape Simpson, Alaska on October 3, 2014.

2. Background

HFR measures surface currents by processing the Doppler spectrum from transmitted radar waves backscattered by ocean waves [Barrick *et al.*, 1985]. At 30-minute intervals, each shore-based 5 MHz HFR collects one-dimensional current vectors up to 200 km in range, measuring the velocity of the current moving toward or away from the field site in a radial pattern. All radial measurements acquired in a three-hour window are then averaged to produce an hourly radial current file, which when combined with a second radial current file produces two-dimensional surface current vectors.

HFR sites have been installed and maintained on the northwest Arctic coast annually during ice-free seasons since 2009, recording real-time hourly surface currents. Vectors are calculated at 6 km spatial resolution and represent the upper 1 - 2 m of the water column. The coverage area varies with sea ice cover, calm sea conditions, and/or ionospheric interference.

3. Project Objectives

Long-range CODAR HFR field sites will be installed and maintained on the northwest Alaska coast at Icy Cape, Wainwright, Point Barrow, and Cape Simpson from June/July through November 2016. Data will be collected and disseminated in real-time.

4. Project Activities

Field sites will be installed by UAF technicians at the locations shown in Table 1. Dependent on snow melt, initial installation of the Wainwright field site will take place in June 2016, while the Icy Cape, Point Barrow, and Cape Simpson installations will follow in July 2016. The Wainwright field site is grid powered and includes two transmit antennas and a receive antenna, which are connected via cables to an electronics chassis. The Icy Cape, Point Barrow, and Cape Simpson sites are similar although they have only one transmit and a receive antenna. Additionally they are remotely powered with 4 small wind turbines, a solar array on the south face, and a battery bank. Data from all sites are transmitted hourly via HughesNet high-speed satellite internet to the University of Alaska Fairbanks.

Table 1. HFR Site Details

Village Name	Site Code	Location	Center Frequency
Point Barrow	PBRW	71.3784 N, 156.4801 W	4.55 MHz
Wainwright	WAIN	70.6434 N, 160.0271 W	4.80 MHz
Icy Cape	ICYC	70.2850 N, 161.9289 W	4.66 MHz
Cape Simpson	SIMP	71.0586 N, 154.75056 W	4.66 MHz

5. Timeline and Milestones

Time	Proposed Activity
June 2016	Install long-range CODAR HFR field sites in Wainwright, Point Barrow, and Icy Cape
July 2016	Install long-range CODAR HFR field site at Cape Simpson, Alaska
July – November 2016	Maintain all HFR field sites and deliver data in real-time
November - December 2016	Demobilize HFR field sites for Arctic winter
December 2016	Semi-Annual Report
June 2017	Semi-Annual Report

6. Deliverables

- All collected data will be made available in real-time to the Alaska Ocean Observing System and Axiom, as well as to the IOOS HFR data server and archived at the University of Alaska Fairbanks in the standard CODAR software formats for spectra, diagnostic, radial, and totals files. Data from all four field sites included in this statement of work have already been incorporated into the IOOS HFR server and AOOS Ocean Data Explorer in the past.
- AOOS and IOOS will be acknowledged in all publications and presentations utilizing the HFR data.
- Pictures from the field sites will be provided to AOOS and/or IOOS upon request for web sites, publications, and outreach presentations.
- A semi-annual report will be submitted to AOOS December 2016.
- A semi-annual report will be submitted to AOOS June 2017.
- If available, we will participate in an AOOS-sponsored stakeholder scientist workshop.
- Presentations will be made to the AOOS board upon request
- A story for the AOOS newsletter will be provided upon request

UNIVERSITY OF ALASKA FAIRBANKS

PROJECT TITLE: HFR Operations and Maintenance
 PI: Tom Weingartner
 START DATE: 6/1/2016
 END DATE: 5/31/2017
 TOTAL BUDGET: \$156,000
 DEPT #: OPDsfos 16-656
 BANNER #: S22810

FY17
6/1/2016 END
5/31/2017

SALARIES AND WAGES							Year 1	Total	
							Hours	Project	
		Hourly	Leave Rate	Yearly					
Senior Personnel		Wage		Increase					
Total Number of Hours	Employee Name								
87.00	Tom Weingartner	F9 - Faculty (UNAC)	\$66.62	13.7%	1.02	87.0	\$6,722	\$6,722	
Total Senior Personnel							\$6,722	\$6,722	
Other Personnel									
Total Number of Hours	Employee Name								
348.00	Rachel Potter	XR - Exempt Staff	\$40.99	20.9%	1.025	348.0	\$17,677	\$17,677	
348.00	Hank Statscewich	XR - Exempt Staff	\$40.20	20.9%	1.025	348.0	\$17,336	\$17,336	
Total Other Personnel							\$35,013	\$35,013	
TOTAL SALARIES AND WAGES							\$41,735	\$41,735	
FRINGE BENEFITS									
Senior Personnel	Tom Weingartner	F9 - Faculty (UNAC)		28.7%			\$1,929	\$1,929	
Total Senior Personnel							\$1,929	\$1,929	
Other Personnel									
	Rachel Potter	XR - Exempt Staff		41.0%			\$7,248	\$7,248	
	Hank Statscewich	XR - Exempt Staff		41.0%			\$7,108	\$7,108	
Total Other Personnel							\$14,355	\$14,355	
TOTAL FRINGE BENEFITS							\$16,285	\$16,285	
TOTAL SALARIES AND BENEFITS							\$58,020	\$58,020	
TRAVEL		Number of Trips							
1. Domestic Travel		Description	Year 1	Purpose	Travelers	Item Cost	Yearly Increase		
Airfare	RT Fairbanks, AK/Barrow,		2	Fieldwork	2	550	1.1	\$2,420	
Meals & Incidental Expenses	AK		10		2	96	1	\$1,920	
Airfare	RT Fairbanks,		2		2	1000	1.1	\$4,400	
Lodging	AK/Wainwright, AK		2	Fieldwork	2	175	1	\$700	
Meals & Incidental Expenses			2		2	83	1	\$332	
Ground Transportation			2		2	100	1.1	\$440	
Airfare	RT Fairbanks, AK/Point Lay,		2		2	1200	1.1	\$5,280	
Lodging	AK		2	Fieldwork	2	255	1	\$1,020	
Meals & Incidental Expenses			2		2	51	1	\$204	
Ground Transportation			2		2	100	1.1	\$440	
TOTAL TRAVEL							\$17,156	\$17,156	
CONTRACTUAL SERVICES		Description							
Other Contractual Service (include description)		UIC Science						\$10,100	
Other Contractual Service (include description)		HughesNet Satellite Communications						\$1,000	
3351 - Freight and Parcel Post		Air Freight						\$1,500	
3017 - Honoraria		Honoraria						\$1,000	
Other Contractual Service (include description)		Codar Ocean Sensors						\$5,000	
3112 - Rental, short-term (Auto, Aircraft, and Boat)		Vehicle/Space Rentals						\$1,000	
Other Contractual Service (include description)		Permit Fees						\$500	
3222 - Software License/Maintenance Fees		Software Licenses/Fees						\$500	
TOTAL CONTRACTUAL SERVICES							\$20,600	\$20,600	
COMMODITIES		Description							
4015 - Supplies (Program/Project Specific)		cables, conduit, fuses and housings, UPS component replacements/upgrades, guyline, replacement tools, and Arctic field safety gear, etc						\$7,879	
TOTAL COMMODITIES							\$7,879	\$7,879	
A. MTDC (total costs subject to F&A)							\$103,655	\$103,655	
B. Facilities and Administration (F&A)							Sponsored Research 50.5%	\$52,346	\$52,346
C. Total Costs Exempt from F&A							\$0	\$0	
D. Total Direct Costs (A+C)							\$103,655	\$103,655	
E. Total Sponsor Request (B+D)							\$156,000	\$156,000	

Project Name: High Frequency Radar Operations and Maintenance

PI Name: Thomas Weingartner, UAF

Period of Performance: June 1, 2016 – May 31, 2017

UAF BUDGET JUSTIFICATION

Salaries:

87 hours (0.50 mo.) are requested for the PI Weingartner (at \$66.62/hour) to supervise the program and will have overall responsibility for the project. 348 hours (2.0 mos.) for Potter (at \$40.99/hour) and 348 hours (2.0 mos.) for Statscewich (at \$40.20/hour) for HFR field operations and maintenance. All salaries are at the employees' current rate of pay. A leave reserve of 13.7% is included for faculty salaries and 20.9% for professionals. Salaries are listed at the FY16 rate and include a 2.0% inflation increase for faculty and 2.5% for professionals each year.

TOTAL PERSONNEL/SALARIES REQUEST: \$41,735

Benefits:

Staff benefits are applied according to UAF's Fixed FY16 fringe benefit rates. Rates are 28.7% for faculty salaries and 41% for professionals. Anticipatory increases have been included for Year 1 of the proposal. A copy of the rate agreement is available at <http://www.alaska.edu/cost-analysis/negotiation-agreements/>.

TOTAL PERSONNELFRINGE REQUEST: \$16,285

Travel:

Domestic: 2 trips are requested for 2 individuals to travel from Fairbanks to Barrow (at \$550/trip for airfare), Fairbanks to Wainwright (at \$1,000/trip for airfare), and Fairbanks to Point Lay (at \$1,200/trip for airfare) to conduct fieldwork. Per Diem (meals/incidentals) for Barrow is \$96/day. UIC Science will provide lodging in Barrow. Per Diem (meals/lodging/incidentals) for Wainwright is \$258/day and for Point Lay is \$306/day. \$100/trip to Wainwright and Point Lay is included for ground transportation.

HFR Field Operations – 2 RT Fairbanks to Barrow	\$4,340
HFR Field Operations – 2 RT Fairbanks to Wainwright with lodging	\$5,872
HFR Field Operations – 2 RT Fairbanks to Pont Lay with lodging	\$6,944

TOTAL TRAVEL REQUEST: \$17,156

BUDGET INFORMATION - Non-Construction Programs

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. UAF Subaward - Danielson- Chukchi Mooring	11.012	\$	\$	\$ 100,000.00	\$	\$ 100,000.00
2.						
3.						
4.						
5. Totals		\$	\$	\$ 100,000.00	\$	\$ 100,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1)	(2)	(3)	(4)	
	UAF Subaward - Danielson - Chukchi Mooring				
a. Personnel	\$ 0.00	\$	\$	\$	\$
b. Fringe Benefits	0.00				
c. Travel	0.00				
d. Equipment	96,990.00				96,990.00
e. Supplies	500.00				500.00
f. Contractual	1,500.00				1,500.00
g. Construction	0.00				
h. Other	0.00				
i. Total Direct Charges (sum of 6a-6h)	98,990.00				98,990.00
j. Indirect Charges	1,010.00				1,010.00
k. TOTALS (sum of 6i and 6j)	\$ 100,000.00	\$	\$	\$	\$ 100,000.00
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.	DAF Subaward - Danielson- Chukchi Mooring	\$	\$	\$	\$
9.					
10.					
11.					
12.	TOTAL (sum of lines 8-11)	\$	\$	\$	\$

SECTION D - FORECASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	\$ 100,000.00	\$ 25,000.00	\$ 25,000.00	\$ 25,000.00	\$ 25,000.00
14. Non-Federal	\$				
15. TOTAL (sum of lines 13 and 14)	\$ 100,000.00	\$ 25,000.00	\$ 25,000.00	\$ 25,000.00	\$ 25,000.00

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. DAF Subaward - Danielson- Chukchi Mooring	\$	\$	\$	\$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	\$	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges:	96990	22. Indirect Charges:	1010
23. Remarks:			

AOOS SUBAWARD STATEMENT OF WORK (SOW) FOR NOAA GRANT #NA16NOS0120027

PROJECT NAME: Chukchi Sea Ecosystem Mooring

PI NAME & CONTACT INFO:

Dr. Seth Danielson
School of Fisheries and Ocean Sciences
Institute of Marine Science
University of Alaska Fairbanks
905 N. Koyukuk Dr.
Rm. 112 O'Neill Bldg.
P.O. Box 757220
Fairbanks, AK 99775-7220

PERIOD OF PERFORMANCE:

1 June 2016 to 31 May 2017

PROJECT GOAL/PURPOSE:

The purpose of this project is to continue and complete the incremental build-out of the Chukchi Sea Ecosystem Mooring, a multi-instrument physical/biological/chemical/geological oceanographic mooring that will be deployed in the NE Chukchi Sea (Figure 1). When fully outfitted, the mooring will record physical, nutrient and carbonate chemistry, particulate, phytoplankton, zooplankton, and fisheries data sets, thereby providing an unprecedented view into the mechanistic workings of the Chukchi shelf ecosystem. This highly instrumented mooring's payload is unique for the Chukchi and Alaskan Beaufort seas, and rare for any continental shelf.

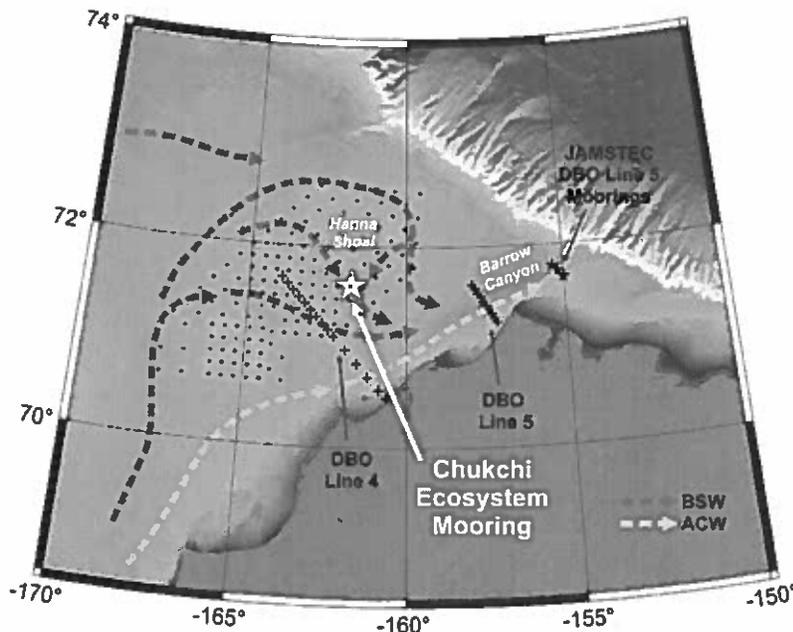


Figure 1. Map of the NE Chukchi Sea, with color-shaded bathymetry, place names, idealized depictions of the flow field (arrows) and sampling locations of the Distributed Biological Observatory (DBO; pluses); the Chukchi Sea Environmental Studies Program (CESP; dots and pluses on DBO Line 4), and DBO Line 5 moorings maintained by the Japanese Agency for Marine-Earth Science and Technology (JAMSTEC, black stars). BSW = Bering Shelf Water; ACW = Alaska Coastal Water.

The proposed project will aid management of subsistence resources and potential commercial fisheries by providing data valuable to an ecosystem-based approach to resource management. We will be able to estimate the particulate fluxes to the seafloor that directly supply the benthic community with organic matter and, in turn, feed the walrus that forage here.

The mooring will collect acoustic data to determine the presence of Arctic Cod (a subsistence resource and marine mammal prey) and euphausiids (Arctic Cod and bowhead whale prey).

Arctic regions are projected to strongly reflect the impacts of an altered climate. The selected site is well situated to monitor the state of ocean acidification, changes to the shelf's nutrient and carbon cycles, and how changing wind, wave, and ice affect the regional oceanography. The proposed mooring will provide biogeochemical model validation data and improve our understanding of the marine carbon pump and shelf-basin exchanges. The project will complement water column, benthic, and passive acoustics sampling carried out by other programs, including serving as a year-round anchor for the Distributed Biological Observatory (DBO), an initiative to collect physical, chemical, and biological observations in the Western Arctic and Subarctic.

This statement of work is a continuation of the 2014-2015 Chukchi Ecosystem Mooring project. The mooring was deployed for the first time in September 2014.

BACKGROUND:

We have formed a multi-institutional consortium that supports the Chukchi Sea Ecosystem Mooring. Our active consortium members currently consist of UAF, AOOS, NPRB, UW and U. Laval. With this assemblage of partners, we find within reach a rare opportunity to achieve an advanced ecosystem observing system that represents nearly 2 million dollars in total effort but with no one partner carrying a disproportionate share of the total.

Instrumentation for the mooring comes from in-house holdings at UAF and new equipment purchases funded by AOOS.

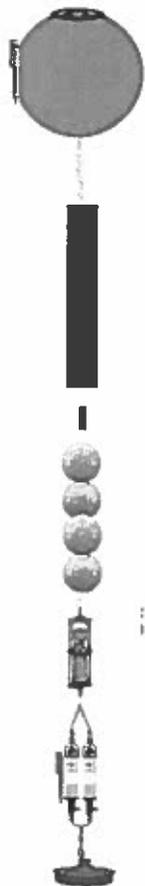
The sampling equipment and measurement parameters of the fully outfitted mooring are shown in Table 1, along with the depth level of each measurement, the vertical resolution of the profiling instruments, and the temporal resolution of each.

Table 1. Instrumentation, measured and derived parameters, and spatial/temporal resolutions of the (eventually) fully outfitted ecosystem mooring.

Manufacturer & Instrument	Measured & Derived Parameters	Sample Depths (Resolution)	Temporal Resolution
TRDI ADCP	Current velocity & 600 KHz signal strength	3-30 m (1 m bins)	1 hr
TRDI ADCP	Significant Wave Height, Period, & Direction	Surface	3 hr
TRDI ADCP	Temperature & Pressure	31 m	1 hr
ASL AZFP	38, 125, 200 & 460 KHz Acoustic Backscatter	0.5-30 m (4 cm bins)	15 s
ASL AZFP	Ice Draft	Reflection surface	1 hr
Seabird SeaCat plus ancillary sensors	Temperature, Conductivity, Salinity, Pressure, Dissolved Oxygen, Colored Dissolved Organic Matter, Optical Backscatter, PAR, Fluorescence	35 m depth	1 hr
Satlantic SUNA	Nitrate	35 m	1 hr
Contros HydroC	Partial Pressure of CO ₂	35 m	1 hr
Satlantic SeaFET	pH	35 m	1 hr
Sequoia LISST	Particle size spectra & concentrations	38 m	1 hr
Seabird MicroCat	Temperature, Conductivity, Salinity & Pressure	48 m	15 min

The Chukchi Sea Ecosystem Mooring will add considerable value to other ongoing Western Arctic science programs, and the mooring, in turn, will benefit from these other efforts. In particular, the NOPP-funded AMBON program, the industry-funded CESP (www.chukchiscience.com/) and the NSF/AON-funded DBO (www.arctic.noaa.gov/dbo/) programs have conducted or will conduct water column and benthic sampling that are critical to a comprehensive understanding of the continuously recorded mooring measurements, and vice-versa. As a DBO-endorsed monitoring mooring, we would participate in DBO-related synthetic analyses. Dr. J. Grebmeier indicates that deployment of a mooring at our particular location will be a critical “anchor” for DBO Line 4, which is located on the shelf near the head of Barrow Canyon (Figure 1). DBO Line 4 coincides with stations that make up the primary cross-shelf transect of the CESP program. Passive acoustic recordings of walrus and whales show a concentration of vocalizations in the vicinity of our mooring site (Fig 2.). The net tows, hydrography, and benthic sampling conducted by our DBO and CESP partners will place our point measurements within a fuller spatial context, help us interpret the acoustic signals, and provide vertically-resolved water column observations.

Our mooring will complement NOAA mooring at DBO Line 1 in the Bering Sea, JAMSTEC moorings deployed at DBO Line 3 (near Bering Strait) and Line 5 (near the mouth of Barrow Canyon at the Canada Basin shelfbreak, see Figure 1), thereby forming a network of moored time series that span broad latitudinal and ecosystem gradients. Moorings equipped with a similar sensor suite and deployed as part of the Beaufort Regional Environmental Assessment-ArcticNet program in Canadian waters (<http://www.arcticnet.ulaval.ca/>) will place us in a position to extend the insights gained with our mooring and make quantitative comparisons to the eastern Beaufort Sea shelf. The data collected by the proposed mooring will also complement the two-decade moored velocity, temperature, and salinity time series in Bering Strait, which is located ~ 700 km south of the selected deployment site and monitors the properties of water entering the Chukchi from the North Pacific.



PROJECT OBJECTIVES:

The objectives of this project are to build, deploy, and recover a mooring that will monitor a suite of ecosystem parameters spanning multiple disciplines and trophic levels in the northeast Chukchi Sea.

Figure 2. Schematic diagrams of the fully outfitted Chukchi Ecosystem Moorings. Because of the addition of additional large equipment pieces (passive acoustic recorder and sediment trap) the deployment beginning in 2015 will be of two moorings located within about 500m of each other. The schematic on the left shows the mooring that will measure currents, temperature, salinity, pressure, and record sounds with passive acoustic recordings. The schematic on the right shows the mooring that houses the AZFP, sediment trap, temperature, salinity, pressure and all optical measurements (O₂, CDOM, Chlorophyll fluorescence and OBS).



PROJECT ACTIVITIES:

To achieve multi-year uninterrupted measurements, we require two sets of fully outfitted moorings to enable an efficient cycle of data downloads, calibrations, instrument/data evaluations and maintenance, and battery replacements. The first mooring was deployed in September 2014 from the R/V Norseman II. The second mooring was deployed in August 2015 and the first mooring recovered. The third year of mooring deployments and second year of recoveries will take place in August 2016 from the USCGC Healy.

PLAN FOR DATA DELIVERY:

Raw data will be available for archive immediately following the cruise. Processed data will be available as soon as post-deployment calibrations and other processing activities are complete. We strive to submit fully processed data within six months of mooring recovery, but the rate limiting step for some datasets will be the turn-around time that we can achieve with the post-deployment factory calibrations.

TIMELINE AND MILESTONES:

- Recover 2015 Chukchi Ecosystem Mooring (August 2016)
- Deploy 2016 Chukchi Ecosystem Mooring (August 2016)
- Submit new equipment orders by 1 November 2016
- Take delivery of new equipment by 31 March 2017
- Construct mooring instrument cage and floatation package by 1 June 2017
- Semi-annual report due December 10, 2016
- Semi-annual report due June 10, 2017
- Delivery of 2015-2016 QA/QC'd data to AOOS data contractor (Axiom) for inclusion in public AOOS Ocean Data Explorer by April 2017

DELIVERABLES (MUST INCLUDE THE FOLLOWING):

- AOOS and IOOS will be acknowledged in all publications and presentations using your project's data.
- Pictures from the field sites will be provided to AOOS and/or IOOS upon request for web sites, publications, and outreach presentations.
- A semi-annual report will be submitted to AOOS December 2016.
- A semi-annual report will be submitted to AOOS June 2017.
- If available, we will participate in an AOOS-sponsored stakeholder scientist workshop, which may include the Alaska Marine Science Symposium.
- Presentations will be made to the AOOS board upon request.
- A story for the AOOS newsletter will be provided upon request.

AOOS SUBAWARD BUDGET & BUDGET JUSTIFICATION FOR NOAA GRANT #NA16NOS0120027

PROJECT NAME: Chukchi Sea Ecosystem Mooring

PI NAME & CONTACT INFO:

Dr. Seth Danielson
School of Fisheries and Ocean Sciences
Institute of Marine Science
University of Alaska Fairbanks
905 N. Koyukuk Dr.
Rm. 112 O'Neill Bldg.
P.O. Box 757220
Fairbanks, AK 99775-7220

PERIOD OF PERFORMANCE: 1 June 2016 to 31 May 2017

BUDGETS MUST INCLUDE THE FOLLOWING LINE ITEMS:

Personnel: No salary is requested in this proposal.

Equipment

We request a total of \$96,990 for the purchase of one each of the SeaPhOx, HydroC and LISST instruments.

1. One SeaBird-Satlantic SeaPhOx sensor \$23,490
2. One Contros HydroC pCO₂ sensor \$34,000
3. One Sequoia LISST sensor: \$39,500

Supplies/commodities

We request \$500 for batteries to instrument the above items.

1. Instrument batteries: \$500

Travel:

No Travel is requested in this proposal

Contracts/services (services or subawards)

We request \$1500 for the purchase of the following contractual services:

1. Factory Instrument Calibrations: \$500
2. Locator Beacon Data Service: \$500
3. Shipping: \$500

Indirect (overhead): calculation of rate must be specified

We request \$1010 (50.5%) of \$2,000 for indirect charges that apply to the supplies/commodities and contractual service category items listed above.

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		Total (g)
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	
1. WFOI Subaward - Baumgartner - AMOS	11.012	\$	\$	\$ 19,969.00	\$	\$ 19,969.00
2.						
3.						
4.						
5. Totals		\$	\$	\$ 19,969.00	\$	\$ 19,969.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1)	(2)	(3)	(4)	
	WHOI Subaward - Baumgartner - AMOS				
	\$ 7,800.00	\$	\$	\$	\$ 7,800.00
a. Personnel					
b. Fringe Benefits	2,886.00				2,886.00
c. Travel	2,279.00				2,279.00
d. Equipment	0.00				
e. Supplies	0.00				
f. Contractual	0.00				
g. Construction	0.00				
h. Other	0.00				
i. Total Direct Charges (sum of 6a-6h)	12,965.00				\$ 12,965.00
j. Indirect Charges	7,004.00				\$ 7,004.00
k. TOTALS (sum of 6i and 6j)	\$ 19,969.00	\$	\$	\$	\$ 19,969.00
7. Program Income	\$ 0.00	\$	\$	\$	\$

SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. WBOI Subaward - Baumgartner - AMOS	\$	\$	\$	\$
9.				
10.				
11.				
12. TOTAL (sum of lines 8-11)	\$	\$	\$	\$

SECTION D - FORECASTED CASH NEEDS

Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal \$ 19,969.00	\$ 4,993.00	\$ 4,993.00	\$ 4,993.00	\$ 4,990.00
14. Non-Federal \$				
15. TOTAL (sum of lines 13 and 14) \$ 19,969.00	\$ 4,993.00	\$ 4,993.00	\$ 4,993.00	\$ 4,990.00

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. WBOI Subaward - Baumgartner - AMOS	\$	\$	\$	\$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	\$	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: 12965	22. Indirect Charges: 7004
23. Remarks:	

Research Proposal Submitted to

Holly Kent
Program Coordinator
Alaska Ocean Observing System
1007 W. 3rd Ave Suite 100
Anchorage, AK 99501

By the

Woods Hole Oceanographic Institution
Woods Hole, MA 02543
IRS Number 04-2105850 --- Congressional District No. 09 --- DUNS No. 00-176-6682

Titled

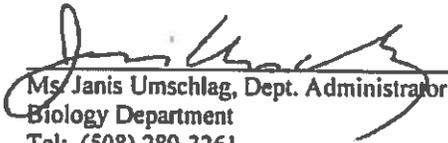
An Arctic marine mammal observing system

Amount of Funds Requested: \$19,969
Period of Performance: February 1, 2017 to January 31, 2018

Endorsements:



Dr. Mark Baumgartner, Principal Investigator
Biology Department
Tel: (508) 289-2678
Email: mbaumgartner@whoi.edu



Ms. Janis Umschlag, Dept. Administrator
Biology Department
Tel: (508) 289-3261
Email: jumschlag@whoi.edu



Ms. Jennifer Carter
Pre-Award Manager, Grant & Contract Services
Tel: (508) 289-2450
Email: jcarter@whoi.edu
awards@whoi.edu

AOOS SUBAWARD STATEMENT OF WORK (SOW) FOR NOAA GRANT #NA16NOS0120027

PROJECT NAME: An Arctic marine mammal observing system

PI NAME & CONTACT INFO: Mark Baumgartner, Woods Hole Oceanographic Institution, Biology Department, MS #33, 266 Woods Hole Road, Woods Hole, MA 02543, 508-289-2678, mbaumgartner@whoi.edu

PERIOD OF PERFORMANCE: February 1, 2017 to January 31, 2018

PROJECT GOAL/PURPOSE: AOOS funds will be used to conduct a simultaneous marine mammal and oceanographic survey of the Chukchi Sea using a Slocum autonomous underwater glider during the summer of 2017. The glider will be equipped with sensors to measure temperature, salinity, chlorophyll fluorescence, turbidity, and the occurrence of several species of marine mammals. The resulting data will be used to study relationships between the distribution of Arctic and sub-Arctic marine mammals and the oceanography of the Chukchi Sea.

BACKGROUND: We have developed a passive acoustic system to record, detect, classify, and remotely report marine mammal calls in near real time from autonomous platforms based on the digital acoustic monitoring (DMON) instrument and the low-frequency detection and classification system (LFDCS). The system has been demonstrated and evaluated on Slocum ocean gliders to detect baleen whales in the temperate northwest Atlantic Ocean, and with AOOS support, we have tested the system for a variety of Arctic and sub-arctic marine mammals in the Chukchi Sea during glider deployments in 2013, 2014, and 2015. We plan to use the system operationally to conduct annual large-scale surveys in the Chukchi Sea.

Shipboard observations of marine mammal distribution and habitat are expensive and logistically challenging to collect in Arctic waters. Port facilities are non-existent and access to appropriate vessels for spending long periods of time at sea is extremely limited. Yet information on the occurrence, distribution, and habitat of many Arctic marine mammals is vital for assessing the health of Alaskan marine ecosystems and informing communities that rely on them for subsistence, particularly during current accelerating climate change and industrial development. Autonomous observing systems such as those adopted and developed by the U.S. Integrated Ocean Observing System can provide sustained measurements of the ocean environment, but to date have lacked critical observations of high trophic levels. With AOOS funds, we are establishing a long-term Arctic marine mammal observing system based on autonomous platforms to monitor changes in marine mammal occurrence, distribution and oceanographic habitat over the next decade. The Alaskan shelf seas are ideally suited for this capability, since marine mammals are a well-recognized and important component of the Alaskan marine ecosystem, and there is intense concern over both anthropogenic impacts and climate change on the Alaskan marine mammal community.

PROJECT OBJECTIVES: Our long-term objective is to annually monitor oceanographic conditions and marine mammal distribution over a 2+ month long transect from the southern Chukchi Sea up to the northeastern Chukchi Sea using a long-duration Slocum G2 glider equipped with the DMON/LFDCS and sensors to measure temperature, salinity, chlorophyll fluorescence, and turbidity. We hypothesize that some Arctic species associate with Alaska coastal current fronts and/or shoals to take advantage of aggregation and retention of either pelagic or benthic prey. We further speculate that marine mammal community composition will

change predictably with the strong spatial variability in oceanographic properties found in this region, and that these predictions will improve efforts to (1) mitigate impacts on marine mammals by human activities and (2) forecast changes in species distributions caused by climate change. Lastly, the G2 Slocum will provide the longest joint oceanographic-real time marine mammal detection system implemented to date.

PROJECT ACTIVITIES

- 1) Prepare, deploy, operate, and recover glider in Chukchi Sea during summer of 2017.
- 2) Provide real-time detections on a publically available website.
- 3) Characterize relationships between the occurrence of each acoustically detected marine mammal species and oceanographic conditions.

PLAN FOR DATA DELIVERY: We will deliver the QA/QC'd glider track, acoustic detections, raw acoustic data, and physical oceanography data to Axiom on an external hard drive annually within 9 months of glider recovery.

TIMELINE AND MILESTONES:

- February 2017 – April 2017 – Update marine mammal call library, prepare DMON, prepare glider.
- May 2017 – At-sea test of glider near Seward, Alaska.
- June 2017 – Semi-annual report due.
- July 2017 – Deploy glider in southern Chukchi Sea using ship of opportunity.
- July-October 2017 – At sea data collection. Maintain website with real time acoustic detections and oceanographic data.
- October 2017 – Glider recovered, acoustic and oceanographic data downloaded.
- December 2017 – Semi-annual report due.
- January 2018 – Present results at Alaska Marine Science Symposium.
- June 2018 – Data QA/QC'd, delivered to Axiom or uploaded to AOOS website.

DELIVERABLES:

- Semi-annual reports in December and June
- Website linked to AOOS with real-time detections and glider track
- Participation in AOOS-sponsored stakeholder-scientist workshops (if available)
- Presentations to AOOS Board (upon request)
- Stories for AOOS newsletter (upon request)
- Copy of QA/QC'd data
- AOOS and IOOS will be acknowledged in all publications and presentations using your project's data
- Pictures from the field sites will be provided to AOOS and/or IOOS upon request for web sites, publications, and outreach presentations



An Arctic Marine Mammal Observing System
MARK F BAUMGARTNER (Subs (NOAA Prime))
 Feb 1, 2017 to Jan 31, 2018
Budget

	Approximate Labor Months		
	02/01/17	01/31/18	
A. Senior Personnel			
1 . M. BAUMGARTNER, Assoc Sci w/Ten	0.67		
C. Total Direct Labor & Benefits			\$10,686
E. Travel			
Domestic			
1. Alaska Marine Science Symposium Woods Hole, MA to Anchorage, AK			
Airfare RT 1 Tickets @ \$900	900		
Ground General 1 @ \$200	200		
Lodging Hotel 1 Rooms 6 Nights @ \$130	780		
Per Diem US Cont 1 People 7 Days @ \$57	399		
Total	<u>2,279</u>		
Total Domestic Travel		<u>2,279</u>	
Total Travel			<u>2,279</u>
H. Total Direct Costs			<u>\$12,965</u>
I. Indirect Costs			
1. Lab Costs		0	
2. General & Administrative		0	
3. Facility & Administrative		<u>7,004</u>	
Total Indirect Costs			<u>7,004</u>
J. Total Direct & Indirect Costs			<u><u>\$19,969</u></u>
L. Amount of this Request			<u><u>\$19,969</u></u>



PI: BAUMGARTNER, MARK
 Agency: Subs (NOAA Prime)
 Proposal: 21502 An Arctic Marine Mammal Observing System
 Submission: 01 An Arctic Marine Mammal Observing System
 Version: 00
 Period: 01 02/01/2017 - 01/31/2018

I. Total Salaries (All Budgeted Personnel)

a) Regular + At Sea	6,619
b) Overtime	0
c) Casual	0
d) GRA Stipend	0
e) Shore Leave	0

Total Salaries & Wages: 6,619

II. Paid Absences (PA) Amount x Rate % = Paid Absences

a) Regular	6,619	17.8500	1,181
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Total Paid Absences: 1,181

III. Total Salaries, Wages & Paid Absences

7,800

IV. Benefit Calculation Amount x Rate % = Benefit Cost

a) Regular + PA	7,800	37.0000	2,886
b) Overtime	0	27.3400	0
c) Casual	0	9.1700	0
d) Cruise Leave	0	8.7500	0
e) Sea Duty	0	8.7500	0

Total Benefits: 2,886

V. Total Direct Labor and Benefits:

10,686

VI. Calculation of the MTDC Overhead Basis:

Total Salary & Benefits	10,686
Less Premium Pay	0
Less GRA Stipends	0
MTDC Overhead Base (non-GRA)	10,686

VII. F&A Overhead Calculation Base x Rate % =F&A Overhead Cost

MTDC Base (non-GRA)	10,686	54.0200	5,773
MTDC Base (Marine)	0	31.1300	0
MTDC Base (GRA)	0	54.0200	0
Fabricated Equipment	0	0	0

Total F&A Cost 5,773

IX. Total Indirect Costs

5,773

X. Total Salary & Related Costs

16,459

INSTRUCTIONS FOR AOOS SUBAWARD BUDGET & BUDGET JUSTIFICATION FOR NOAA GRANT

These can be provided on your institution's regular documents or you can use the AOOS budget template (attached). In any event, the following must be itemized in a table, with narrative justification and detail provided.

Institutional Information

The Woods Hole Oceanographic Institution (WHOI) is a non-profit [501c(3)] research and education organization subject to the cost principles of 2 CFR 200. WHOI Principal Investigators are responsible for conceiving, funding and carrying out their research programs. Senior Personnel are expected to raise 12 months of support for themselves and their staff by writing proposals and obtaining sponsored research grants and contracts from a variety of sources. Some teach voluntarily in WHOI's Joint Program, but support for this is limited. NSF has confirmed to WHOI that salary support from grants beyond 2 months per year can be justifiable for these Principal Investigators.

The rates included in the proposal are negotiated with our cognizant government agency.

For 2017 and beyond, WHOI has a negotiated rate agreement with the Office of Naval Research and uses the method of allocation of indirect costs to Modified Total Direct Costs (MTDC). The normal exclusions contained in 2 CFR 200.68 (MTDC) apply, as well as the following cost categories; ship use, submersible use, vessel charters and ship fuel.

A proposed labor month is equal to 152 hours or 1824 hours annually versus 2080 hours (40 hours/week for 52 weeks). The difference is for vacations, holidays, sick time, and other paid absences, which are included in the Paid Absences calculation. WHOI cannot "waive" or reduce overhead rates on any sponsored research project due to the structure of our negotiated rates with our cognizant government agency (Office of Naval Research). When a program sets limits on overhead, WHOI must use Institution unrestricted funds to pay the unfunded portion of the overhead costs.

PROJECT NAME: An Arctic marine mammal observing system

PI NAME & CONTACT INFO: Mark Baumgartner, Woods Hole Oceanographic Institution, Biology Department, MS #33, 266 Woods Hole Road, Woods Hole, MA 02543, 508-289-2678, mbaumgartner@whoi.edu

PERIOD OF PERFORMANCE: February 1, 2017 to January 31, 2018

BUDGETS MUST INCLUDE THE FOLLOWING LINE ITEMS:

Personnel (salary and fringe broken out)

Funds are requested for PI Mark Baumgartner (0.67 months) to prepare the DMON instrument, pilot the glider, support real-time data availability at dcs.whoi.edu, conduct post-recovery statistical analysis, and present project results at the 2018 Alaska Marine Science Symposium.

Equipment (anything over \$5k)

None

Supplies/commodities (less than \$5k)

None

Travel (airfare, per diem (including hotel), mileage, other must be broken out)

Funds are requested for travel from Boston, Massachusetts to the 2018 Alaska Marine Science Symposium in Anchorage, Alaska. Funds include airfare (\$900), lodging (6 nights at \$130 per night), ground transportation (\$200), and per-diem (7 days at \$57 per day).

Contracts/services (services or subawards)

None

Indirect (overhead): calculation of rate must be specified

The overhead rate of 54.02% is applied to both salary and travel costs.

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		Total (g)
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	
1. IAF Subaward - Winsor - AMMS	11.012	\$	\$	\$ 45,000.00	\$	\$ 45,000.00
2.						
3.						
4.						
5. Totals		\$	\$	\$ 45,000.00	\$	\$ 45,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1)	(2)	(3)	(4)	
	UAP Subaward - Winsor - AHSOS				
a. Personnel	\$ 12,940.00	\$	\$	\$	\$ 12,940.00
b. Fringe Benefits	5,000.00				5,000.00
c. Travel	0.00				
d. Equipment	18,000.00				18,000.00
e. Supplies	0.00				
f. Contractual	0.00				
g. Construction	0.00				
h. Other	0.00				
i. Total Direct Charges (sum of 6a-6h)	\$ 35,940.00				\$ 35,940.00
j. Indirect Charges	9,060.00				9,060.00
k. TOTALS (sum of 6i and 6j)	\$ 45,000.00	\$	\$	\$	\$ 45,000.00
7. Program Income	\$ 0.00	\$	\$	\$	

Authorized for Local Reproduction

SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program		(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8.	UAF Subaward - Winsor - AMXDS	\$	\$	\$	\$
9.					
10.					
11.					
12.	TOTAL (sum of lines 8-11)	\$	\$	\$	\$

SECTION D - FORECASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	\$ 45,000.00	\$ 20,000.00	\$ 10,000.00	\$ 10,000.00	\$ 5,000.00
14. Non-Federal	\$				
15. TOTAL (sum of lines 13 and 14)	\$ 45,000.00	\$ 20,000.00	\$ 10,000.00	\$ 10,000.00	\$ 5,000.00

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. UAF Subaward - Winsor - AMXDS	\$	\$	\$	\$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	\$	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: 35940	22. Indirect Charges: 9060
23. Remarks:	

AOOS SUBAWARD STATEMENT OF WORK (SOW) FOR NOAA GRANT #NA16NOS0120027

PROJECT NAME: An Arctic marine mammal observing system

PI NAME & CONTACT INFO: Peter Winsor, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, 905 Koyukuk Drive, Suite 245 O'Neill Building, Fairbanks, AK 99775, 907-474-7740, pwinsor@alaska.edu

PERIOD OF PERFORMANCE: February 1, 2017 to January 31, 2018

PROJECT GOAL/PURPOSE: AOOS funds will be used to conduct a simultaneous marine mammal and oceanographic survey of the Chukchi Sea using a Slocum autonomous underwater glider during the summer of 2017. The glider will be equipped with sensors to measure temperature, salinity, chlorophyll fluorescence, turbidity, and the occurrence of several species of marine mammals. The resulting data will be used to study relationships between the distribution of Arctic and sub-Arctic marine mammals and the oceanography of the Chukchi Sea.

BACKGROUND: We have developed a passive acoustic system to record, detect, classify, and remotely report marine mammal calls in near real time from autonomous platforms based on the digital acoustic monitoring (DMON) instrument and the low-frequency detection and classification system (LFDCS). The system has been demonstrated and evaluated on Slocum ocean gliders to detect baleen whales in the temperate northwest Atlantic Ocean, and with AOOS support, we have tested the system for a variety of Arctic and sub-arctic marine mammals in the Chukchi Sea during glider deployments in 2013, 2014, and 2015. We plan to use the system operationally to conduct annual large-scale surveys in the Chukchi Sea.

Shipboard observations of marine mammal distribution and habitat are expensive and logistically challenging to collect in Arctic waters. Port facilities are non-existent and access to appropriate vessels for spending long periods of time at sea is extremely limited. Yet information on the occurrence, distribution, and habitat of many Arctic marine mammals is vital for assessing the health of Alaskan marine ecosystems and informing communities that rely on them for subsistence, particularly during current accelerating climate change and industrial development. Autonomous observing systems such as those adopted and developed by the U.S. Integrated Ocean Observing System can provide sustained measurements of the ocean environment, but to date have lacked critical observations of high trophic levels. With AOOS funds, we are establishing a long-term Arctic marine mammal observing system based on autonomous platforms to monitor changes in marine mammal occurrence, distribution and oceanographic habitat over the next decade. The Alaskan shelf seas are ideally suited for this capability, since marine mammals are a well-recognized and important component of the Alaskan marine ecosystem, and there is intense concern over both anthropogenic impacts and climate change on the Alaskan marine mammal community.

PROJECT OBJECTIVES: Our long-term objective is to annually monitor oceanographic conditions and marine mammal distribution over a 2+ month long transect from the southern Chukchi Sea up to the northeastern Chukchi Sea using a long-duration Slocum G2 glider equipped with the DMON/LFDCS and sensors to measure temperature, salinity, chlorophyll fluorescence, and turbidity. We hypothesize that some Arctic species associate with Alaska coastal current fronts and/or shoals to take advantage of aggregation and retention of either pelagic or benthic prey. We further speculate that marine mammal community composition will

change predictably with the strong spatial variability in oceanographic properties found in this region, and that these predictions will improve efforts to (1) mitigate impacts on marine mammals by human activities and (2) forecast changes in species distributions caused by climate change. Lastly, the G2 Slocum will provide the longest joint oceanographic-real time marine mammal detection system implemented to date.

PROJECT ACTIVITIES

- 1) Prepare, deploy, operate, and recover glider in Chukchi Sea during summer of 2017.
- 2) Provide real-time detections on a publically available website.
- 3) Characterize relationships between the occurrence of each acoustically detected marine mammal species and oceanographic conditions.

PLAN FOR DATA DELIVERY: We will deliver the QA/QC'd glider track, acoustic detections, raw acoustic data, and physical oceanography data to Axiom on an external hard drive annually within 9 months of glider recovery.

TIMELINE AND MILESTONES:

- February 2017 – April 2017 – Update marine mammal call library, prepare DMON, prepare glider.
- May 2017 – At-sea test of glider near Seward, Alaska.
- June 2017 – Semi-annual report due.
- July 2017 – Deploy glider in southern Chukchi Sea using ship of opportunity.
- July-October 2017 – At sea data collection. Maintain website with real time acoustic detections and oceanographic data.
- October 2017 – Glider recovered, acoustic and oceanographic data downloaded.
- December 2017 – Semi-annual report due.
- January 2018 – Present results at Alaska Marine Science Symposium.
- June 2018 – Data QA/QC'd, delivered to Axiom or uploaded to AOOS website.

DELIVERABLES:

- Semi-annual reports in December and June
- Website linked to AOOS with real-time detections and glider track
- Participation in AOOS-sponsored stakeholder-scientist workshops (if available)
- Presentations to AOOS Board (upon request)
- Stories for AOOS newsletter (upon request)
- Copy of QA/QC'd data
- AOOS and IOOS will be acknowledged in all publications and presentations using your project's data
- Pictures from the field sites will be provided to AOOS and/or IOOS upon request for web sites, publications, and outreach presentations

UNIVERSITY OF ALASKA FAIRBANKS

PROJECT TITLE: An Arctic marine mammal observing system
 PI: Peter Winsor
 START DATE: 2/1/2017
 END DATE: 1/31/2018
 TOTAL BUDGET: \$45,000
 DEPT #: OPDsfos 16-660
 BANNER #: S22823

							FY18	END
							2/1/2017	1/31/2018
SALARIES AND WAGES							Year 1	Total
							Hours	Project
Senior Personnel			Hourly	Leave Rate	Yearly			
Total Number of Hours	Employee Name		Wage		Increase			
40.00	Peter Winsor	F9 - Faculty (UNAC)	\$52.37	13.7%	1.02	40.0	\$2,478	\$2,478
							Total Senior Personnel	\$2,478
Other Personnel								
Total Number of Hours	Brita Irving	XR - Exempt Staff	\$25.44	20.9%	1.025	323.8	\$10,462	\$10,462
							Total Other Personnel	\$10,462
							TOTAL SALARIES AND WAGES	\$12,940
FRINGE BENEFITS								
Senior Personnel	Peter Winsor	F9 - Faculty (UNAC)		28.7%			\$711	\$711
							Total Senior Personnel	\$711
Other Personnel	Brita Irving	XR - Exempt Staff		41.0%			\$4,289	\$4,289
							TOTAL FRINGE BENEFITS	\$5,000
							TOTAL SALARIES AND BENEFITS	\$17,940
A. MTDC (total costs subject to F&A)							\$17,940	\$17,940
B. Facilities and Administration (F&A)								
Sponsored Research 50.5%							\$9,060	\$9,060
EQUIPMENT								
AUV Glider Batteries							\$18,000	\$18,000
							TOTAL EQUIPMENT	\$18,000
C. Total Costs Exempt from F&A							\$18,000	\$18,000
D. Total Direct Costs (A+C)							\$35,940	\$35,940
E. Total Sponsor Request (B+D)							\$45,000	\$45,000

AOOS SUBAWARD BUDGET JUSTIFICATION FOR NOAA GRANT #NA16NOS0120027

PROJECT NAME: An Arctic marine mammal observing system

PI NAME & CONTACT INFO: Peter Winsor, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, 905 Koyukuk Drive, Suite 245 O'Neill Building, Fairbanks, AK 99775, 907-474-7740, pwinsor@alaska.edu

PERIOD OF PERFORMANCE: February 1, 2017 to January 31, 2018

Salaries:

40 hours (0.2 mo.) are requested for the PI Winsor (at \$52.37/hour) to manage the AUV glider deployment and perform data analysis and interface with the co-PIs, and 323.8 hours (1.9 mos.) are requested for Research Professional Brita Irving (at \$25.44/hour) to purchase lithium batteries, ballast the glider, coordinate deployments and recovery, and perform CTD post processing. All salaries are at the employees' current rate of pay. Anticipatory increases have been included for Year 1 of the proposal.

A leave reserve of 13.7% is included for faculty salaries and 20.9% for professionals. Salaries are listed at the FY16 rate and include a 2.0% inflation increase for faculty and 2.5% for professionals each year.

Benefits:

Staff benefits are applied according to UAF's Fixed FY16 fringe benefit rates. Rates are 28.7% for faculty salaries and 41% for professionals. Anticipatory increases have been included for Year 1 of the proposal. A copy of the rate agreement is available at <http://www.alaska.edu/cost-analysis/negotiation-agreements/>

Equipment:

Funds (\$18,000) are requested for one complete AUV glider lithium pack, which has a life time of over 4 months of continuous use; is longer than one ice-free field season in the Arctic.

Indirect Costs:

Facilities and Administrative (F&A) Costs are negotiated with the Office of Naval Research. The predetermined rate for sponsored research at UAF is calculated at 50.5% (FY14–FY16 predetermined agreement) of Modified Total Direct Costs (MTDC). MTDC includes Total Direct Costs minus tuition and associated fees, scholarships, participant support costs, subaward amounts over \$25,000, and equipment. A copy of the rate agreement is available at: <http://www.alaska.edu/cost-analysis/negotiation-agreements/>.

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		Total (g)
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	
1. UW Subaward - Stafford - AMOS	11.012	\$	\$	\$ 35,000.00	\$	\$ 35,000.00
2.						
3.						
4.						
5. Totals		\$	\$	\$ 35,000.00	\$	\$ 35,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1)	(2)	(3)	(4)	
	UM Subaward - Stafford - AMOS				
a. Personnel	\$ 13,814.00				\$ 13,814.00
b. Fringe Benefits	8,468.00				8,468.00
c. Travel	0.00				
d. Equipment	0.00				
e. Supplies	0.00				
f. Contractual	0.00				
g. Construction	0.00				
h. Other	7,130.00				7,130.00
i. Total Direct Charges (sum of 6a-6h)	29,412.00				\$ 29,412.00
j. Indirect Charges	5,588.00				\$ 5,588.00
k. TOTALS (sum of 6i and 6j)	\$ 35,000.00				\$ 35,000.00
7. Program Income	\$ 0.00				\$ 0.00

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. UW Subaward - Stafford - AMMOS	\$	\$	\$	\$
9.				
10.				
11.				
12. TOTAL (sum of lines 8-11)	\$	\$	\$	\$

SECTION D - FORECASTED CASH NEEDS

Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal \$ 35,000.00	\$ 10,000.00	\$ 10,000.00	\$ 10,000.00	\$ 5,000.00
14. Non-Federal \$				
15. TOTAL (sum of lines 13 and 14) \$ 35,000.00	\$ 10,000.00	\$ 10,000.00	\$ 10,000.00	\$ 5,000.00

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. UW Subaward - Stafford - AMMOS	\$	\$	\$	\$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	\$	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: 29412	22. Indirect Charges: 5588
23. Remarks:	

AOOS SUBAWARD STATEMENT OF WORK (SOW) FOR NOAA GRANT #NA16NOS0120027

PROJECT NAME: An Arctic marine mammal observing system

PI NAME & CONTACT INFO: Kate Stafford, Applied Physics Laboratory, University of Washington, 1013 NE 40th Street, Seattle WA 98105, 206-685-8617, kate2@uw.edu

PERIOD OF PERFORMANCE: February 1, 2017 to January 31, 2018

PROJECT GOAL/PURPOSE: AOOS funds will be used to conduct a simultaneous marine mammal and oceanographic survey of the Chukchi Sea using a Slocum autonomous underwater glider during the summer of 2017. The glider will be equipped with sensors to measure temperature, salinity, chlorophyll fluorescence, turbidity, and the occurrence of several species of marine mammals. The resulting data will be used to study relationships between the distribution of Arctic and sub-Arctic marine mammals and the oceanography of the Chukchi Sea.

BACKGROUND: We have developed a passive acoustic system to record, detect, classify, and remotely report marine mammal calls in near real time from autonomous platforms based on the digital acoustic monitoring (DMON) instrument and the low-frequency detection and classification system (LFDCS). The system has been demonstrated and evaluated on Slocum ocean gliders to detect baleen whales in the temperate northwest Atlantic Ocean, and with AOOS support, we have tested the system for a variety of Arctic and sub-arctic marine mammals in the Chukchi Sea during glider deployments in 2013, 2014, and 2015. We plan to use the system operationally to conduct annual large-scale surveys in the Chukchi Sea.

Shipboard observations of marine mammal distribution and habitat are expensive and logistically challenging to collect in Arctic waters. Port facilities are non-existent and access to appropriate vessels for spending long periods of time at sea is extremely limited. Yet information on the occurrence, distribution, and habitat of many Arctic marine mammals is vital for assessing the health of Alaskan marine ecosystems and informing communities that rely on them for subsistence, particularly during current accelerating climate change and industrial development. Autonomous observing systems such as those adopted and developed by the U.S. Integrated Ocean Observing System can provide sustained measurements of the ocean environment, but to date have lacked critical observations of high trophic levels. With AOOS funds, we are establishing a long-term Arctic marine mammal observing system based on autonomous platforms to monitor changes in marine mammal occurrence, distribution and oceanographic habitat over the next decade. The Alaskan shelf seas are ideally suited for this capability, since marine mammals are a well-recognized and important component of the Alaskan marine ecosystem, and there is intense concern over both anthropogenic impacts and climate change on the Alaskan marine mammal community.

PROJECT OBJECTIVES: Our long-term objective is to annually monitor oceanographic conditions and marine mammal distribution over a 2+ month long transect from the southern Chukchi Sea up to the northeastern Chukchi Sea using a long-duration Slocum G2 glider equipped with the DMON/LFDCS and sensors to measure temperature, salinity, chlorophyll fluorescence, and turbidity. We hypothesize that some Arctic species associate with Alaska coastal current fronts and/or shoals to take advantage of aggregation and retention of either pelagic or benthic prey. We further speculate that marine mammal community composition will change predictably with the strong spatial variability in oceanographic properties found in this

region, and that these predictions will improve efforts to (1) mitigate impacts on marine mammals by human activities and (2) forecast changes in species distributions caused by climate change. Lastly, the G2 Slocum will provide the longest joint oceanographic-real time marine mammal detection system implemented to date.

PROJECT ACTIVITIES

- 1) Prepare, deploy, operate, and recover glider in Chukchi Sea during summer of 2017.
- 2) Provide real-time detections on a publically available website.
- 3) Characterize relationships between the occurrence of each acoustically detected marine mammal species and oceanographic conditions.

PLAN FOR DATA DELIVERY: We will deliver the QA/QC'd glider track, acoustic detections, raw acoustic data, and physical oceanography data to Axiom on an external hard drive annually within 9 months of glider recovery.

TIMELINE AND MILESTONES:

- February 2017 – April 2017 – Update marine mammal call library, prepare DMON, prepare glider.
- May 2017 – At-sea test of glider near Seward, Alaska.
- June 2017 – Semi-annual report due.
- July 2017 – Deploy glider in southern Chukchi Sea using ship of opportunity.
- July-October 2017 – At sea data collection. Maintain website with real time acoustic detections and oceanographic data.
- October 2017 – Glider recovered, acoustic and oceanographic data downloaded.
- December 2017 – Semi-annual report due.
- January 2018 – Present results at Alaska Marine Science Symposium.
- June 2018 – Data QA/QC'd, delivered to Axiom or uploaded to AOOS website.

DELIVERABLES:

- Semi-annual reports in December and June
- Website linked to AOOS with real-time detections and glider track
- Participation in AOOS-sponsored stakeholder-scientist workshops (if available)
- Presentations to AOOS Board (upon request)
- Stories for AOOS newsletter (upon request)
- Copy of QA/QC'd data
- AOOS and IOOS will be acknowledged in all publications and presentations using your project's data
- Pictures from the field sites will be provided to AOOS and/or IOOS upon request for web sites, publications, and outreach presentations

Budget

	Amount	Rate	Subtotals	Totals
A. Salaries	PM			
Kathleen Stafford	1.1137	12,404	\$13,814	
Subtotal PM/Salaries	1.1137			\$13,814
Estimated Staff Hours ¹	193			
Total Salaries				\$13,814
B. Employee Benefits ²				
Professional	13,814	.313	\$4,324	
Subtotal Benefits			\$4,324	
Leave Allowance				
Professional	13,814	.300	\$4,144	
Subtotal Leave Allowance			\$4,144	
Total Benefits/Leave Allowance				\$8,468
C. Equipment				
Total Equipment				\$0
D. Travel				
Total Travel				\$0
E. Other Direct Costs				
<i>Services</i>				
Services Subtotal			\$0	
<i>Supplies</i>				
Supplies Subtotal			\$0	
Total Other Direct Costs				\$0
F. Prorated Direct Costs ⁴				
32% MTDC				\$7,130
G. TOTAL DIRECT COSTS				\$29,412
H. Facilities & Administration Costs ⁴				\$5,588
(19% of G less Equip, Grad Op Fees, & Subcontract amounts above \$25K)				
I. TOTAL				\$35,000

**AOOS SUBAWARD BUDGET and BUDGET JUSTIFICATION
FOR NOAA GRANT #NA16NOS0120027**

Project Name: An Arctic marine mammal observing system

PI Name and Contact Information:

Kathleen M. Stafford, UW Principal Investigator
Applied Physics Laboratory-University of Washington
1013 NE 40th Street
Seattle, WA 98105
Phone: (206) 685-8617
Fax: (206) 543-6785
stafford@apl.washington.edu

Administrative Contact:

Amanda Snyder, Acting Co-Director
Office of Sponsored Programs-University of Washington
4333 Brooklyn Ave NE
Seattle, WA 98195-9472
206-543-4043 (office)
lvnnf@apl.washington.edu

Period of Performance: February 1, 2017 – January 31, 2018

DUNS Number: 605799469

Cage Code: IHEX5

Budget Justification

In this collaborative project with Dr. Peter Winsor (University of Alaska-Fairbanks) and Dr. Mark Baumgartner (WHOI), funds are requested for 1.1137 months for Kathleen Stafford. Dr. Stafford's effort on this project will be to update the Arctic marine mammal real-time call library, coordinate field season 2017 glider deployment with Dr. Winsor, real-time analysis and post-processing of acoustic data. Additionally Dr. Stafford will work with Drs. Winsor and Baumgartner to produce semi-annual reports.

Salary

Salary is paid in accordance with University policy and is set at June 2016 rate plus 4% inflation.

Fringe Benefits

The benefit and leave rates included in the budget are in accordance with University of Washington's negotiated rates approved by the Department of Health and Human Resources (DHHS) and UW policy on proposal budgets. These are preliminary rates effective July 1, 2016. The benefit rate is 31.3 %, and the APL leave rate is 30%.

Equipment: None

Travel: None

Other Direct Costs:

Services: None

APL Prorated Direct Costs: The University's negotiated indirect cost rate applied to APL is lower than the rate elsewhere on campus (19% vs. 54.5%) and does not recover the Laboratory's central costs. These are recovered by applying a Prorated Direct on a modified total direct cost (MTDC) basis. Prorated Direct Costs include such expenses as salaries and employee benefits for central service employees, administrative data processing, some communications and some facilities costs. The cost applied to this project is 32% MTDC based on a the APL-UW provisional Prorated Direct Costs reviewed and accepted by the Navy's resident Administrative Contracting Officer, Evan Wood, Office of Naval Research, Seattle Regional Office, per letter dated May 3, 2016, to Jeffrey Simmen, Director, Applied Physics Laboratory. This provisional rate is effective October 1, 2016. *See attached provisional prorated direct cost letter.*

Indirect Cost: The APL-UW F & A rate applied is 19% of Modified Direct Cost based on the F&A rates beginning July 1, 2016. These rates are posted at the UW website:

<https://www.washington.edu/research/osp/gim/gim3a.html>

The current approved rate agreement dated March 2, 2016 is posted at the UW Website:

<https://www.washington.edu/research/osp/gim/gim3a.html>

As per current approved practice, the APL-UW may rebudget within the total estimated cost.

BUDGET INFORMATION - Non-Construction Programs

OMB Number: 4040-0006
Expiration Date: 06/30/2014

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. Axiom Contract - Bochenek - Core DMAC	11.012	\$ []	\$ []	\$ 540,000.00	\$ []	\$ 540,000.00
2.	[]	[]	[]	[]	[]	[]
3.	[]	[]	[]	[]	[]	[]
4.	[]	[]	[]	[]	[]	[]
5. Totals		\$ []	\$ []	\$ 540,000.00	\$ []	\$ 540,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1)	(2)	(3)	(4)	
	Axiom Contract -Bochenek - Core OMAC				
a. Personnel	\$ 343,157.00	\$	\$	\$	\$ 343,157.00
b. Fringe Benefits	102,947.00				102,947.00
c. Travel	0.00				
d. Equipment	0.00				
e. Supplies	214.00				214.00
f. Contractual	0.00				0.00
g. Construction	0.00				
h. Other	93,682.00				93,682.00
i. Total Direct Charges (sum of 6a-6h)	540,000.				\$ 540,000.00
j. Indirect Charges	0.00				\$
k. TOTALS (sum of 6i and 6j)	\$ 540,000.00	\$	\$	\$	\$ 540,000.00
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.	Axiom Contract - Bochenek - Core DMAC	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
9.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
10.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
11.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
12. TOTAL (sum of lines 8-11)		\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>

SECTION D - FORECASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	\$ <input type="text" value="540,000.00"/>	\$ <input type="text" value="135,000.00"/>			
14. Non-Federal	\$ <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
15. TOTAL (sum of lines 13 and 14)	\$ <input type="text" value="540,000.00"/>	\$ <input type="text" value="135,000.00"/>			

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.	Axiom Subaward - Bochenek - Core DMAC	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
17.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
18.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
19.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
20. TOTAL (sum of lines 16 - 19)		\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: <input type="text" value="540000"/>	22. Indirect Charges: <input type="text"/>
23. Remarks: <input type="text"/>	

AOOS CONTRACT STATEMENT OF WORK (SOW) FOR NOAA GRANT NA16NOS0120027

PROJECT NAME:

Contract for AOOS Data Management Services – H2400-70 Year 1 2016

PI NAME & CONTACT INFO:

Rob Bochenek

rob@axiomdatascience.com

907-230-0304

PERIOD OF PERFORMANCE:

September 1 2016 – August 31 2017

PROJECT GOAL/PURPOSE:

The following document details the elements of first year activities specifying core activities, milestones/deliverables, schedule, responsibilities and staff roles for project activities between September 2016 and August 2017. The first year of this effort will focus on further cultivating the AOOS cyber infrastructure and data repository, extending the capabilities of existing tools and developing new functionality.

BACKGROUND:

The Alaska Ocean Observing System (AOOS) requires a data management system that allows a complex array of oceanographic data types to be well organized, accessible, and understandable. Axiom Data Science provides comprehensive technical solutions to data management needs, underpinned by a scalable, open source system that uses existing and emerging software resources, high performance compute clusters and interoperability services. The framework will directly leverage systems, capabilities and lessons learned from ongoing data management and communications (DMAC) activities that support the Southeast Coastal Ocean Observing System (SECOORA), Central and Northern California Ocean Observing System (CeNCOOS) and the Integrated Ocean Observing System (IOOS). The resulting data management system will provide an environment that increases the access and use of data by all user groups and will allow AOOS data management staff to rapidly develop new capabilities and tools to meet a variety of user needs.

Managing oceanographic data is particularly challenging due to the variety of data collection protocols and the vast range of oceanographic variables studied. Data may derive from automated real-time sensors, remote sensing satellite/observational platforms, field/cruise observations, model outputs, etc. Variables can range from mesoscale ocean dynamics to micro-scale zooplankton counts. The resulting datasets are packaged and stored in advanced formats and describe a wide spectrum of scientific observations and metrics. Due to the complexity of the data, developing data management strategies to securely organize and disseminate information is also technically challenging. Distilling the underlying information into usable products for various user groups requires a cohesive, end-to-end approach in addition to a fundamental understanding of the needs and requirements of the user groups and stakeholders.

PROJECT OBJECTIVES:

The objectives of this project are to:

1. Provide core data management support services that allow AOOS to fulfill its mission and contribute to the development of IOOS.
2. Provide DMAC support to the AOOS program.
3. Develop and maintain specialized data products and tools.

PROJECT ACTIVITIES

Activities below will be further refined on an annual basis with input from the AOOS Board and the AOOS Data Management Advisory Committee and incorporated into an annual work plan. The plan will be reviewed and updated by AOOS and Axiom staff on a quarterly basis.

Objective 1: Provide Core Data Management Support

Task 1: Provide Technical Support for AOOS Cyber Infrastructure – Axiom will ensure that the AOOS data system is healthy, secure and monitored and will respond to system problems and map out future upgrade and expansion strategies. This task includes the support, cultivation and expansion of both the hardware and software, which enables the AOOS data management system to function. Axiom staff will also focus on extending the capabilities of the existing AOOS cyber infrastructure by exploring and implementing new software server technology, optimizing physical hardware configurations and deploying additional server resources to power applications and functionality that is requested by the user community and required for the multiple integrated research efforts that AOOS is supporting.

Task 2: Data Portal Development – The AOOS Ocean Data Explorer framework will continue to be cultivated to integrate new technologies and functionalities, including further implementation of AOOS lite and “my aOOS” type functions. Improved mechanisms of interactivity could greatly augment the usefulness of the various AOOS data assets for the broader user base. The following list includes several capabilities that will be implemented during this year’s development activities:

- Extend the virtual sensor to produce histograms to convey distribution of hypothetical measurements across values.
- Extend virtual sensor to provide depth profiles so that users can visualize data through the water column.
- Enable complex GIS datasets (ones with large numbers of feature types) to provide intelligent information for users during roll over events. This will be extremely useful for habitat classification data sets and other complex datasets.
- Apply hexagonal binning techniques to densely packed data sets such as Shorezone to convey regional trends for habitat types and other features.
- Extend the capabilities of the Model Explorer to perform model-to-model and model-to-observation comparisons.
- Develop new and extend existing search indexes to support more advanced querying by space, time, taxonomy and parameter.

Task 3: Implement QARTOD QA/QC checks for AOOS real time data feeds. Working with the broader IOOS community, Axiom will implement protocols for applying QARTOD checks to real-time data feeds.

Objective 2: Provide DMAC support to the AOOS program

Task 1: Provide overall DMAC project management and oversight – This task includes supporting the AOOS Data Management Advisory Committee and participating in committee meetings. Axiom will submit written reports to the AOOS Executive Director according to a time schedule dictated by the NOAA grant, but normally twice a year, and based on a template provided by the Executive Director. These reports will include reporting on the “status of the system” as of the reporting dates. Axiom will provide short project highlights for newsletters and monthly updates when requested. Axiom will work with the AOOS Executive Director to develop appropriate performance metrics for assessing usage and value of the data system and products. Axiom will work with AOOS staff with input from the AOOS Board and advisory committees to develop an annual work plan that will include specific milestones and deliverables. Axiom will assist AOOS in becoming an IOOS certified Regional Association, especially in developing the materials and capabilities to meet the data management requirements of certification.

Task 2: Participate in regional, state, national and international DMAC activities – This includes participating on behalf of AOOS in groups such as the AK Interagency Data Integration Working Group, as well as national IOOS and IOOS Association data management committees and working groups. Axiom will participate in statewide and national conferences to promote AOOS data services and products. Funding for travel expenses may be provided by the AOOS Executive Director if not budgeted.

Objective 3: Develop and maintain special data products

Task 1: Support existing products - Based on input from the AOOS Data Management Advisory Committee (DMAC), this task will support existing products, which could include the Arctic Research Assets page, Yukon Chinook Run Timing forecast, and Cook Inlet Response Tool.

Task 2: Ingest new data - This task will be primarily funded through other grants. However, funds will be set aside to ingest new high priority with input from the AOOS DMAC.

Task 3: Develop new data products - Based on input from the AOOS Data Management Advisory Committee (DMAC), this task will support development of new products. These could include mobile phone apps; specialized data portals, products or tools for subregions of Alaska’s Large Marine Ecosystems; specialized data portals, products or tools for unique Alaska stakeholder groups such as recreational fishers, commercial fisheries, and emergency planners; and specialized data portals, products or tools for topical issues such as Arctic shipping, ocean acidification, and community based monitoring.

PLAN FOR DATA DELIVERY:

N/A

MILESTONES

Milestones will be incorporated into the project’s annual work plan, which will be finalized by Sept 1, 2016, the starting date of this project.

DELIVERABLES:

- **Annual Work Plan – Sept 1, 2016**
- **Semi-annual report – Dec 10 2016**

- **Semi-annual report – June 10 2017**
- **Participation in one AOOS-sponsored stakeholder-scientist workshop (if available)**
- **Presentations to AOOS Board upon request**
- **1 story for AOOS newsletter (upon request)**

Project: AOOS 2300-70

PI: R. Bochenek

			540,000	
			YEAR 1	
			Budget	MTDC
a. Personnel		Sal/yr		% FTE
Rob Bochenek		106,214.00	24%	
4 Brian Stone		96,827.00	33%	
Chris Turner		79,246.00	24%	
Malcolm Herstand		69,571.00	24%	
Will Koeppen		86,413.00	30%	
John Dunaway		76,814.00	30%	
Jordan Jenckes		49,237.00	40%	
Luc Mehl		76,843.00	30%	
Dave Foster		102,649.00	24%	
Lance Finrock		97,439.00	32%	
Ross Martin		98,516.00	20%	
Stacey Buckelew		73,294.00	20%	
Jessica Austin		92,157.00	20%	
Kyle Wilcox		103,482.00	24%	
Shane Stclair		103,482.00	24%	
Total Personnel				
				343,157
				343,157
b. Fringe Benefits (@30%)		Rate		
Rob Bochenek		30%		
Brian Stone		30%		
Lance Finrock		30%		
Ross Martin		30%		
Dave Foster		30%		
John Dunaway		30%		
Jordan Jenckes		30%		
Luc Mehl		30%		
Dave Foster		30%		
Lance Finrock		30%		
Chris Turner		30%		
Malcolm Herstadt		30%		
Jessica Austin		30%		
Kyle Wilcox		30%		
Shane Stclair		30%		
Total Fringe Benefits				
				102,947
				102,947
c. Travel and Per Diem		Rate	Qty	
Airfare				
Total Travel and Per Diem				0
				0
d. Equipment/software >\$5,000		Rate	Qty	
Total Equipment>5000				0
				0
e. Supplies/commodities/equipment <\$5,000		Rate	Qty	
Various Suppiles		0	1	
Total Supplies/commodities< 5000				214
				214
f. Contracts/Services:		Rate	Qty	
Total Services				0
				0
Sub-Award		Rate	Qty	
Total Sub-Awards				0
				0
g. Other (Facilities Rate 21%)				
21% of Personell and Fringe				93,682
				93,682
TOTAL Categories				540,000
				540,000

Axiom Consulting & Design Budget Justification

Year 1 of this award; Year 7 of Contract

The requested funds will pay for salary for several contractors over the project which will begin on September 1st, 2016 and end August 31st, 2017.

Year 1 Personnel (\$343,157.00) – Rob Bochenek is budgeted for 24% FTE to manage the project and personnel. Ross Martin is budgeted at 20% FTE to support the AOOS Cyber-infrastructure. Shane StClair is budgeted at 24% FTE to support the AOOS data system. Brian Stone is budgeted at 33% FTE to develop and support AOOS user interface systems. Lance Finrock is budgeted for 32% FTE to support the IOOS SOS effort AOOS data system. John Dunaway is budgeted at 30% FTE to develop web services and process data. Will Koeppen is budgeted at 30% FTE to provide scientific support. Chris Turner is budgeted at 24% FTE to provide support for metadata and coordinate the transfer of data. Malcolm Herstadt is budgeted for 24% FTE to support data ingestion and GIS processing. Jordan Jenkes is budgeted for 40% FTE to support Arctic Assets. Kyle Wilcox is budgeted for 24% FTE to support the AOOS data system and search indexes. Dave Foster is budgeted for 24% FTE to support python programming tasks. Stacey Buckelew is budgeted for 20% FTE to provide project management support and data coordination. Jessica Austin is budgeted at 20% to lead the AIS system project.

Year 1 Fringe (\$102,947.00) – Fringe benefits cover 401K, health insurance, and paid leave for staff salaries.

Year 1 Commodities (\$214.00) – Funds are budgeted to purchase several replacement hard drives and server components.

Year 1 Other/Facilities (\$93,682) – Funds are budgeted for support of the Axiom server infrastructure calculated at 21% of personnel costs.

BUDGET INFORMATION - Non-Construction Programs

OMB Number: 4040-0006
Expiration Date: 06/30/2014

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. Axiom Subaward - Bochenek - Special projects	11.012	\$	\$	\$ 344,538.00	\$	\$ 344,538.00
2.						
3.						
4.						
5. Totals		\$	\$	\$ 344,538.00	\$	\$ 344,538.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1)	(2)	(3)	(4)	
	Axiom Subaward - Bochenek - Special projects				
a. Personnel	\$ 218,285.00	\$	\$	\$	218,285.00
b. Fringe Benefits	65,486.00				65,486.00
c. Travel	0.00				
d. Equipment	0.00				
e. Supplies	1,175.00				1,175.00
f. Contractual	0.00				
g. Construction	0.00				
h. Other	59,592.00				59,592.00
i. Total Direct Charges (sum of 6a-6h)	344,538.00			\$	344,538.00
j. Indirect Charges				\$	
k. TOTALS (sum of 6i and 6j)	\$ 344,538.00	\$	\$	\$	344,538.00
7. Program Income	\$	\$	\$	\$	

SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program		(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8.	Axiom Subaward - Bochenek - Special projects	\$	\$	\$	\$
9.					
10.					
11.					
12.	TOTAL (sum of lines 8-11)	\$	\$	\$	\$

SECTION D - FORECASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	\$ 344,538.00	\$ 86,135.00	\$ 86,135.00	\$ 86,135.00	\$ 86,133.00
14. Non-Federal	\$				
15. TOTAL (sum of lines 13 and 14)	\$ 344,538.00	\$ 86,135.00	\$ 86,135.00	\$ 86,135.00	\$ 86,133.00

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. Axiom Subaward - Bochenek - Special projects	\$	\$	\$	\$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	\$	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges:	344538	22. Indirect Charges:	
23. Remarks:			

AOOS SUBAWARD STATEMENT OF WORK (SOW) FOR NOAA GRANT NA16NOS0120027

PROJECT NAME:

AOOS Special Projects

PI NAME & CONTACT INFO:

Rob Bochenek

rob@axiomdatascience.com

907-230-0304

PERIOD OF PERFORMANCE:

June 1 2016 – May 31 2017

PROJECT GOAL/PURPOSE:

This project is primarily carried out by the AOOS DMAC support partner, Axiom Data Science, LLC. Several tasks described here involve other partners including the IOOS PO, MBON supported principal investigators, High Frequency Radar operators across the regional associations, and the ATN Steering Committee and DAC developers. This project supports: ongoing stewardship of several open source software packages that are crucial to the IOOS DMAC enterprise, integration of the results of the brokering/scalability tool with the IOOS Catalog, and improvement of tools for managing biological data. An overarching goal is to continue to steward these projects using best practices for open source software development in hopes of bolstering the IOOS/Axiom investment with input from a larger open source community. This includes improving documentation/planning/testing/ease-of-use to further mature the projects and maximize the likelihood of external contributions and use by the community.

PROJECT OBJECTIVES:

The objectives of this project are to:

1. Support the IOOS office by cultivating software packages and national DMAC networks.

OBJECTIVE 1: IOOS OFFICE ACTIVITIES***Task 1: i52n Suite Maintenance and Development***

The central aim of this task is to augment and maintain the i52n SOS server. This subtask includes adding additional observation response encodings (IOOS CSV and IOOS enabled GeoJSON), incorporating upstream bug fixes and enhancements from the stock 52 North SOS, and submitting bug fixes to the upstream 52 North SOS.

In addition to this central focus, this task also supports ongoing enhancements and improvements for supporting software packages. Examples of related IOOS SOS tools include the ioos-sos-compliance-tests test suite, sos-injector library, and sensor-web-harvester data collection tool. One of the goals of IOOS technical development is to create a collection of mature software tools that can be used by the entire ocean observations data management community. However, to encourage widespread community use, we must view these software packages and standards as

products for public use, and not for use solely by IOOS organizations. Under this task, considerable effort will be focused on making the IOOS SOS suite of tools more robust through better documentation, testing, installation scripts and planning. In addition, this task involves direct engagement with technical staff at regional associations and other observing systems to assist in adoption, propagation and support of these technologies. As IOOS software is used by an increasingly large community, gaps in documentation, software bugs, and new enhancements will surface. To facilitate better testing and quality control of the software packages, “gold standard” test data sets and robust test servers will be developed.

Axiom will also investigate opportunities to collaborate and/or align efforts with Ocean Data Interoperability Platform (ODIP). ODIP is also utilizing a 52 North SOS server stack, and there may be leveraging opportunities in regard to software development tasks and response encoding standard definition. This subtask may include travel funding to attend an ODIP workshop and/or meet with ODIP developers.

Key software stewardship activities include the following subtasks; approximate allocation of resources for each subtask is provided in parentheses.

- **A) Defining High-Level Feature Roadmaps (5%)** - Provide well defined release milestones for upcoming versions. The Roadmap should include a high level description of where the software project is going, and will help to put in place a framework for longer term budgeting that shows how the software dovetails with system-wide strategic plans. It also helps community developers gain an understanding of the project goals to determine how, or if, they can contribute and if changes will impact their internal systems.
- **B) Release Planning and Management (10%)** - Determining a realistic software release plan is an important step for setting expectations within the IOOS Program Office and for external users. There are a variety of tools that can be used to assist in release planning, many of which support agile software development processes. Regardless of the tool, every software package funded by IOOS must have a release plan. Release plans should be written at a high enough level of detail that dates can be assigned and resources allocated. However, release plans (particularly in agile development environments) are not immutable contracts; if issues arise during project execution, features can be reallocated across releases. Ultimately, the projects are operating on a fixed budget and schedule, so the only available degree of flexibility is that of scope.

Further:

- All software releases should be accompanied by a minimum set of documentation, including README.txt, release notes and CHANGES file¹.
- Releases shall follow Semantic Versioning practices as described at:
<http://semver.org/>
- **C) Enhancements and Bug Fixes (50%)** - Planned enhancements include the implementation of IOOS CSV and GeoJSON observation encodings as described above. Feature enhancements will also be incorporated from the upstream stock 52 North SOS

¹ Best practices for release documentation: <http://oss-watch.ac.uk/resources/releasemanagementbestpractice>

project. The IOOS github repository (<https://github.com/ioos>) will be the primary reference site for IOOS-funded software projects, and all should be the tool used for tracking enhancement requests and software defects (bugs). Github issue labels and milestones can be used to indicate priority and planned release for enhancements and bug fixes.

- **D) Improved User Documentation (15%)** - A very important aspect of software stewardship is the ongoing maintenance and expansion of documentation. All documentation should be updated to incorporate changes to the software packages and lessons learned. There is also a need to expand the breadth and utility of the documentation, to make packages more user friendly (e.g. platform-specific installation instructions, step-by-step user guides for less tech-savvy community members, usage examples etc.). In addition, all IOOS projects should have an examples directory with a few well commented scripts showing how to use software libraries and tools. These examples can be leveraged as acceptance criteria for new features.
- **E) Establishment of Test Environments and Test Datasets (10%)** - A key challenge in deploying software tools to a broad community is ensuring the software is stable and well-tested before it is widely distributed. This requires a robust test environment with adequate test data sets that will adequately exercise all aspects of the software. Standard test datasets will be developed and made available to the public for consistent testing of IOOS SOS tools.
- **F) Investigate ODIP Collaboration Opportunities (10%)** - Since ODIP is also utilizing a 52 North SOS stack and focusing on sensor observation interoperability, collaboration opportunities should be investigated. This may include leveraging software development time or aligning observation encodings where possible. This task may include travel funding to attend an ODIP workshop or meet with ODIP developers.
- **G) IOOS SOS 2.0 Template Development** - OGC published the SOS 2.0 specification in 2012, which incorporates updated versions of the O&M, SWE, and GML specifications. These updates provide more advanced and optimized request and response encoding capabilities than SOS 1.0. Of particular interest is the addition of a spatial filtering profile, which will allow SOS clients to filter observations based on the individual observation location (useful for mobile sensors/gliders). SOS 2.0 also allows additional flexibility in the format of Capabilities responses, which will allow for the reduction of bloat and noise in SOS responses. To streamline the creation of IOOS SOS 2.0 templates using the SOS 2.0 specification, Axiom will produce draft templates of GetCapabilities, Describe Sensor, and GetObservation responses, which will then be opened for comments from the larger IOOS group for a defined time period (probably one to two months). Describe Sensor templates for networks, stations, and sensors will be produced, and GetObservation response templates will include all relevant CF feature types (time series, time series profile, trajectory, and trajectory profile).

Task 2: Enhancements of the Environmental Sensor Map on ioos.us

The goal of this project is to continue enhancements to the Environmental Sensor Map and to continue to integrate it with the latest version of the IOOS Catalog. Software stewardship activities described above also apply to Task 3.

- **A) Defining a high-level roadmap** - this will include defining what constitutes the various versions of the Map, describing major target enhancements and estimating the number of releases based on enhancements anticipated to be completed within the current budget and period of performance. As with the other IOOS software packages, the Roadmap should include a high level description of where the software project is going, and will help to put in place a framework for longer term budgeting that shows how the software dovetails with system-wide strategic plans. The roadmap will also help to identify and prioritize development of and enhancements to other IOOS software tools. It also helps community developers gain an understanding of the project goals to determine how, or if, they can contribute and if changes will impact their internal systems.
 - Continue to add RA data to the map.
 - Enhance linkages to the IOOS Catalog, as it is developed and as RA metadata/services are corrected/enhanced.
- **B) Release Planning and Management** - A realistic software release plan is an important step for setting expectations within the IOOS Program Office and for external users. The Release Plan will define the number of anticipated releases and include target dates for each. However, as with the software packages in Task 1, Release Plans (particularly in agile development environments) are not immutable contracts, if issues arise during project execution, features can be re-allocated across releases. Ultimately, the projects are operating on a fixed budget and schedule, so the only available degree of flexibility is that of scope.
- **C) Enhancements, Bug Tracking and Fixes** The IOOS github repository (<https://github.com/ioos/freezing-avenger>) is the primary tool for tracking enhancement requests and software defects (bugs). Github issue “labels” and “milestones” will be used to indicate priority and planned release for enhancements and bug fixes. The following list provides a summary of the initial backlog of updates and enhancements that will be considered during the release planning process. These tasks will be further prioritized during the planning process and the number of releases will be defined by the release plan:
 - Support and cultivation of the map
 - Client Libraries (HTML 5) for Federal Backbone Broker Map and Assets Map can be deployed to catalog.ioos.us and backend services can exist on Axiom infrastructure OR client libraries and backend services (just broker and asset map analytics) can be run on Axiom infrastructure under another subdomain or path point to our systems.
 - Differentiate between maps - need descriptions
 - Add assessment phase of backend catalog services and data model to ensure that NextGen Hex bin will work
 - An API will be developed, exposed and documented so that external users and systems can programmatically interact with the data in the HPC cache. This API will emulate SOS style requests/response services in addition to several higher level methods which allow users access summary analytics and advanced packaging of data for downloading.
 - Ingest new data sets according to the priorities expressed in the project Github repository <https://github.com/ioos/freezing-avenger/issues/>
- **D) Improved documentation** - Documentation of the deployment environment including hardware and software technologies and dependencies. This documentation

must include a plan for migrating the entire application to a new computational environment.

Task 3: ATN Data Standards

The IOOS office and ATN DAC at Stanford (<http://oceanview.pfeg.noaa.gov/ATN/>) have made great strides in developing standards, tools and systems for managing animal telemetry data sets. Axiom proposes to complement these existing efforts by providing tools for users producing animal telemetry data sets which streamline the data management process and accelerate integration into relevant data assembly centers (ATN DAC).

The Research Workspace will be utilized to provide investigators collecting animal telemetry data with tools and interfaces to accelerate the correct management of this information and accelerate the process of submission to the ATN DAC based on ATN existing standards and services (<https://github.com/ioos/animal-telemetry>).

Figures 1 and 2 show notional examples of the types of queries and input capabilities that will be discussed and prioritized in the user meetings mentioned in the subtasks.

Objectives:

1. Facilitate getting external data providers submitting information.
2. Use the RW to capture, store temporarily, and document ATN data.
3. Investigate the data model used in the current ATN and assemble a generic data submission package that contains all requirements needed by the DAC
4. Get at least two new data providers submitting data to the ATN DAC

Specific subtasks for the above objectives may include:

- Under direction of Hassan Moustahfid and in close coordination with ATN DAC project manager at Stanford (Randy Kochevar) develop a detailed project plan and timeline including role and responsibilities.
- Organize meetings (mostly virtual) to discuss specific details on how to improve the workspace to enable ATN data sharing.
- Integrate the Workspace with ATN data sharing tools with the ATN DAC front end interface (perhaps by just adding the link to the workspace directly as a new tab with other data integration tools that exist in ATN DAC <http://oceanview.pfeg.noaa.gov/ATN/>).
- Propagate and Package this information for use by the IOOS community (i.e. workspace + guide on how to use it to enable ATN data sharing) . This can be as training material that we can pursue in FY16.

Deliverables:

- Demo of the workspace with improved tools
- Final report + Documentations of the workspace ATN improved tools (how to use the workspace to integrate ATN Data)

Task 4: AIS Analytical Tool

Axiom Data Science will develop a scalable methodology for storing and querying the national AIS data set assembled by the NOAA Office of Coast Survey (~20 Billion records) to produce standard and customizable outputs and data products. This project will build upon a prototype AIS analysis platform that was developed in the summer of 2015 utilizing 300 Million AIS records. The team will benchmark and test several horizontally scaling data sharding approaches (Postgres-XL, Hadoop, Mongo DB, Elastic Search) to determine an optimal approach and technology for storage and analysis of the data set. This project will leverage several in kind contributions and funding matches. Axiom will provide 8 high performance compute nodes (96 cores, 576 GBs of Ram, 48 TBs of storage) for long term support of the AIS data storage and analysis platform. The Alaska Ocean Observing System will provide 25K of match. Additional match is being sought from several partners including National Ocean Service, Department of Homeland Security and others. The following list of bullets details core functionality expected to be delivered from the Phase I of this effort.

- interact with data in ArcGIS
- filter data both spatially and temporally
- build tracklines using user-defined parameters (distance and time)
- maintain transit id, MMSI, IMO and other vessel characteristics
- output subsets based on time/distance, vessel type
- define resolution, output coordinate system
- calculate density per cell based on:
 - Total number of vessels
 - Total number of unique vessels (based on MMSI/IMO)
 - Total number of unique vessels with user-defined cap (number of vessels within an individual cell may be set to not exceed a customizable number)
- clean data to separate time at anchor vs time in transit.
- be run on a large (national) scale.
- generate null values for grid cells where there is no vessel traffic (we are interested in the entire area between the shoreline and the extents of the US EEZ)
- generate a raster output
- calculate difference between charted depth and reported vessel draft possibly using an authoritative list of vessel characteristics associated with MMSI numbers (future requirement)
- calculate number of unique vessels within a given grid cell navigating within 1 m of the charted depth (future requirement)

Task 5: HFR Range Series and the Research Workspace

Improved tools for preserving High Frequency Radar (HFR) output and allowing for reprocessing HFR data: applying Research Workspace to capturing, documenting, and preserving HFR Range Series files

HFR Range Series files are a low-level intermediate file produced by HFRs. The output captured in these files are processed and combined with platform and site specific metadata to create range-Doppler spectra which are further processed to produce radial velocity files. The radial velocity files are then further processed using various gridding algorithms to create the gridded total vector files which are served through the HFRnet and NDBC THREDDS servers. The total vector files are the product most often used by external customers.

IOOS HFR community members have formed a working group (WG) under management by the IOOS Program Office to develop a straightforward instruction manual for HFR operators as to how to use the Axiom workspace. The WG will engage with Axiom once its initial requirements are identified in the draft manual. Axiom will be providing support and input to the HFR operators as the manual gets finalized and when the workspace goes “live” for HFR usage.

PLAN FOR DATA DELIVERY:

N/A

MILESTONES

- **Project begins June 1st, 2016**
- **Environmental Sensor Map Improved with API Access Jan 1, 2016**
- **Semi-annual report due December 10, 2015**
- **52 North Software Stack upgraded to SOS 2.0 templates May 1, 2017**
- **AIS analytical system complete May 1, 2017**
- **Semi-annual report due June 10, 2017**

DELIVERABLES:

- **December 2015 Semi-annual report**
- **June 2016 Semi-annual report**
- **Participation in one AOOS-sponsored stakeholder-scientist workshop (if available)**
- **Presentation to AOOS Board**
- **1 story for AOOS newsletter (upon request)**
- **SOS 2.0 52 North Software Stack**
- **Advanced National Sensor Map Deployed**
- **AIS Analysis Tool**
- **Research Workspaces for HFR data and ATN data**

Project: AOOS 2400-67

PI: R. Bochenek

a. Personnel	
Rob Bochenek	
4 Brian Stone	
Chris Turner	
Malcolm Herstand	
Will Koeppen	
John Dunaway	
Jordan Jenckes	
Luc Mehl	
Dave Foster	
Lance Finrock	
Ross Martin	
Stacey Buckelew	
Jessica Austin	
Kyle Wilcox	
Shane Stclair	
Total Personnel	
b. Fringe Benefits (@30%)	
Rob Bochenek	
Brian Stone	
Lance Finrock	
Ross Martin	
Dave Foster	
John Dunaway	
Jordan Jenckes	
Luc Mehl	
Dave Foster	
Lance Finrock	
Chris Turner	
Malcolm Herstadt	
Jessica Austin	
Kyle Wilcox	
Shane Stclair	
Total Fringe Benefits	
c. Travel and Per Diem	
Airfare	
Total Travel and Per Diem	
d. Equipment/software >\$5,000	
Total Equipment>5000	
e. Supplies/commodities/equipment <\$5,000	
Various Suppiles	
Total Supplies/commodities< 5000	
f. Contracts/Services:	
Total Services	
Sub-Award	
Total Sub-Awards	
g. Other (Facilities Rate 21%)	
21% of Personell and Fringe	
TOTAL Categories	

		344,538	
		YEAR 1	
		Budget	MTDC
	Sal/yr		
	% FTE		
		12,746	12,746
		23,238	23,238
		0	0
		0	0
		12,962	12,962
		19,204	19,204
		12,309	12,309
		15,369	15,369
		24,636	24,636
		27,283	27,283
		0	0
		14,659	14,659
		0	0
		31,045	31,045
		24,836	24,836
		218,285	218,285
	Rate		
		3,824	3,824
		6,972	6,972
		0	0
		0	0
		3,889	3,889
		5,761	5,761
		3,693	3,693
		4,611	4,611
		7,391	7,391
		8,185	8,185
		0	0
		4,398	4,398
		0	0
		9,313	9,313
		7,451	7,451
		65,486	65,486
	Rate		
	Qty		
		0	0
		0	0
		0	0
		1,175	1,175
		1,175	1,175
		0	0
		0	0
		0	0
		59,592	59,592
		344,538	344,538

Total Per Funding Source

344,538

Axiom Data Science Budget Justification Year 1

The requested funds will pay for salary for several investigators over the project which will begin on June 1st, 2016 and end May 31st, 2017.

Year 1 Personnel (\$218,285.00) – Rob Bochenek is budgeted for 12% FTE to manage the project and personnel. Stacey Buckelew is budgeted at 20% FTE to support the Animal Telemetry Network and manage the project. Shane StClair is budgeted at 24% FTE to support the IOOS SOS stack. Lance Finrock is budgeted for 28% FTE to support the IOOS SOS effort and scalability experiment. John Dunaway is budgeted at 25% FTE to develop web services and process data. Will Koeppen is budgeted at 15% FTE to provide scientific support. Jordan Jenkes is budgeted for 25% FTE to support data processing and integration. Kyle Wilcox is budgeted for 30% FTE to support the IOOS python libraries. Dave Foster is budgeted for 24% FTE to support python programming tasks. Brian Stone is budgeted at 24% to support user interface systems.

Year 1 Fringe (\$65,486) – Fringe benefits cover 401K, health insurance, and paid leave for staff salaries.

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Year 1 Facilities (\$59,592) – Funds are budgeted for support of the Axiom server infrastructure calculated at 21% of personnel costs.