



2013 Work Plan Oil Spill Recovery Institute

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Prince William Sound Oil Spill Recovery Institute

2013 Work Plan

I. Purpose and organization of this document

This document describes the Oil Spill Recovery Institute (OSRI) 2013 Work Plan in the context of the overall Research Plan approved by the OSRI Board in February 2010 for fiscal years 2011 through 2015. The Research Plan should be referenced for detailed descriptions of the OSRI Program, the planning process and supporting documents. The annual reports and previous work plans should be referenced for more information regarding previously funded projects. The 2013 Work Plan provides descriptions of projects proposed for funding in the 2013 fiscal year beginning October 1, 2012 and a brief description of projects funded in previous years that have funding continuing into fiscal year 2013 (FY13). The OSRI Science Plan and previous OSRI Work Plans can be found on the internet at: www.pws-osri.org.

II. OSRI Strategic Goals and FY13 Work Plan New Projects

The Advisory Board of OSRI and the Executive Committee of the Board of Directors for the Prince William Sound Science Center (PWSSC) conducted a strategic planning session in 2008. The purpose of the planning session was to evaluate the past, the present, and plan for the future of OSRI. Four goals were identified as part of the strategic plan: Understand, Respond, Inform, and Partner (see OSRI Science Plan). The fiscal year 2013 Work Plan has been placed in the context of these four goals.

A. Goal #1 Understand:

Attain an interdisciplinary understanding of: the fate and effects of spilled oil in Arctic and sub-Arctic marine environments and the recovery of those environments following a spill.

Real time physical observations of surface and subsurface current direction and magnitude, and biological observations on resources in the path of the spill are absolutely essential to effective and timely oil spill response. Without a reliable forecast of the direction and speed of a spill, and knowledge of the resources likely to be impacted, even the best clean up technologies in the world may be misapplied.

This goal addresses the OSRI mandate to “determine, document, assess, and understand the long-range effects of Arctic or subarctic oil spills”. The objectives listed in the science plan are to:

- Evaluate short and long-term effects.
- Identify chemical, biological, and physical impacts and consequences.

- Emphasize the nearshore region.
- Identify the impacts of oil spill response options.
- Profile potential impacts from oil spills on the economy, life-style and well-being of communities and resource users.

This work plan describes projects totaling \$235K for projects related to Goal #1. OSRI has elected to support a portfolio of initiatives.

- (1) Support for operation of SNOTEL meteorological stations in partnership with AOOS.
- (2) Research leading to validation of hydrological models.
- (3) Continued partnership with NPRB for biological research.

1. Physical science programs

The OSRI science plan outlines an approach for addressing goal #1. This approach builds upon lessons learned during the 2009 Sound Prediction experiment that tested the modeling and observational capabilities of the Prince William Sound Observing System (PWSOS). There are two primary goals of the Prince William Sound Observing System. The first is to combine long-term monitoring with short-term hypothesis-driven process studies to understand mechanisms underlying the regional ecosystem dynamics. Understanding the circulation and the patterns of water exchange will provide a solid scientific foundation for addressing fisheries and ecosystem management needs related to long-term oceanic and climatic variability. The second goal is to provide information to the major user groups in Prince William Sound (PWS) including the coastal communities, oil and gas transportation industry (tanker traffic and oil spill response), air taxis, commercial fishermen, recreational and commercial boaters, and Coast Guard search and rescue operations.

Coastal surface circulation is commonly determined by seasonal freshwater input. Our ability to predict freshwater fluxes in PWS is challenging due to: 1) high quantities of rainfall in southern Alaska, 2) few gauged rivers, 3) the amount of freshwater flowing in small creeks, and 4) the contribution of freshwater from glacial melt. Errors in the modeling of freshwater input lead to biases in the modeled salinity that can potentially lead to errors in modeled surface currents that are important to oil spill response. The PWSOS includes several SNOTEL meteorological stations that are designed to help improve our understanding of freshwater input. We desire to utilize these stations to build an observation program designed to test the hydrological model.

These programs address the surface circulation portion of the OSRI Research Plan.

a. Meteorology (OSRI cost: \$10K)

Understanding the circulation of Prince William Sound requires accurate measurements of wind fields and precipitation. Snowmelt runoff and rainfall creates a freshwater layer that sets up aspects of the surface circulation. Wind stress then modifies the circulation creating local and seasonal circulation patterns. By understanding the basic meteorological conditions, including precipitation, we hope to improve our ability to model the hydrology of Prince William Sound, improve our understanding of the forces driving seasonal changes in circulation, and provide oil spill response organizations with necessary data.

Snowpack Telemetry (SNOTEL) meteorological stations set up in partnership with the Natural Resources Conservation Service (NRCS) and the Alaska Ocean Observing System (AOOS) measure precipitation from snow and rain throughout the year and are needed to establish the freshwater budget. Since the summer of 2005, six new SNOTEL stations have been deployed at sea level in PWS, and two stations at alpine elevations. Each station in PWS measures temperature, wind speed and direction, precipitation from rain and snow, and solar radiation. With several years of data now available, we are able to more quantitatively test our understanding of freshwater input into PWS.

The SNOTEL stations provide important information about the amount of freshwater stored as snow in the watershed of Prince William Sound, an important driver of summertime circulation in the Sound. Deployment of the SNOTEL Stations was funded by a combination of grants to the Prince William Sound Science Center (PWSSC) from the National Oceanic and Atmospheric Administration (NOAA), Exxon Valdez Oil Spill Trustees Council (EVOS), AOOS, PWS Regional Citizens' Advisory Council, and OSRI.

The annual operating cost for the weather stations is about \$4K per station per year. The operating costs include regular maintenance, calibration of sensors, access to the sites, and telemetry related expenses. The FY13 budget includes \$10K for National Resource Conservation Service maintenance of eight sites. This represents a further decrease in OSRI's commitment to these sites as they are now considered operational rather than a demonstration. Funding for operation of these sites is being transitioned to AOOS. Continued support of the sites is important for the Hydrological Model Validation.

b. Hydrological Model Validation (OSRI cost: \$125K)

A bias in the modeled salinity was observed during the 2009 Sound Predictions exercise. This bias was the underlying cause of the difficulty of hydrological modeling in a region with limited information on freshwater flow and large input of freshwater from precipitation and glacial melt. The existing hydrological model relies on river gauge data from the Copper River, which has a very different watershed than PWS, and modeled precipitation, which has not been validated. In 2009 the meteorological modeling effort funded by OSRI included a precipitation validation component. However, nothing is available for estimating input from glacial melt.

In FY12 OSRI sought proposals for a three-year project to validate the hydrological model currently being used as input to the oceanographic model developed for Prince William Sound. A proposal led by Dr. David Hill of Oregon State University with contribution from the University of Alaska Fairbanks and University of Alaska Southeast was selected. Funding began in FY 12. The work combines measures of precipitation, snowfall, and stream gages with a high-resolution hydrological model. The objectives are to:

- Apply and modify a suite of recently developed and proven highly distributed models for the prediction of weather, snowmelt processes, and streamflow to the PWS watershed.
- Sustain existing weather stations in PWS and deploy additional stations (at high elevation).
- Sustain existing stream gaging stations in PWS and deploy additional streamflow instrumentation suites.
- Integrate our modeling work and data collection efforts with other related modeling and observational efforts in PWS.

Focused measurement areas are near Cordova, Valdez, and Whittier. The output of the hydrological model will be input to the ocean circulation model run by Dr. Yi Chao.

The overall OSRI budget is expected to be \$290K with \$75K in FY12, \$125K in FY13, and \$90K in FY14. The Alaska Ocean Observing System is also contributing \$100K over the life of the project.

2. Biological science programs

The current five-year research plan emphasizes nearshore biology and a desire for working in partnership. To understand the recovery from an oil spill requires a biological research program capable of both helping define baseline conditions and monitor recovery. To achieve the objective laid out in this Science Plan, OSRI expects to fund the following research program.

Funding partnership with the North Pacific Research Board (NPRB) (OSRI cost: \$100K)

The NPRB and OSRI have science plans that encourage research partnerships. Section 4.2.3 of NPRB's science plan directly responds to a strong recommendation of the National Research Council to seek partnerships with other entities to support joint research and funding of projects of mutual interest. Similarly, Section III.A.1 of OSRI's research plan identifies a potential partnership with NPRB to support ecological research projects in Arctic and sub-Arctic climates. NPRB and OSRI have science and implementation plans that provide the foundation for defining research priorities of mutual interest in any given year.

This year OSRI will review proposals from many potential topic areas in the NPRB request for proposals that overlap with OSRI's research plan. The OSRI research plan notes that the nearshore environment is the most likely area to be impacted by an oil spill, therefore knowledge of the environment and ecology of this zone is of greatest use to OSRI. There is also increasing pressure from shipping and oil development in the Arctic that makes that area of particular interest.

OSRI may contribute up to a total of \$100K for one or more projects relevant to its research plan.

B. Goal #2 Respond:

Enhance the ability of oil spill responders to mitigate impacts of spills in Arctic and sub-Arctic marine environments.

This goal addresses the OSRI mandate to "identify and develop the best available techniques, equipment, and materials for dealing with oil spills in the Arctic and subarctic marine environment." The objectives listed in the Research Plan are to:

- Fill knowledge gaps on behavior of spilled oil.
- Fill knowledge gaps on the use and effectiveness of specific mitigation techniques.
- Identify and evaluate new prevention and response technologies.

The components to achieve these objectives are described below.

1. Technology research and development

This work plan describes projects totaling \$150K for projects related to Goal #2, oil spill response, OSRI is looking to fund projects in partnership with other organizations or that complement ongoing research programs.

a. Partnership proposals. (OSRI cost - \$150K)

A number of agencies, organizations, and industry members fund research designed to improve spill response. The missions of the various groups can be diverse, but overlap with OSRI's mandate to identify and develop the best available techniques, equipment and materials for dealing with oil spills in the Arctic and sub-Arctic marine environment. Such organizations include, but are not limited to, Bureau of Ocean Energy Management (BOEM, www.boem.gov), Bureau of Safety and Environmental Enforcement (BSEE, www.bsee.gov), Coastal Response Research Center (www.crrc.unh.edu), Alaska Clean Seas (ACS, www.alaskacleanseas.org), Prince William Sound Regional Citizens Advisory Council (PWSRCAC, www.pwsrcac.org), United State Coast Guard (USCG, <http://www.uscg.mil/hq/cg9/rdc/>), Emergency Preparedness Prevention and Response, North Slope Borough (www.north-slope.org), American Petroleum Institute

(www.api.org), and the oil industry. The oil industry currently has a joint industry program (JIP) focused on biodegradation in the Arctic, and in May 2011 started another JIP focused on several arctic spill response issues, including detection and tracking, improved mechanical recovery, in-situ burning, and fate of dispersed oil.

Expected opportunities for partnerships this year include working with BSEE to provide time at the Ohmsett facility with oil and ice available for use to demonstrate Arctic projects. Additional work with oil in ice may be available at the Cold Regions Research and Engineering Laboratory in partnership with Alaska Clean Seas. The Coast Guard is planning another exercise to demonstrate different sensors in the ice environment of the Great Lakes. With the Arctic JIP active we expect that there will be opportunities to contribute to their efforts. For instance, industry is looking to build a large (20m x 40m x 3m) test facility on the North Slope for spill response training and equipment testing.

By pursuing potential partnerships OSRI can leverage its limited funds to engage in larger projects, expanding the total budget for innovation. It should be noted that it is inherently expensive to work in Arctic and sub-Arctic regions, which increases the cost of proposals. OSRI will look to contribute to a JIP aligned with our research goals. If a partnership in a JIP or elsewhere is unavailable for the OSRI developed research topics OSRI will develop and release an RFP as the sole funding source. The research topics will be guided by these OSRI science plan response subjects:

- 1) Oil Spill Detection and Tracking
- 2) Spill Response in Ice
- 3) Best Practices
- 4) Spill Response Information Tools

Potential areas of research include, but aren't limited to:

- 1) Demonstration of airborne remote sensing technologies for broken ice conditions. (Partnership with BSEE at Ohmsett)
- 2) Demonstration of Autonomous Underwater Vehicle (AUV) applications under ice. (Partnership with USCG or Alaska Clean Seas)
- 3) Demonstration of underwater technologies for detecting oil encapsulated in ice. (Partnership with Alaska Clean Seas)
- 4) Testing new spill recovery equipment in Arctic and sub-Arctic waters. (Partnership with JIP)
- 5) Testing the stickiness of physically and chemically dispersed oil on arctic organisms.
- 6) Demonstration of unmanned vessels for meteorological measurements.
- 7) Developing best practices and tactic guides for spill response.
- 8) Non-mechanical response options in ice.

A total of \$150K is expected to be available to fund one or more proposals under this topic area.

C. Goal #3 Inform:

Disseminate information and educate the public on the issues of oil spill prevention, response, and impacts.

The objectives of this goal are to:

- Facilitate the exchange of information and ideas through education and outreach.
- Brief the scientific community and oil spill responders on OSRI products.
- Develop and maintain a web page that provides relevant and timely information.
- Provide graduate and undergraduate fellowships and internships.

The approach to reach these objectives OSRI proposes spending \$150K to fund a suite of projects related to education and outreach along with supporting workshops and conferences that provide a means to disseminate OSRI research.

1. Education

Development of future researchers, engineers, and others involved in oil spill response requires an education component that exposes students to the issues important to ecology and technology. OSRI has been a strong supporter of education programs targeting students from kindergarten to graduate school. OSRI intends to continue building upon the existing regional education and outreach programs.

a. Graduate Research Fellowships (OSRI Cost: \$50K)

Support of graduate students provides a means of focusing people at the start of their careers on oil spill related issues. OSRI funds are provided to support graduate projects that will better understand the social and economic effects of oil spills on coastal communities, provide information needed by managers and decision-makers for oil spill response and recovery, improve the technologies available to spill responders, and improve public awareness and understanding of marine and estuarine ecosystems.

Masters students may be supported for two years and doctoral students for up to three years. Applications for extensions beyond that time frame will be considered during the last year of existing funding. Students will be expected to present results to the OSRI Board at some point in their fellowship. Two Graduate Research Fellowship projects will be supported in FY13. Both are continuing fellowships and no new fellowships are expected in FY13.

Continuing fellowship: Remediation monitoring using microbial DNA profiles

Saum, University of California Riverside.

Lingering oil pockets still found in the beaches of the Prince William Sound (PWS) demonstrate that petroleum hydrocarbons can persist and continue to damage ecosystems decades after initial cleanup efforts following a marine oil spill. Currently, the methods of monitoring marine oil bioremediation efficiency are chemical processes

that can take over a month to return results and can cost up to \$1,000 per assay if outsourced commercially. The goal of this research project is to develop molecular biology tools to monitor the state of polycyclic aromatic hydrocarbon (PAH) degradation in oil contaminated beach sediments in near real-time by tracking the dominant bacterial species and their associated dioxygenase genes that function for oil degradation. Bacterial populations of PWS beaches will be collected via sediment sampling as well as activated carbon sampling columns. The extracted and purified microbial DNA will be amplified at both the 16S rRNA and dioxygenase gene sequences via polymerase chain reaction (PCR), and analyzed with terminal restriction fragment length polymorphism (TRFLP) through capillary electrophoresis. In order to quantify the 16S rRNA gene sequences, each purified DNA sample will also be analyzed via real-time PCR using primers for bacterial species of interest. The community composition and dioxygenase enzyme patterns will then be used to train a neural net statistical program for pattern recognition of PAH degradation status. Chemical analyses will be conducted via gas chromatography to verify the PAHs present in each sample.

The results of this project will produce a more rapid and inexpensive method of monitoring the rate of marine oil degradation by microbial communities. Potential application of the data generated by this procedure includes evaluation and addition of the dominant bacterial species' trace nutrient requirements in order to achieve effective biostimulation in the PWS.

This year is the third year of OSRI support for this Ph.D. project.

Continuing fellowship: Molecular Characterization of Arctic Marine Petroleum-degrading Microbial Communities and Comparison to the Deepwater Horizon

McFarlin, University of Alaska Fairbanks.

As the oil industry continues to explore drilling and production activities in the Arctic, it becomes imperative to understand how the marine microbial community will respond to petroleum inputs and their potential to biodegrade the contaminant. This research proposal will identify arctic marine microbial communities in the surface, sub-surface and deep waters in Shell Oil's 193 lease location in the Chuckchi Sea. It will determine if these same species are also located in nearshore environments of Barrow, AK. In addition to microbial species characterization and quantification, it is also important to determine their potential to biodegrade petroleum and chemically dispersed petroleum. High throughput pyrosequencing of bacterial 16S rRNA genes will be conducted on filtered seawater samples to provide information regarding the taxonomic identity of the microbial communities. Filtered seawater samples will also be analyzed by GeoChip microarrays. This powerful technology detects hundreds of thousands of different microbial functional genes simultaneously and is a measure of the biodegradation potential of a microbial community. This research proposal will also capitalize on preexisting filtered samples from mesocosms of Alaska North Slope (ANS) crude oil and chemically dispersed ANS incubated at -1°C with indigenous microorganisms from fresh Chuckchi Sea water. Pyrosequencing and GeoChip data from these filters will be

compared to deep-sea dispersed oil samples from the Deepwater Horizon blowout, in collaboration with Dr. Terry Hazen. During the Deepwater Horizon spill, Hazen *et al.*, 2011 performed the most comprehensive molecular microbial analyses ever performed on an oil spill, which also occurred in deep, cold waters (5°C). This proposal will provide an arctic microbial community baseline and insight into how this important region of the Alaskan arctic marine ecosystem would respond to inputs of petroleum and how it compares to another well-studied cold water system.

This year is the second year of OSRI support for this Ph.D. project.

b. K-12 School Year Programs: (OSRI Cost: \$45K)

OSRI will continue to support the Prince William Sound Science Center's Discovery Room school year programs in order to introduce younger students to the concepts important to understanding oil spill response and the recovery of the environment. Programs include oceanographic monitoring, environmental education, and an introduction to oceanographic technologies. Beyond classroom delivery OSRI is requesting that a strategy be developed to transfer the classroom activities to other geographic areas, particularly rural communities, and effectively develop partnerships.

This funding is for the third year of a three-year project to continue the Discovery Room environmental and technical education at the K-12 level. Funding in FY13 is expected to be \$45K with a three-year total of \$135K.

c. Internship: (OSRI Cost: \$12K)

Undergraduate internships provide a mechanism to support students who will become the future workforce, but who are not necessarily continuing their education in graduate school. This is particularly true of students getting degrees designed to prepare for jobs with oil spill recovery organizations. This program is intended to provide an internship for a student to work with an oil spill response organization on activities related to Arctic and subarctic issues.

OSRI will seek proposals from a spill response related organization to support an internship of up to \$12K at their organization.

2. Outreach

Outreach to the public, researchers, and spill responders is important in ensuring OSRI's activities provide benefits and are peer-reviewed. Several means have been used to publicize OSRI's activities including sponsoring workshops and conferences, outreach activities of the Research Program Manager, and supporting public outreach through lecture series, radio programs, and development of printed materials. This year the funding for the latter activities has been included in the Research Program Manager's budget.

a. Workshops and Conferences (OSRI cost: \$43K)

These funds are for workshops or special projects at the discretion of the OSRI Advisory Board. Funding is set aside for regularly scheduled conferences where OSRI funded research is presented and for supporting workshops that help OSRI achieve its mission. Workshops being considered for FY13 support include:

(1) **Alaska Marine Science Symposium.** (OSRI cost: \$4K) Each January, researchers from throughout Alaska are invited to participate in a 3-4 day conference. It is an excellent opportunity for presentation of new results and networking. OSRI will contribute \$4K to support this workshop, which will be held in late January in Anchorage.

(2) **Alaska Forum on the Environment.** (OSRI cost: \$5K) OSRI will continue its support of the Alaska Forum on the Environment, which is typically during February in Anchorage. The conference covers many issues relevant to understanding the potential impact of oil spills in Arctic and sub-Arctic marine environments. OSRI will allocate \$5K to the Alaska Forum on the Environment. A limited number of registration waivers will be available for the staff, Board, and Scientific and Technical Committee to attend the workshop.

(3) **Workshops of opportunity.** (OSRI cost: \$34K) Many important workshops occur that could provide improved products with a little additional support. The support provided here is intended to help cover the cost of running the workshop, the addition of teleconference capabilities, providing a facilitator or report editor, or other needs. We foresee several opportunities to support such workshops this fiscal year. Potential workshops include the Northern Oil and Gas Forum, a workshop on a comparison of *in-situ* oil detectors, and an opportunity to partner on a workshop for identifying new techniques to clean small spills. OSRI will allocate a total of \$34K to support workshops that align with the OSRI mission.

D. Other Programs

1. Program coordination (OSRI cost: \$135K). The position of OSRI Research Program Manager is a programmatic expense. The total costs include salary, benefits, travel and commodities. The Research Program Manager's responsibilities include:

- Preparation of the annual work plan in consultation with the Board-appointed Work Plan Committee and in accordance with the Five-Year Science Plan adopted in 2005. Compiling information about potential projects, writing brief project descriptions and preparing project budget estimates.
- Implementing the work plan as approved by the Board. This includes drafting requests for proposals based on the Annual Work Plan priorities, and coordinating the peer review process with OSRI's Scientific and Technical Committee and with other organizations OSRI partners with for research projects.

- Coordinating with the Chair of OSRI's Scientific and Technical Committee (STC) to assure regular transfer of information between the OSRI Board and the STC. Also provide assistance, as requested by the STC Chair, in scheduling meetings.
- Meeting 2-3 times per month with the OSRI Executive Director (ED) to exchange information concerning program issues and contract awards. Work with the ED to develop a monthly program report for distribution to the OSRI Board.
- Assisting the Executive Director to ensure compliance with all policies and procedures of the OSRI Grant Policy Manual.
- Coordinating the processing of contracts for successful proposals. Monitor progress and final report deadlines for these contracts.
- Preparing bi-annual reports on OSRI grant awards and research and education programs for distribution to the OSRI Board.
- Preparing and publishing an annual report for broad distribution.
- Supervising maintenance of the OSRI website.
- Collaborating with the OSRI Executive Director to develop and maintain cooperative agreements with other organizations for research and education programs, for example with the Exxon Valdez Oil Spill Trustee Council, two Regional Citizens' Advisory Councils, the Alaska Department of Environmental Conservation, the Alaska Ocean Observing System (AOOS), the North Pacific Research Board, the UNH/NOAA Coastal Response Research Center, US Minerals Management Service, and Norwegian SINTEF's Joint Industry Program.
- Periodically representing OSRI at professional meetings and workshops.
- Maintaining files and a library on oil pollution issues.
- Providing leadership in planning future research programs and work plans.
- Preparing technical reports on OSRI programs.
- Overseeing many outreach activities including presenting at workshops and conferences, maintaining the OSRI website, and publishing the OSRI annual report. Other outreach efforts are aimed to disseminate OSRI efforts through a wide array of media options, such as printed materials, radio broadcasts, and video or computer presentations.

OSRI funding will provide approximately \$113.5K personnel (10 months), \$7.65K travel, \$13.4K contractual, and \$0.45K commodities for a total of \$135K.

2. OSRI Science and Technical Committee meetings (OSRI Cost: \$8K).

Funds are set aside to support the functions of the OSRI Science and Technical Committee, and to support Board and STC travel related expenses associated with OSRI partnerships such as the JIP, NPRB, etc.

E. Partnerships

The use of partnerships is a goal outlined in the OSRI strategic plan. While there is not any funding that is dedicated solely to the development or maintenance of partnership

programs, there are many existing partnerships and opportunities to develop new partnerships. We continue to partner with the Alaska Ocean Observing System (AOOS) to support an ocean observing system in Prince William Sound and to validate the physical and biological models developed through efforts by OSRI and AOOS. The meteorology and oceanography programs described in the Understand section contribute to this partnership. We are partnering with AOOS on the hydrological model validation component as well. In the biological sciences we continue to partner with NPRB.

To achieve our objectives under the Respond goal requires partnerships. We are looking to work with industry-sponsored research programs that align with OSRI's science plan. Industry is currently considering the development of six different programs, four of which are closely linked with the goals outlined in the OSRI science plan. BSEE and USCG also have important programs to follow. BSEE recently had a call for white papers for the use of the Ohmsett facility with ice in it, and several topics related to improving spill response in the ice environment. The USCG continues to work in the Great Lakes to test technologies in the ice environment. Their work provides a relatively low cost to test some emerging technologies. We are one of several groups that are contributing to a National Research Council study titled, "Responding to Oil Spills in Arctic Environments."

Our Inform goal related projects are also heavily dependent on partnerships, most often developed by the programs we fund. OSRI contributes a portion of the cost of the education programs outlined. These programs gain additional funding from several private, corporate, and grant contributions. The Discovery Room is also a collaborative effort with the U.S. Forest Service and the Copper River Watershed Project. OSRI contributes small amounts to the Alaska Marine Science Symposium and the Alaska Forum on the Environment. The workshop of opportunity section is designed to provide an opportunity to develop new partnerships to achieve OSRI's goals.

F. FY13 New Programs Spending Summary

Area	Project	FY12 Work Plan
Understand		
	Meteorological Stations	\$10K
	Hydrological Model Validation	\$125K
	NPRB Partnership	\$100K
		\$235K
Respond		
	Partnership Projects	\$150K
		\$150K
Inform		
	K-12	\$45K
	Internship	\$12K
	Graduate Fellowships	\$50K
	Workshops	\$43K
		\$150K
Other		
	Research Program Manager	\$135K
	STC travel	\$8K
		\$143K
Subtotal		\$678K
Administration		
	Based on 20% of total expenditure	\$169.5K
Total		\$847.5K

III. Prior Years' Encumbered Projects Continuing in FY13

Because OSRI projects are started at the beginning of each quarter, many projects funded in previous years will continue into fiscal year 2013. The purpose of this section is to identify those projects so that the work plan aligns with the FY13 budget sheets. These projects are listed as the Prior Years' Encumbered portion of the budget. If an existing project is to get new funding in FY13 – multi-year grants – the project description exists in the previously provided section. Because the exact amount of funds that are being carried forward will not be known until sometime in October, there are no dollar amounts provided with the individual projects.

A. Goal #1 - Understand

1. *Physical science projects*

a. Data rescue: Improvements to bathymetric digital elevation models spanning Alaska region waters (*Weingartner, University of Alaska Fairbanks., contracted by NPRB through 6/30/2014*)

This proposal seeks to improve existing bathymetric digital elevation models (DEMs) that span the greater Alaska region by salvaging data from historical Russian nautical charts and by processing newly available ship track soundings from the Bering, Chukchi and Beaufort Seas. Oceanic DEMs allow scientists, natural resource managers, students, and others to graphically depict their domain of interest, often in conjunction with other geospatially-referenced data. While existing DEMs suffice for some visualization needs, many applications require the best possible representation of bathymetric depths. For example, DEM quality and resolution is intimately tied to the quality of numerical model results, which in turn inform oil spill responses, search and rescue missions and countless scientific research projects. To improve DEM quality, we assembled one of the most comprehensive sets of unclassified bathymetric soundings between the Russian Far East and western Canada and then created the publicly available Alaska Region Digital Elevation Model (ARDEM; *Danielson et al., 2008; Danielson et al., 2011*), gridded at ~1 km horizontal resolution and spanning 130°E to 120°W and 45°N to 75°N. The ARDEM grid is based in part on our previous digitization of 139 Russian nautical charts and chart inserts. In this project, we will digitize 153 additional charts and inserts in order to increase data density in coastal arctic regions having sparse data coverage and for which few other public data exist. We will also further refine our data quality control algorithms and update the ARDEM grid with the rescued and other recently collected ship track soundings.

b. Oceanographic observation in support of a nowcast/forecast system in Prince William Sound (*Halverson, PWSSC, contracted through 12/30/2012*)

This purpose of this project is to use supplementary funds for the OSRI-sponsored project: *Oceanographic observations in support of a nowcast/forecast system in Prince William Sound*. The funds will be used to ensure that the goals set out by the FY2010 Scope of Work are accomplished.

A modest funding supplement and extension will create significant gains. The project deliverable will be a peer-reviewed research paper on the tidal and synoptic timescale exchange of water between Prince William Sound and the Gulf of Alaska. The work will be performed with the aid of an in-kind collaboration with Dr. Clint Winant, a senior physical oceanographer at the UCSD Scripps Institute of Oceanography in La Jolla, California.

2. Biological science projects

a. The three amigos- A shoreline biota monitoring program for Prince William Sound (*Harper, Coastal & Ocean Resources Inc., contracted through 6/30/2012*)

This proposal outlines an approach to establish an intertidal biotic monitoring program within the Gulf of Alaska. As a pilot, the program would support broader scale ecological studies by providing detail on seasonal and inter-annual changes to intertidal biota within Prince William Sound. We propose to develop a draft protocol (our interpretation of a the *white paper* component of the RFP) that is based on a tiered imagery collection program with a few time lapse camera locations (providing daily data), a dozen or so quarterly photo-registered locations (e.g., Mearns Rock type photos) and a few dozen annual photo-registered locations. The tiered reference locations would be focused on a single habitat type (e.g., protected, rock cliffs or benches) that can be tied directly to the spatial mapping of ShoreZone. The intention of the tiered station network is to capture temporal changes at the frequently monitored sites and to capture the spatial extent of change within the Sound at a more widely distributed network of monitoring sites. A daily time series of imagery at a few sites is likely to provide direct observations of the agents of change such as hard-freezes, ice-scraping events, severe heat events or biological invasions.

Imagery data collected in PWS will be validated by cross-comparison with annual on-the-ground surveys of an intertidal site in Kachemak Bay, Alaska that has been regularly censused since 1999 (Klinger and Fukuyama, submitted). Establishing a site at which daily, quarterly, and annual images are collected *in combination with* annual quadrat sampling will assist in interpretation of the imagery data and improve the power of the analysis.

An image-based monitoring program will allow citizen scientists and community scientists to interact with research scientists throughout the program. Image acquisition can be performed by citizen scientists and by community-based scientists. Image categorization can be performed by community-based scientists using the *three-amigo* protocol. A quarterly program review will be conducted by research scientists to ensure data management and interpretation meet anticipated standards.

The ultimate goals of such a program are: (1) to publish results in a refereed journal to ensure they are to a rigorous scientific standard and can be used as high-quality baseline data; (2) disseminate the protocols for implementation across a broader geographic area; and (3) invest community scientists in performance of long-term monitoring of their local sites.

b. Data rescue: Epibenthic invertebrates from the Beaufort Sea sampled during WEBSEC and OCS cruises in the 1970s (*Bluhm, University of Alaska Fairbanks, contracted through 3/30/2014*)

This proposal seeks to rescue data on epibenthic invertebrates sampled by trawls and photographs in the Alaskan Beaufort Sea during Western Beaufort Sea Ecological Cruises (WEBSEC) and Outer Continental Shelf (OCS) cruises in the 1970s. The material includes station information, count and weight data, a taxonomic inventory and yet unidentified samples. A major challenge in climate- and human impact-related studies is the lack of historical data against which to assess biological response to changes and stresses in the environment. This is particularly relevant in the Alaskan Arctic with its large changes in the sea ice regime and substantially increased interest in oil and gas exploration in the last decade. Epibenthic fauna includes important prey items for fishes, marine mammals and birds and some epibenthic species may in the future become harvestable in the Arctic. The historic data in question will form a reference point for the 1970's and can in the future be compared to current surveys in the Beaufort Sea done in 2008 and 2011. The rescue involves 1) transforming tables from reports into digital format, 2) processing unsorted samples, 3) updating the taxonomy to today's standards, 4) making the data available to recognized open access online data bases, and 5) integrating the taxonomic inventory into the Arctic Register of Marine Species. Outreach will include species pages of dominant species in the data and will be posted on the web site of the Arctic Ocean Diversity project from where the content is harvested by the Encyclopedia of Life.

c. Seabirds as indicators of forage fish stocks and marine ecosystems in Alaska (*Piatt, USGS, contracted by NPRB through 6/30/2014*)

The distribution and abundance of small, schooling forage fish (e.g., sandlance, capelin) in Alaska is known from small-scale directed studies, but mostly inferred from incidental catches in large-scale trawl surveys that were not designed (by gear or location) to sample forage species. In contrast, seabirds are conspicuous, highly mobile, samplers of forage fish that go to great distances (100+ km) and depths (200m) to locate ephemeral prey with great efficiency. Thus, data on their dietary habits provides a valuable

complement to traditional fisheries sampling. We propose to analyze large diet databases for three abundant seabirds (puffins, murre and kittiwakes) to: 1) characterize forage fish communities in the Gulf of Alaska (GOA) and Bering Sea/Aleutians, 2) describe temporal changes in abundance of forage species, and, 3) examine the possibility of using diet data to assess recruitment in selected species. We will also examine 20-30 year time-series of seabird breeding success and phenology at several colonies to determine: 1) whether these parameters can be used to make inferences about local forage fish stocks (abundance or timing), and 2) whether these seabird data co-vary with the prey base data at similar time/distance scales.

B. Goal #2 Respond:

1. Partnership projects

a. Oil spill trajectory analysis from the 2009 Prince William Sound field experiment (*Beegle-Krause, Research4D, Contracted through 06/30/13*)

The proposed analysis of the observational data and model predictions from *Sound Predictions* is based on trajectory predictive ability. The intent is to identify areas of higher and lower predictive skill for the field conditions during the experiment, and provide insight and recommendations for future improvements. The proposal fits with OSRI's goal "To identify and develop the best available techniques, equipment and materials for dealing with oil spills in the Arctic and sub-Arctic marine environment" (<http://www.pws-osri.org/>).

The work will examine the effect of observational data assimilation in potential oil spill simulations by comparing observed and simulated drifter trajectories using the General NOAA Operational Modeling Environment (GNOME) model. Observed circulation fields (winds and currents), and two different types of the PWS circulation fields (nowcast and forecast) will be examined in order to isolate the effects of data assimilation without re-running the circulation models. The hindcast fields will have assimilated all available observations, while the forecast fields will not have the benefit of the observational program. Simulated trajectories will be compared with observed drifter trajectories during *Sound Predictions*, and the other observational data will be used to construct hypothesis for any trajectory differences. If necessary, a diagnostic circulation model will be constructed in GNOME to test these hypotheses.

b. Sonar detection of oil in and under ice (*Maksym, Woods Hole Oceanographic Institution, Contracted through 06/30/13*)

A practical system for oil spill response in the sea ice environment must be capable of rapidly mapping the extent and quantity of oil over large areas and under a range of ice and weather conditions. This project will test and validate the detection of oil under ice using a single beam sonar and underwater cameras that can be readily mounted on an

unmanned underwater vehicle (UUV). The aim is to develop a system for direct detection and quantification of oil from below so that oil spilled under broken or continuous sea ice can be detected, quantified, and its spill trajectory can be mapped. Such a system will have the advantages of being deployable in a range of ice conditions and capable of detecting and monitoring an oil spill in conditions that preclude traditional detection from above.

This project builds on previous successful tests performed by the present team and funded by OSRI. These tests, carried out in the outdoor ice tank facility at the US Army Cold Region Research and Engineering Laboratory in Hanover, New Hampshire demonstrated that thin slicks of oil can be detected under ice using a combination sonar and camera system. This project will perform further tests using the combined sonar/camera system in controlled laboratory ice tank experiments to:

- 1) Determine the acoustic signature of oil under sea ice, for both warm and cold oil,
- 2) Determine the evolution of the acoustic signature over time as the oil percolates into the porous structure and/or melts the ice underside, thus determining the coevolution of acoustic signature and oil/ice structure,
- 3) Determine the ability of sonar to detect oil as it becomes encapsulated in the ice,
- 4) Determine whether a camera system can reliably detect encapsulated ice (alone, or in conjunction with sonar), and

5) Provide recommendations for an optimized sensor system for deployment on a UUV. Results of this study will allow us to construct quantitative models of the sensor response to oil under, or encapsulated within, ice and provide an empirical basis for interpretation of under ice measurements. These experiments will allow us to develop a complete sensor system to be integrated into UUVs for under ice operations at WHOI.

c. Responding to oil spills in Arctic environments (*Waddell, The National Academy of Sciences, Contracted through 03/30/14*)

The National Research Council is the operating arm of the U.S. National Academy of Sciences. It is a non-governmental organization whose mission is to provide the federal government and others with independent, objective advice on science and technology policy issues.

For this study, the National Research Council will assemble a volunteer ad hoc committee to assess the current state of the science regarding oil spill response and environmental assessment in the Arctic region, with emphasis on potential impacts in U.S. waters. The committee will develop existing decision tools and approaches that utilize a variety of spill response technologies under the types of conditions and spill scenarios encountered at high latitudes. The report will also review new and ongoing research activities in both the public and private sectors, identify opportunities and constraints for advancing oil spill research, describe promising new concepts and technologies for improving the response, including containment approaches to reduce spill volume and spatial extent, and recommend strategies to advance research and address information gaps. Finally, the committee will assess the types of baselines

needed in the near-term for monitoring the impacts of an oil spill and for developing plans for recovery and restoration following an oil spill in U.S waters.

Committee members will have expertise in the following areas: oil spill response and recovery, physical oceanography, ice conditions, Arctic ecology and natural resources, marine engineering, maritime transportation, and maritime safety and risk assessment. These volunteers will be drawn from a pool of nominees, including those at universities, federal government laboratories, industry, and nongovernmental organizations.

This will be a two-year study. Funding has been received from the Arctic Research Commission, the American Petroleum Institute, the Bureau of Ocean Energy Management, and the Marine Mammal Commission, in addition to the Oil Spill Recovery Institute. Additional funding is anticipated from the U.S. Coast Guard and the National Oceanic and Atmospheric Administration.

d. High speed recovery system (*Kennedy, Pacific Petroleum Recovery, Contracted through 06/30/13*)

The PPR Open Water Skimming System is based on materials and technology currently in use in other maritime applications. It is extremely robust, scalable and capable of high recovery and continuous operation. It can be deployed and operated simply, and its use will be understandable to the industry. Towing tests have been conducted in Puget Sound and with oil at the OHMSETT facility for both calm water and wave conditions.

This proposal will fund a demonstration the system, revised for higher current conditions. This positive pressure, open water skimming system is unique in that it relies on robust, modified “off-the-shelf” components such as a common trawl net with liner and fish pumps. The net components can be easily replaced and are relatively inexpensive to produce. The system is scalable with the net opening easily expandable.

This open water demonstration is meant to provide feedback that can be incorporated in the design for a system that includes an ice management feature that is being funded by BSEE.