



2010 Work Plan Oil Spill Recovery Institute

October 2009

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Prince William Sound Oil Spill Recovery Institute

2010 Work Plan

I. Purpose and organization of this document

This document describes the Oil Spill Recovery Institute (OSRI) 2010 Work Plan in the context of the overall Science Plan approved by the OSRI Board in February 2005 for fiscal years 2005 through 2010. The Science 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 2010 Work Plan provides descriptions of projects proposed for funding in the 2010 fiscal year beginning October 1, 2009 and a brief description of projects funded in previous years that have funding continuing into fiscal year 2010 (FY10). 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 FY10 Work Plan New Projects

The Advisory Board of OSRI and the Executive Committee of the Board of Directors for the 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 2010 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.

The components to achieve these objectives are described below.

1. Physical science programs

The OSRI science plan outlines an approach for addressing goal #1. This approach is to develop and test modeling and observational capabilities by contributing to 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 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. For example, the high-resolution wind, wave and ocean current forecast products will provide improved information to recreational and commercial vessel and aircraft operators and enhance the safety of oil tanker traffic in PWS. The improved physical and ecological forecasting products will enable resource managers (e.g., PWS hatchery and commercial fishing organizations) to make informed and scientifically sound management decisions on food supply, predation, and human activities such as commercial and recreational fishing.

a. Meteorology (OSRI cost: \$5K telemetry, \$24K NRCS \$5K logistics [Total \$35K])

Meteorological and precipitation data for ocean circulation models

Understanding the circulation of Prince William Sound requires accurate measurements of wind fields and precipitation. Snow melt runoff and rain fall leads to a freshwater layer that sets up the surface circulation. Wind stress then modifies the circulation creating local and seasonal circulation patterns. By understanding the basic meteorological conditions we hope to improve our ability to model the meteorology of Prince William Sound, improve our understanding of the forcing 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), measure precipitation from snow and rain throughout the year and are needed to establish the freshwater budget. They are fully-automated, land-based stations that are usually set up in remote locations. Since the summer of 2005, six new SNOTEL stations have been deployed at sea level in PWS, and two stations at alpine elevations. Although three additional alpine stations were initially planned permitting and logistical issues has caused NRCS to abandon

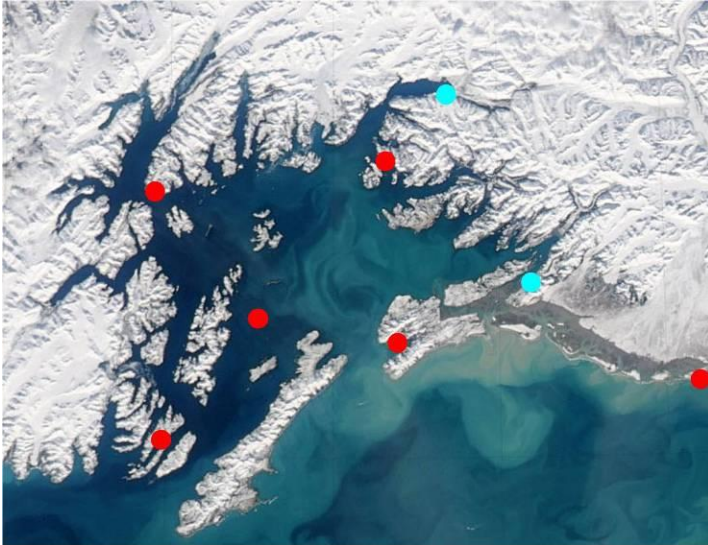
deployment of those stations. The fully deployed system in PWS is described in Table 1.

Each station in PWS measures wind speed and direction, air temperature, air pressure, precipitation from rain and snow, and solar radiation. Four stations (one sea level station in each quadrant of the sound) also have digital cameras that transmit pictures every fifteen minutes to the internet so the actual weather conditions in each area can be seen. Data transmitted by the weather stations will be accessible through the Alaska Ocean Observing System (AOOS, aoots.org) and PWSOS (pwsos.org) web pages and archived at the University of Alaska Fairbanks.

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) and AOOS (Congressional earmarks), PWS Regional Citizens' Advisory Council, and OSRI. In accordance with the OSRI Science Plan the annual maintenance costs for all stations will be provided by OSRI, at least, through 2010.

Table 1. Location of SNOTEL stations.

PWS Quadrant	Site name	Altitude	Deployment date
SW	Chenega Bay/Port San Juan	50 feet	2005
NW	Esther Island	60 feet	2005
NE	Tatitlek	50 feet	2005
	Sugarloaf Mt, Valdez	550 feet	2007
SE	Strawberry Reef/Copper River Delta	30 feet	2006
	Mt. Eyak	1,405 feet	2005
Central Basin	Seal Island	20 feet	2005
Hinchinbrook Entrance	Nuchek	50 feet	2005



Location of Snotel sites in Prince William Sound. Red dots are sea level installations and blue are existing alpine stations.

The annual operating cost for the weather stations is about \$5,000 per station per year. The operating costs include regular maintenance, calibration of sensors, access to the sites, and telemetry related expenses. The FY10 budget includes \$40K for maintenance of eight sites.

b. Oceanography (OSRI cost: \$110K)

Water exchange between PWS and the Gulf of Alaska and seasonal variations of hydrographic properties in central PWS

A primary component in improving our understanding of the circulation of Prince William Sound is the collection of oceanographic measurements. These measurements allow direct studies of circulation, the exchange of water between Prince William Sound and the Gulf of Alaska (GOA), and provide validation data for testing circulation models.

The OSRI funded oceanography work is a constituent of the Prince William Sound Observing System (PWSOS). In its current state, the program encompasses three components: 1) Long-term monitoring of the water exchange between the Gulf of Alaska and Prince William Sound, 2) Monitoring of the seasonal variability of the hydrographic properties and circulation in PWS, and 3) Long-term monitoring of sea water temperature, salinity and fluorescence at nearshore sites in northern and western PWS.

The goal of the water exchange component of the five-year observational oceanography program is to provide an improved description of the flow through the straits connecting PWS with the GOA. This is a necessary step towards a better understanding of the relationship between circulation variability and biological variability in PWS. The current mooring program addresses two limitations of previous mooring programs (lateral variations not accounted for and lack of data in the near surface part of the water column). Knowledge acquired from this five-year program should provide an

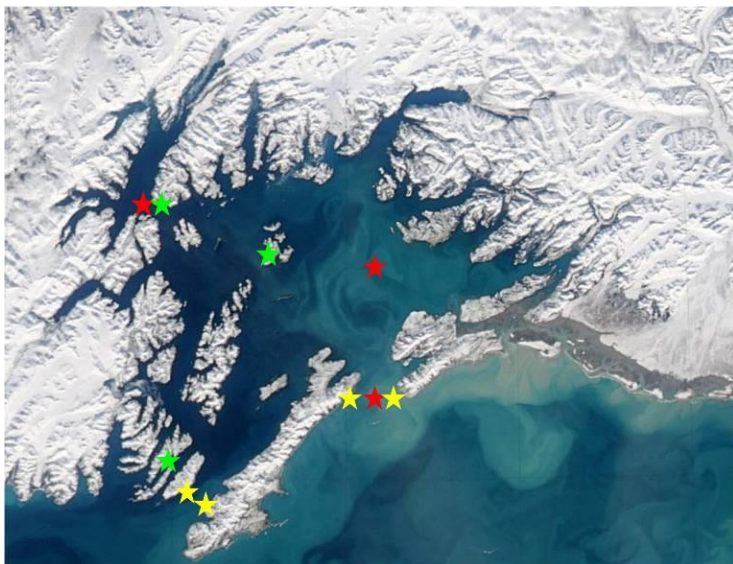
understanding of measurements made using a single downward-looking ADCP at the NDBC buoys, which is the long-term monitoring planned for the area.

The “water exchange” moorings deployed by Prince William Sound Science Center (PWSSC) since June 2005 consist of 2 moorings in Hinchinbrook Entrance (HE) and 2 moorings in Montague Straits (MS). Each of these moorings is composed of 2 internally recording Acoustic Doppler Current Profilers (ADCP) and 3 conductivity-temperature (CT) sensors (Fig. 3). Both ADCPs are positioned around 100 m depth, one upward-looking and one downward-looking. The CTs are positioned at three depths of 30 m, 100 m, and 10 m above the bottom. In addition the Seal Rocks NDBC buoy in Hinchinbrook Entrance has been equipped with a downward-looking ADCP and a near-surface CT and is positioned roughly mid-way between the two PWSSC moorings.

Initial costs for equipping the moorings at Hinchinbrook and Montague were supported by other entities, while OSRI funds support most of the semi-annual servicing and data analysis costs. The moorings will be in place through the spring of 2010.

The second component of the observational program consists of a regular monitoring of the hydrographic properties in the central basin of PWS and at the main entrances. A goal of this work is to acquire a description of the seasonal evolution of the hydrographic properties at these locations to be able to provide indications of mixed layer depth, and estimates of surface flow direction and speed for oil spill response planning. The work involves seasonal vessel-based hydrographic surveys (three to four cruises per year) during which conductivity-temperature-depth (CTD) profiles are acquired at a number of stations. For each survey, two transects (west-east, north-south) are visited, and extra stations may be added depending on the needs of the moment. The planned duration of this project is the same as for the “water exchange” moorings, that is through 2010.

The third component of the oceanography program began in 2007. This component is the addition of telemetered, near-shore moorings with temperature, conductivity, and fluorescence measurements. AOOS funded the design and installation at Port San Juan of one pilot mooring in 2007; it was renovated and reinstalled in March 2009, and two additional moorings were installed at Esther Island and Naked Island. The goal of the near-shore mooring program is to provide real-time data for model assimilation and to provide biological data within the surface waters of the Sound. It is expected that the data from this project will be analyzed at PWSSC.



Mooring locations. The yellow stars represent the deep water moorings maintained by PWSSC for monitoring the water exchange with Prince William Sound. The red stars represent the location of the National Data Buoy Center's oceanographic moorings. The green stars represent the planned deployment of near-shore, real-time moorings by the end of this fiscal year.

For the oceanography program, the data are being processed at PWSSC, archived and posted on an internet site at the University of Alaska Fairbanks (UAF). There will be a monthly quality control at PWSSC and the quality controlled data will be sent to replace the raw data. The data from these observational campaigns will be downloadable and the diverse information relative to data acquisition and processing will be provided in downloadable data reports.

The approach to operating the programs described above is to fund a researcher at PWSSC. More detail about the approach is provided below.

PWSSC oceanography research fellowship; (OSRI cost: \$70K from the total \$110K in Oceanography)

This position is responsible for maintaining the equipment associated with the oceanographic program described above and analyzing the data collected in that program. The intent of the OSRI Oceanography Research Fellowship is to 1) research diverse issues relevant to the OSRI mission; 2) to maintain the highest caliber of research possible; and 3) provide research staff to the PWSSC. The length of the position is two years, with possible one-year extensions if the project warrants the extra time.

For the oceanography program, OSRI will fund a position to conduct basic and applied research in Prince William Sound and the Gulf of Alaska as described in the oceanographic program described above. The research focus will be on understanding the physical circulation and mixing of PWS waters and how these affect oil spill trajectories in space and time. The research area includes the Sound and the adjacent Gulf of Alaska. The position will also be responsible for maintaining the equipment associated with the program, collecting and processing data, maintaining quality control, and analyzing the data collected in this program. As this program is nearing

completion we expect that most of the effort associated with this project will be in data analysis and manuscript preparation.

PWS oceanography (Program expenses); (OSRI cost: \$40K from the total \$110 in Oceanography)

In addition to the personnel costs, the oceanography program requires funds to deploy and maintain the equipment used in this program. A total of \$15K is used to maintain existing sensors and replace lost or damaged equipment. Since no new deployments are expected during this funding period the maintenance funding is only for that work necessary to ensure the equipment is in good working order at the end of its deployment.

An additional \$25K will be provided to contract for ship time and personnel to help with mooring deployment and for publication of manuscripts. Ship time is used to maintain the moorings and conduct hydrographic surveys. The moorings require additional and often specialized assistance for short periods of time so it is best to get that assistance through contracts. As stated earlier we desire the publication of manuscripts based on the results of this program so funding is available for that purpose.

2. Biological science programs

To improve our understanding of the impacts of *Exxon Valdez* oil spill and to improve the ability to assess impacts of future oil spills requires a biological research program. To achieve the objective laid out in the Science Plan, OSRI will fund the following research programs.

a. 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 IV.A.5.b.i of OSRI's science plan identifies a potential partnership with NPRB to support ecological research projects in Arctic and sub-Arctic climates, generally within the NPRB geographic area of interest, but with particular emphasis on the Gulf of Alaska and Prince William Sound. Both organizations have a strong interest in ocean observing, habitat, ecological and socioeconomic studies. The NPRB and OSRI have science and implementation plans that provide the foundation for defining research priorities of mutual interest in any given year.

Again this year, an opportunity exists to conduct collaborative research in the Gulf of Alaska and Prince William Sound. OSRI and NPRB each plan to commit \$100K for biological research in 2009. In the spring of 2007 the OSRI Scientific and Technical

Committee (STC) identified the strongest areas of overlap between the two program areas as being socioeconomic research and the near shore environment. It has been noted that the near shore 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. Since OSRI currently has an active socioeconomic project and will be reviewing how to develop that line of research, in FY10 we are focusing on ecological issues, including the validation of biological models being developed for PWS. By developing a focused plan to study near shore ecology we will be able to pull together previous and future work to provide a comprehensive understanding of this subject.

What follows are the descriptions of three topics for the FY10 joint RFP. It is most likely that only one of the following topics will be awarded, given the total of \$200K available for award (\$100K each from OSRI and NPRB).

PWS NPZ model validation

Nutrient-plankton-zooplankton (NPZ) models provide a modeling linkage between ocean circulation models and fisheries models. The GLOBEC and AOOS programs have both been involved in the development of NPZ models in the Gulf of Alaska and Prince William Sound. It is important to validate these models with field observations so that they can be applied to increase ecosystem understanding. We are requesting proposals to validate the existing NPZ models for the area with data collected during the 2009 field experiment (see <http://www.aos.orf/> for details) or alternatively through another coordinated modeling and observation program designed for this validation purpose. Proposals should test the model's ability to forecast nutrient, phytoplankton, and zooplankton distributions and levels throughout the summer and possibly into the fall.

Rockfish habitat association in Prince William Sound

Rockfish are a diverse group of long-lived marine fish which can be prone to impacts from oil spills and overfishing. In Prince William Sound the recovery of the rockfish population from the *Exxon Valdez* oil spill is considered to be unknown, in part to not knowing what the original impact may have been. A better understanding of the impact of spills and fishing to rockfish requires an understanding of the available habitat. Recent advances in technology and the completion of high-resolution bathymetric surveys may make better identification of rockfish habitat in Prince William Sound possible. We request proposals that use existing data to identify rockfish habitat and to provide a measure of the quality of that habitat in Prince William Sound.

Larval drift, transport and distribution in Prince William Sound

Several ocean circulation models have been developed that cover the Gulf of Alaska and smaller regions within the Gulf. Several important fish and shellfish in Prince William Sound; including herring, crab, and clams, have planktonic life stages where the oceanographic circulation can determine their dispersal. We request proposals to model the larval transport of a commercially important (current or historic) species in relation to Prince William Sound (i.e. out of or into the Sound). We desire the generation of

probability maps of where settling of the selected species may occur given a fixed spawn/hatch location and date, and several different years of ocean and meteorological conditions.

OSRI expects to contribute \$100K to this collaboration. With the NPRB contribution the total request will be for \$200K. No amounts have been specified for specific topics. All proposals received under this section will be competed against each other with a funding cap of \$200,000 for all categories. This section of the RFP is open to all organizations and individuals and is in no way restricted to those associated with OSRI or the Prince William Sound Science Center.

b. PWSSC Biological Research (OSRI cost: \$70K)

The PWSSC research fellowships are intended to fund short term focused investigations on biological issues relevant to the OSRI mission. This research program is to 1) research diverse issues relevant to the OSRI mission); 2) maintain the highest caliber of science possible; and 3) provide research staff to the PWSSC. The program is intended as partial support for the researcher who must also take a lead role in securing other funds to support process oriented studies that further our understanding of PWS, the Gulf of Alaska and the surrounding watersheds. To achieve the objective OSRI will fund proposals in the following types of programs.

- 1.) Data storage and visualization. A significant amount of research has been conducted over the past twenty years by the Prince William Sound Science Center that is valuable in understanding the ecology of PWS. The maintenance of that data is the responsibility of the investigator that collected it, which makes it highly susceptible to becoming unavailable after a few years due to changes in storage techniques or changes in personnel. It is also difficult to combine data to develop new interdisciplinary questions and understanding because of the diverse storage locations and formats.

Starting from scratch the task of creating and populating a data management structure can be a daunting task, especially if one considers inputting several years of existing data. This task can be made much more manageable by focusing on the future. The initial effort should be made to identify or develop a structure that allows easy input of recently collected data and data expected to be collected in the near future. Once that information is in place then as the opportunities allow data recovery projects can more fully populate the data base.

We do not expect that the amount of funding is adequate to develop a full data management and visualization system, but we feel it is important that we begin the process. We expect to be able to fund the individual investigators to inventory their data and provide a description of it. From this information a data management group would need to be contracted to

help develop a data management plan, and set up a data management structure so the individual investigators can store their data. As part of the planning process, existing data bases will be examined to determine if they can meet the needs for storing and retrieving the existing data. Data storage is an important component, but visualization capabilities are required before the system will be useful to other researchers. We encourage the PWSSC to seek additional funding to enable the visualization tools to be developed.

- 2.) PWS model validation analysis. As part of the Prince William Sound model validation experiment conducted in the summer of 2009 biological sampling occurred. We expect that it may not be possible to complete analysis of the data collected during FY09 and will consider proposals to extend the data analysis to provide information needed to understand the potential impacts of surface and subsurface oil on the biology of Prince William Sound during the time period of the model validation exercise. The expected analysis will help identify the types of organisms present, their concentration, and if there are areas where the concentration of organisms are significantly greater than the mean distribution. The area of focus should be the central portion of Prince William Sound where most observations were made.

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 science 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 \$75K for projects related to Goal #2, oil spill response, OSRI has elected to fund a portfolio of initiatives.

- (1) Co-sponsorship of a cold climate spill response project received by one of our partners.

- (2) Spill response information tools.
- (3) Model validation experiment.

a. Partnership proposals. (OSRI cost - \$50K)

A number of agencies and organizations fund research in oil spill response. The missions of the various groups can be diverse, but have 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, Minerals Management Service (www.mms.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/>), and the oil industry.

By pursuing potential partnerships OSRI can leverage its limited funds to engage in larger projects. It should be noted that it is inherently expensive to work in the Arctic and sub-Arctic regions, which increases the cost of proposals. OSRI will both assist with partner developed research topics and develop its own research topics for potential RFPs. If partnerships are unavailable for the OSRI developed research topics OSRI will consider releasing the RFP as the sole funding source. The research topics will be guided by the OSRI science plan response subjects.

- 1) Develop and/or apply novel and cost-effective methods and technologies for preventing, recovering, reducing, or eliminating spilled contaminants.
- 2) Develop new sensors and technologies to detect and quantify contaminants in the environment.
- 3) Develop and/or apply novel and cost effective technologies and methods to remediate contaminated sediments and water.

Project topics will be further refined by other guiding documents, such as the OSRI funded report titled, *Advancing oil spill response in ice-covered waters* (http://www.pws-osri.org/publications/OilIce_final.pdf).

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

- 1) Development of airborne Ground Penetrating Radar for detection of oil in ice.
- 2) Support of balloon based observation systems.
- 3) Scoping workshops for oil spill information tools
- 4) Demonstration of the ability to track oiled ice using satellite remote sensing.
- 5) Improving the deployment duration or reducing cost of tracking buoys.
- 6) Developing an oil simulant for use in testing oil spill response equipment in Arctic waters.

- 7) Test techniques to prevent ice buildup on recovery equipment.
- 8) Determination of the role of glacial sediments in the natural dispersion of oil.
- 9) Testing new spill recovery equipment in Arctic and sub-Arctic waters.
- 10) Developing best practices and tactic guides for spill response.

A total of \$50K is expected to be used to fund one or more proposals under this topic area.

b. Spill Response Information Tools. (OSRI cost \$0K)

One direction OSRI expects to move towards in the next five years is the development of information tools for spill responders. Several products useful to spill responders have been developed in the recent years. In Alaska these include the ShoreZone maps; the Geographic Response Strategies, the Geographic Resource Information Network, Alaska Oil Spill Permits Tool, and the Alaska Ocean Observing System. These are just a few of the tools and places that contain valuable information for spill responders. Because there can be so many areas where information is available, some personnel may not be aware of the local resources, and it can be difficult to find the information needed during an emergency, OSRI would like to support the development of new information tools that help gather the existing information and provide it in an easy to visualize manner.

One such tool that has been developed recently is the Emergency Response Management Application (ERMA) that was developed through a grant from the Coastal Response Research Center. It is a geographic information tool that contains historical and real-time information for spill responders with mechanisms to input information during a spill. It appears that NOAA's Emergency Response Program will be adopting this tool for application throughout the country in the future. Any tools developed in by OSRI will need to be able to be compatible with ERMA. Any project funded should also build upon the approaches that have been taken in other areas; such as Louisiana, Florida, and Maine.

What is expected in FY10 is a need to support scoping meetings that are designed to bring together responders assigned to a particular incident command section with information tool designers to outline what information is desired and how it is most likely to be accessed. These workshops would be used to provide the information needed to develop new information tools and products.

A total of \$0K is expected to be used to fund one or more meeting under this topic area.

c. Model Validation Experiment (OSRI cost \$25K)

Over the last several years OSRI has contributed to the development and refining of atmospheric and oceanic forecast models, and installation and upgrade of measurement

systems. In July and August of 2009 an experiment was held to collect the data necessary to test the ability of the ocean and atmospheric circulation models and to provide data to oil spill response models. The model runs and field data should be processed by the beginning of this fiscal year, but an understanding of the model performance will require the data to be analyzed. Analysis of the model performance should include the ability to make accurate forecasts with and without data assimilation. It may be desirable to also conduct a hindcast once additional data from non-real-time sensors become available. Of particular interest is in evaluating the models capabilities to determine surface water circulation as measured using high-frequency radar and drifting buoys, and the prediction of mixed layer depth. This analysis will test the null hypothesis that the oil spill response models ability to predict buoy positions cannot be improved by inclusion of information from the observing system.

OSRI is prepared to contribute up to \$25K in FY10 for completion of an analysis and report of model performance, and a final report on findings during the summer 2009 experiment. Additional funding is available from AOOS for this effort. The Research Program Manager will be responsible for ensuring the completion of this project.

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:

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

1. Education (Total OSRI cost: \$48K for the programs described below)

OSRI intends to continue building upon the existing regional outreach programs. In addition, within the next year, OSRI will seek out partnering opportunities to broaden the geographic influence of the PWSSC education programs to state and national audiences and share expertise among a consortium of other education and outreach institutions.

a. School Year Programs: Discovery Room, Outreach Discovery, NOSB, Community Programs (OSRI Cost: \$40K)

The Discovery Room and Outreach Discovery programs create the opportunity for hands-on science in both classroom and outdoor settings. The Discovery Room enhances the science curriculum for Cordova students in third through sixth grade by providing hands-on lessons and activities. These include classroom and monitoring activities. The program's goals are to encourage students to better understand and

appreciate the PWS region while working within state science standards. The Discovery room is conducted as a partnership between PWSSC, the Forest Service, Cordova School District, and the Copper River Watershed Project. Additional funding for the program comes from BP, Conoco-Phillips, EPA, and community donors.

In the Discovery Room the third grade classes will be focused on a new program designed around education and monitoring related to weather and climate. The fourth grade class will examine salmon habitat. The fifth grade will focus on ocean monitoring and ecology. And the sixth grade will be working with technology to build remotely operated vehicles that will be used for a variety of tasks including a small-scale oil recovery system of their own design.

Outreach Discovery takes Discovery Room lessons to the villages of Chenega Bay and Tatitlek. These lessons greatly enhance the limited resources these schools have available for science education. The activities generally are developed from one of the Discovery Room projects, but are modified for mixed-grade classes. One visit to each community will occur during the upcoming school year.

OSRI will provide institutional sponsorship for the Alaska Tsunami Bowl, the regional competition for the National Ocean Science Bowl and the Cordova NOSB team. This program encourages high school students to excel in math and science studies by involving them in a quiz-bowl competition focused on ocean sciences.

Community Programs serve adults and families in Cordova and Valdez through a weekly seminar series during the school year and irregularly during the summer months. These programs primarily focus on current science being conducted in the region. The community programs are run in partnership with the Marine Advisory Program, U.S. Forest Service Cordova Ranger District, PWS Audubon Society, and the PWS Community College. This program expanded in FY09 to include Valdez through a video-conference link provided by the Community College and USFS. Additional in-person programs in Valdez are envisioned for FY10.

b. Summer Programs: Forest to the Sea, Weekend Workshops (OSRI Cost: \$8K)

From the Forest to the Sea program provides the tools and guidance for participants to understand the interdependence of all ecosystems. Hands-on education in the outdoor classroom and scientific knowledge, combined with positive experiences in the outdoors, builds a foundation for campers to grow into good environmental stewards and wise decision-makers. While immersed in their surroundings, participants learn how ecosystems are connected through interactive studies of the temperate rainforest, glacier, wetlands, and ocean. The Forest to the Sea program involves a wide array of activities and funding sources.

Forest to the Sea programs have included activities for students of all ages. The OSRI contribution will go towards science camps for 8 to 15 year olds that connect the various ecosystems described above and factors that affect them. It will also contribute to a high school program that develops environmental leadership through a week to 10 day course on an environmental topic that includes a marine component. It may also contribute towards day events, such as tide pooling for tots, which involves children and their parents in marine ecology programs, or the development and delivery of short programs aimed at adult audiences.

The summer programs are run in partnership with the US Forest Service, Alaska River Expeditions, and others. These programs are advertised throughout the state and scholarships are available to help attract students from other communities. The total cost of the Forest to the Sea program exceeds \$70K with additional funding coming from other grants, contributions, fees, and volunteer support. This allows OSRI funding to be focused on the components closely connected to OSRI's mission.

c. Coastal community outreach and education (OSRI Cost: \$0K)

OSRI desires a program that seeks out opportunities to broaden the geographic influence of the OSRI funded PWSSC education programs to state and national audiences. Efforts to increase geographic scope have begun. Outreach materials were developed to share marine ecology research and facts about changes in oil spill response since the *Exxon Valdez* oil spill. There have also been opportunistic connections with Anchorage schools that bring students from those schools to Cordova to participate in the education programs. What is ideal is to shift away from making opportunistic connections to outside organizations to a more systematic approach. Several approaches to expansion of the geographic scope are possible. We foresee funding a project that may include developing and marketing programs designed for outside schools and delivered in Cordova, it may include developing programs that would be delivered in other communities, or it may be used to support a sharing of expertise with a consortium of other education and outreach institutions to develop best practices and connections that allow successful programming to be transferred to other regions.

2. Technology Internships (OSRI cost: \$0K) 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. OSRI is looking to convert its technology scholarship to two internships. We found that the most valuable portion of the previous program was the ability to have students work with oil spill response organizations (OSRO) that operate in the Arctic or subarctic. We will request proposals from OSROs for internship activities. Up to two internships will be provided to one or two successful proposals. Students will then be recruited to fill those internships. OSRI is committing \$25K for this program in FY10

3. Graduate Research Fellowships (OSRI cost: \$25K per student per year, \$0K total)

Under Goal#3 of the OSRI strategic plan, the suggested focus areas for research projects funded by the OSRI fellowship program are: Social science, education, and outreach; economic, sociological, and/or anthropological research applicable to the effects of oil spills on coastal communities; application of ocean observing system products in coastal community education programs.

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, 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. There are no Graduate Research Fellowship projects that extends into FY10. Because of budget shortfalls OSRI will not advertise for students this fiscal year.

4. Outreach

a. OSRI Advisory Board discretionary workshops (OSRI cost: \$20K)

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 FY10 support include:

(1) **Alaska Marine Sciences Symposium.** (OSRI cost: \$2K) 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 \$2K 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, and staff is encouraged to attend the workshop with waived registration fees.

(3) **Workshops of opportunity.** (OSRI cost: \$13K) It is recognized that many important workshops occur that could provide improved products as outcomes 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. OSRI will allocate a total of \$13K to support workshops that align with the OSRI mission.

b. OSRI web page maintenance and upgrades (OSRI cost: \$5K, Support for upgrading the OSRI web site and ongoing maintenance).

D. Other Programs

1. Program coordination (OSRI cost: \$118K). The position of OSRI Research Program Manager is a programmatic expense. The total costs include salary, benefits, travel and commodities. The Research Program Managers responsibilities include:

- Preparation of annual work plan in consultation with the Board-appointed Work Plan Committee and in accordance with the Five-Year Science Plan adopted in 2005. Compile information about potential projects, write brief project descriptions and prepare project budget estimates.
- Implement 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.
- Coordinate 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.
- Meet 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.
- Assist the Executive Director to ensure compliance with all policies and procedures of the OSRI Grant Policy Manual.
- Coordinate the processing of contracts for successful proposals. Monitor progress and final report deadlines for these contracts.
- Prepare bi-annual reports on OSRI grant awards and research and education programs for distribution to the OSRI Board.
- Prepare and publish an Annual Report for broad distribution.
- Supervise maintenance of the OSRI website.
- Collaborate 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, and 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 represent OSRI at professional meetings and workshops.
- Maintain files and a library on oil pollution issues
- Provide leadership in planning future research programs and work plans.
- Prepare technical reports on OSRI programs.

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. The model validation topics in the NPRB partnership, PWSSC biological studies and Respond goal sections build upon the recent joint effort to provide validation data to examine the skill of the existing nowcast-forecast models. The NPRB partnership section describes projects that the two organizations would like to partner to fund in the upcoming year. There are additional opportunities to partner in the Understand goal section through the topics of the PWSSC biological research section. The data storage and visualization is designed to help expand the Headwaters to Ocean (H2O) program. This program combines funding from various organizations to help develop a database and data visualization system for information related to the marine environment in Prince William Sound.

The Respond goal section begins with a description of a number of potential projects that OSRI will pursue partnerships for. Those projects tend to be more expensive than OSRI can hope to fund on its own and the partnerships are necessary to achieve the desired results. The spill response information tools section under the Respond goal also require partnerships. The Cook Inlet Regional Citizens' Advisory Council has begun to develop partnerships to address the information tool need and OSRI expects to contribute to that partnership. The model validation experiment was conducted in partnership with the Alaska Ocean Observing system and the analysis of the model performance is expected to be a continued collaboration with AOOS.

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 collaboration with the U.S. Forest Service. The intent of the coastal community outreach section is to develop new collaborations within the education field to allow greater geographic coverage of education and outreach opportunities. Other outreach activities are also collaborations with OSRI contributing small amounts to the Alaska Marine Sciences Symposium and the Alaska Forum on the Environment. The workshops of opportunity section is designed to provide an opportunity to develop new partnerships to achieve OSRI's goals.

F. FY10 New Programs Spending Summary

Area	Project	FY10 Work Plan	Science Plan budget for FY10
Understand			
	Meteorological Stations	\$35K	\$40K
	Physical Oceanography	\$110K	\$150K
	NPRB Partnership	\$100K	\$100K
	PWSSC Biology Fellowship	\$70K	\$85K
	Data Management	\$0	\$45K
		\$315K	\$420K
Respond			
	Partnership Projects	\$50K	\$150K
	Spill Response Information	\$0K	\$0
	Model Validation	\$25K	\$0K
		\$75K	\$150K
Inform			
	Discovery Room	\$40K	\$95K
	Forest to the Sea	\$8K	
	Community Outreach	\$0K	
	Technology Scholarship	\$0K	\$0K
	Graduate Fellowships	\$0K	\$100K
	Workshops	\$20K	\$15K
	Web Page	\$ 5K	\$6K
	Annual Report	Moved to RPM	\$10K
		\$73K	\$226K
Other			
	Research Program Manager	\$118K	\$90K
	STC travel	\$8K	\$15K
		\$126K	\$105K

III. Prior Years' Encumbered Projects Continuing in FY10

Because the OSRI projects are started at the beginning of each quarter many projects funded in 2009 will continue into fiscal year 2010. The purpose of this section is to identify those projects so that the work plan aligns with the FY10 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 FY10 – multi-year grants – the project description will reference 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 programs

a. Meteorology (Contracts through 06/30/10)

Meteorological and precipitation data for ocean circulation models

These funds are being carried forward for the maintenance of SNOTEL sites being conducted by the National Resource Conservation Service and MicroSpecialties as described on page 4 of this plan.

2. Biological science programs

a. Fish habitat association (*Rob Bochenek, Axiom*, Contracted through 6/30/10)

This project evolved out of the OSRI and NPRB joint RFP. None of the original proposals were considered to be sufficiently developed at the time of the joint funding decision. Because of unspent funds in the biological science program and the Science and Technical Committee's strong support of the program the proposers were requested to revise their proposals to address reviewer's comments and resubmit them directly to OSRI. The revised proposals were reviewed by members of the STC and a proposal selected. The abstract of the proposal follows.

Pacific herring has been identified as a critical species for North Pacific marine ecosystems. Current data sets regarding herring are in a dispersed state and have not been coupled to shore zone and habitat classification in a standard geospatial framework. The investigators propose to consolidate and integrate herring datasets and shore zone classification data into a common geospatial framework and perform analyses that test that framework for correlations between reproductive activities (herring spawn) in the vicinity of shore zone habitat types and subsequent age class recruitment.

The investigators propose to build upon an existing herring data system, the Prince William Sound Herring Data Portal (www.pwsherringportal.org), which currently houses herring shoreline spawn, biomass and Age Sex Length Weight (ASLW) observation data from 1973 to present. The various data are in a geospatially and temporally explicit state (work performed in 2007 for EVOSTC project 070822 and in 2008 for EVOSTC project 08082).

The effort detailed within this proposal will expand the data holdings of the Herring Data Portal to include shoreline spawn, biomass and and Age Sex Length Weight data for the Kameshak Bay region (1978 – 2002). In addition, this proposal will integrate existing shorezone mapping datasets (www.coastalaska.net) and other shorezone habitat classifications (environmental sensitivity index) into the data system. This data integration will provide the investigators with consistent information regarding two separate herring populations. This information will describe herring spawning activities near defined shorezone habitat types with resulting age class recruitment success. Statistical and analytical correlations can be performed regarding herring spawn occurrence and proximity to shorezone habitat types and resulting age class recruitment both temporally and spatially. If a correlation can be found regarding this relationship, resource managers can use this information to protect stocks in specific habitat areas and isolate critical habitat types for pacific herring.

b. PWSSC Fellowship

1) (*Bishop and Powers, PWSSC and USA, Contracted through 12/30/09*)

A joint project between Mary Anne Bishop of PWSSC, and Sean Powers of the University of South Alabama titled, “Tracking Movements of Lingcod *Ophiodon elongatus* in Prince William Sound Using Acoustic Tags and Arrays: Expanding PWSSC Partnerships, Infrastructure and Capacity” was funded. This project follows on previous OSRI funded work related to tracking of marine species. It utilizes the OSRI and other funding to leverage funding from the Pacific Ocean Shelf Tracking project. The abstract from the proposal follows.

“The goal of this project is to create new partnerships and collaborations for the fisheries research program being conducted at the Prince William Sound Science Center. Specifically, the long-term Prince William Sound (PWS) Science Center/Dauphin Island Sea Lab fisheries research program will partner with the Pacific Ocean Shelf Tracking (POST) project to deploy a large-scale acoustic array in PWS that will become a significant component of the POST project. We also will partner with Kintama Research for a public workshop and PWSSC staff training that will expand our local capacity to effectively and efficiently design and deploy acoustic arrays. This project will also create new collaborations and synergise with efforts of Ocean Tracking Network (OTN) and the Tagging Ocean Predators Project (TOPP) in PWS. We will achieve our goal using funding from the PWS Oil Spill Recovery Institute and in-hand equipment and/or funds from three other partners (Ocean Tracking Network, Rasmuson Foundation, and

PWSSC) to match a grant from POST.

The proposed project includes three main components: a) a workshop by Kintama Research on designing large-scale telemetry arrays; 2) training of PWS Science Center personnel by Kintama Research on how to assemble and deploy large-scale array installations; and, 3) acoustic tagging and tracking of lingcod. With assistance from Kintama Research, we will deploy across the mouth of Port Gravina an acoustic array consisting primarily of VR3 underwater receivers. Two smaller arrays of VR2W underwater receivers will also be deployed at Gravina Island and Gravina Rocks, two sites located near the VR3 array.

Once the arrays are in place, we propose to capture and tag lingcod with acoustic transmitters in and around the arrays, and track their movements and residency in Prince William Sound. Lingcod, a bottomfish species unique to the coastal waters of the Pacific Coast of North America, support an important commercial and recreational fishery. Because of their depressed stock sizes, lingcod are currently a species of critical concern to fisheries managers throughout the Pacific Coast. The project would also rely on data from acoustic arrays being installed in 2009 by Ocean Tracking Network at the entrances to Prince William Sound to detect lingcod movements out of and back into the Sound. This combination of projects will further develop a comprehensive, ecosystem-based understanding of the importance of lingcod within the North Pacific Region and will increase the scope and capacity of POST for monitoring fish movements in Alaska.”

2) (Cooney and *Campbell*, Contracted through 3/31/10)

The second fellowship project funded in FY 08 is for planning a synthesis of the ecology of Prince William Sound. The proposal titled, “Planning workshop for a research and socioeconomic review and synthesis on Prince William Sound” was submitted by Ted Cooney and Rob Campbell. The outcomes of the proposed work include putting together a writing team, a workshop to guide the efforts, an outline of the synthesis, and a proposal for funding the effort. Their proposal abstract follows.

This proposal requests funds to hold a workshop to plan a synthesis of past marine science and socio-economic studies in Prince William Sound, Alaska. Specifically, we propose to host a 3-day workshop in Cordova to outline the contents, determine writing assignments, and design a proposal to fund its publication. A preliminary meeting was held in late January to gauge the interest among potential contributors to this synthesis project; this proposal takes the project to the next step and will involve a smaller, working group of 7-10 scientists and others knowledgeable about the region.

3. Socioeconomic

a. Social disruption from oil spills and spill response (*Thomas Webler, SERI*, Contracted through 6/30/10 all funding committed from the FY08 budget)

This project is a supplement to a project funded by the Coastal Response Research Center. The project is designed to examine the social disruption from oil spills and spill response. In particular, to characterize effects, vulnerabilities, and the adequacy of existing data to inform decision-making. OSRI's contribution will add Cordova, Alaska to their study sites. This provides a study site that has had a relatively long period for the effects to be fully realized. It also builds on the previous research done in relation to the *Exxon Valdez* oil spill. The proposal abstract follows.

Oil spill response planners never disregard the human dimensions of oil spills. In fact, the National Contingency Plan requires that items of economic and environmental importance that are threatened by a spill be covered in the plan. However, the strength of ecological concerns and the wealth of information on ecological sensitivity tend to be primary drivers in contingency planning. The socioeconomic lags behind the ecological in terms of readily available information and tools to assess sensitivity. Social endpoints that are acutely threatened *are* protected in an emergency response, but the systematic assessment of social and economic effects is not widely done in area-based contingency planning processes. This research project investigates what is involved in bringing a systematic assessment of socioeconomic vulnerability considerations into area-based oil spill contingency planning. While this project has one eye on the ultimate goal of producing practical decision-support or social impact assessment tools, it presupposes that several types of information need to be collected, evaluated, and synthesized before such tools can be constructed. Specifically: (1) human dimensions endpoints threatened by oil spills need to be systematically identified; (2) the relationships between these endpoints, effects, and planning and management actions should be evaluated; (3) the sufficiency of existing data and data-analysis tools to characterize and anticipate these causal relations must be assessed. Initial inquiries with emergency responders and contingency planners into these questions have validated their importance.

Drawing on existing data wherever possible, we propose to review qualitative data to reveal the types of human dimensions endpoints that matter in oil spills. In Phase 1, we will document how the importance of endpoints can be understood and, eventually, measured using the conceptual framework of vulnerability. We will meet with experienced personnel as part of three case studies to identify endpoints of concern and use the conceptual framework of vulnerability to identify key factors influencing losses. The information we gather will be structured in a way that facilitates planning interventions. In Phase 2, we will investigate to what extent existing data are capable of depicting the human dimensions considerations identified in Phase 1 and we will propose recommendations for how a planning process that has been strongly led by ecological considerations can be broadened to also include the most important human dimensions. These recommendations will also summarize how oil spill planning can proceed using a perspective that highlights the coupled human and natural systems.

4. Modeling

One modeling effort will continue into FY10.

a. Atmospheric circulation modeling *(by Peter Olsson, AEFF, Contracted through 6/30/10)*

The model validation experiment is scheduled for summer of 2009. The atmospheric modeling is necessary as an input to ocean circulation and wave models, as well of interest to oil spill response models. OSRI has supported the Alaska Experimental Forecast Facility (AEFF) in their development of a Regional Atmospheric Model System (RAMS) and Weather Research and Forecasting Model (WRF). This funding is to allow those models to be run through the model validation exercises.

At the Alaska Experimental Forecast Facility (AEFF), a daily numerical weather forecast model—the Weather Research and Forecasting Model (WRF)— is operational for the region of Prince William Sound (PWS). As is true of all weather forecast models, this involves using a cluster of computers to solve a mathematical model approximating how we think the atmosphere works. In fact this is the same thing that the National Centers for Environmental Prediction (NCEP) does for the National Weather Service (NWS). What is different with our project is that while NCEP does this for all of Alaska, AEFF concentrates available computing power on the region of Prince William Sound. This allows for a finer-scale grid spacing (4-km) than the NCEP models (12.5 km at best). This finer grid-scale hopefully resolves smaller scale topographic effects that are not in the NWS simulations.

In our study we exploit the capability of grid nesting, in effect telescoping down from a coarse grid-mesh grid that covers all of Alaska and surrounding oceans, to an intermediate grid that covers all of southern Alaska and the Gulf of Alaska, and ultimately down to the fine-mesh grid that covers PWS and its surrounding terrain/ocean.

The model simulations produce hourly (or less if necessary) 3-d forecast fields of a host of variables, including: temperature, pressure, winds (3-d), humidity, precipitation, and cloudiness. This is just a small sampling of variables of most interest to the typical user in PWS, a host of other 2- and 3-d variables are available and more can be calculated from the raw output.

The model provides estimates of the conditions between observation points. Several weather stations have been deployed in the Sound and there are several C-MAN stations and NDBC buoys in the Sound. Still there are several data-sparse sections in a region where weather and wave conditions can vary dramatically over a scale of 10 km or so. The model provides estimates of the conditions in those places where direct observations do not exist. These are, of course, predictions and so will never replace having an actual observation at a given point in space and time

In FY09 the focus is on supplying atmospheric predictions in support of ocean modeling efforts, and validation of the atmospheric model predictions. The final report must present a section on the validation of the model output and how the model was used by other components of the validation exercise.

B. Goal #2 Respond:

1. Joint Industry Program (JIP): Oil Spill Contingency for Arctic and Ice-laden Waters. (Hajo Eicken, UAF, Contracted through 06/30/10)

In 2006 OSRI began working with CRRC to develop an RFP for a study of biological effects to compliment the work of the JIP. This led to the development of a proposal to CRRC that has three components. The first is a study to examine how the growth of the ice affects the transport of various fractions of the hydrocarbons through the ice. The second is to examine the ability of microbes to degrade the oil at temperatures and salinities associated with sea ice. The third is to combine the results in models in order to estimate exposure and degradation potential. Several institutes collaborated in submitting the proposal and OSRI committed to fund the University of Alaska portion of the proposal. OSRI's funding commitment was \$45K in FY08 and another \$18K in FY09. The statement of work from the proposal submitted by UAF follows.

The contribution by the University of Alaska Fairbanks (Petrich and Eicken) to this project will consist of the following:

- (1) Develop and code a numerical model for simulating multiphase fluid dynamics in sea ice as relevant for the movement of oil and transport of water-soluble compounds (WSC) released from oil entrained into sea ice. This work will build on earlier work for single-phase flow and brine-flux simulations.
- (2) Carry out a series of model runs to assess the sensitivity of oil and WSC movement to relevant boundary conditions and parameterizations of key processes, including ice growth rate and temperature, ice permeability, oil layer properties and thickness.
- (3) Consult and participate in laboratory experiments at SINTEF, Norway on oil release into sea ice and its potential impacts on ice microbial communities. This work includes analysis of ice microstructure and stratigraphy and potential ancillary experiment to characterize predominant mode of oil entrainment.
- (4) Work with other team members at SINTEF, Norway and other institutions to synthesize results from model studies and laboratory experiments.

C. Goal #3 Inform:

1. Education

a. Update of Darkened Waters exhibit (OSRI cost: \$15K) The Darkened Waters exhibit was originally built as an informal education tool discussing the *Exxon Valdez* oil spill. The exhibit was updated approximately 10 years ago and toured museums at that time. It has been in storage in Kansas for much of the last 10 years due to a lack of funding and space to return it to Cordova. The funds requested here are to be used to assist in returning the exhibit to Cordova and begin updating the exhibit to include the lessons learned over the past 20 years. This funding should be used as matching funds for other requests that will be needed to complete the work.

3. Graduate Research Fellowships

b. Promoting Sustainable Oil and Gas Development on Alaska's North Slope through Local-Scale Integration of Geophysical and Traditional Knowledge; Matthew Druckenmiller, University of Alaska Fairbanks Ph. D. student (Contracted through 6/30/10)

These funds are being carried forward for the Graduate Research Fellowship as described on page 17 of this plan.