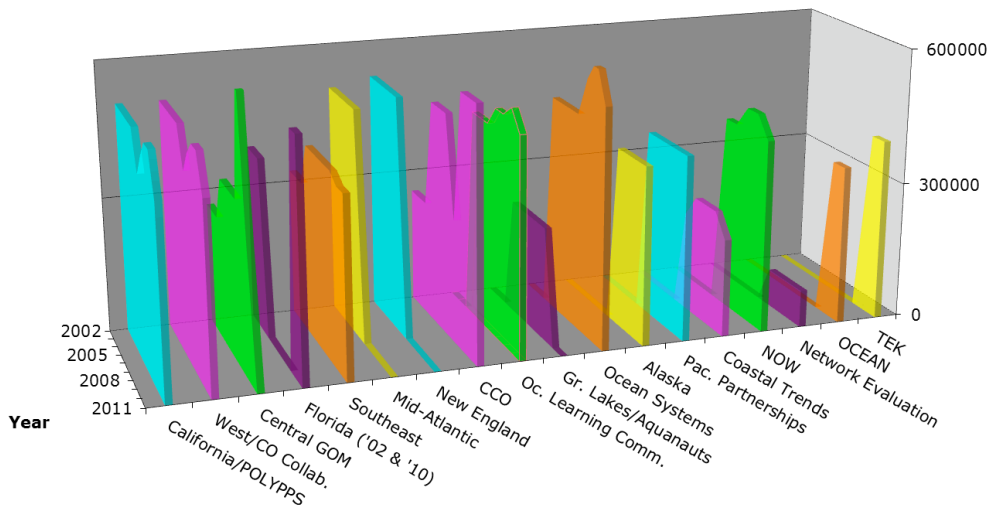


National Science Foundation Funding for COSEE FY 2002-2010

Following are the award information and the Project Summaries for all NSF COSEE awards, grouped chronologically by funding cycle. NSF issued 5 Requests for Proposals between 2001 and 2010 and made COSEE awards totaling \$44,153,438. A total of 17 distinct Centers have been funded, and several Centers have been renewed through one or two solicitations; several Centers were not renewed. The Figure below provides a snapshot of Center funding over the years from 2002 to 2010 and the amount of funding provided to each Center.

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- 2002 **NSF 01173** - 7 Centers and the Central Coordinating Office (CCO at CORE)
COSEE California (CA), COSEE WEST, COSEE Central Gulf of Mexico (CGOM),
COSEE Florida (FL 2002), COSEE South East (SE), COSEE Mid-Atlantic (MA),
COSEE New England (NE)
 - 2004 Additional funding for the CCO at CORE
 - 2005 **NSF 05503** - 3 New Centers COSEE Ocean Learning Community (OLC), COSEE Great
Lakes (GL), COSEE Ocean Systems (OS) and 2 Renewed - COSEE CGOM, COSEE SE
 - 2007 **NSF 07527** - 4 New Centers COSEE Alaska, COSEE Pacific Partnerships (PP), COSEE
Coastal Trends (CT), COSEE Networked Ocean World (NOW), and 2 Renewed COSEE
CA, COSEE WEST, (COSEE MA split into COSEE NOW and COSEE CT)
 - 2008 **NSF 08509** - New National Coordinating Office (NCO), National Evaluator, 5
Collaborative Awards with existing COSEE Centers
 - 2009 5 Collaborative Awards for Cross COSEE activities
 - 2010 **NSF 10527** - 3 New Centers – COSEE OCEAN, COSEE TEK, COSEE Florida 2010 and
2 Renewed COSEE OS and COSEE SE
-

Overview of Annual Funding Levels (\$) through 2011



0215416 Collaborative Research: Establishment of Mid-Atlantic COSEE, 1-Aug-02 - 31-Jul-09, PI: Michael DeLuca, Rutgers University, New Brunswick, \$962,000

Associated collaborative proposals:

0215433 PI: Michael Newman, VIMS, William & Mary, \$625,330

0215094 PI: Laura Murray, University of Maryland Center for Environmental Sciences, \$462,050

0215399 PI: Liesl Hotaling, Stevens Institute of Technology, \$460,620

This collaborative award establishes the Mid-Atlantic Center for Ocean Science Education Excellence to serve 4 states (Virginia, Maryland, New Jersey and New York). Using a 'matrix model', the Center will scale-up successful individual programs at the partner institutions and establish strong linkages between partners. A primary thematic focus is on the visualization and K-12 classroom use of data from ocean observatories and monitoring buoys (Rutgers, UMCES, and VIMS). Stephens Institute of Technology will contribute expertise in K-12 educational technology and delivery. Hampton University will serve as a conduit to underrepresented minority groups and provide financial support for both undergraduates and graduate students.

0215341 Regional Center for Ocean Sciences Educational Excellence [COSEE]—Gulf of Mexico, 15-Sep-02 — 28-Feb-07, PI: Walker, Sharon, University of Southern Mississippi, \$794,707

This award provides funding for a Regional Center for Ocean Sciences Education Excellence with administrative offices located at the University of Southern Mississippi's Marine Education Center and Aquarium in Biloxi, MS. The proposal would establish satellite centers in Louisiana and Alabama, and expand existing USM teacher professional development efforts into these states. This Center would make extensive use of the expertise of regional marine educators as interpreters of ocean and coastal marine science research in professional development institutes for formal and informal educators. This center will be one of seven regional centers that represent the initiation of the COSEE network.

0215458 Florida Center for Ocean Science Education Excellence 1-Sep-02 — 31-Aug-07, PI: Paula Coble, University of South Florida, \$1,156,572

This award provides support to establish a Florida Center for Ocean Science Education Excellence that will serve as a regional hub with a strong emphasis on the integration of ocean research and education. The partnerships to be established include a diverse mix of institutions: three state universities, one private university, four state and federal research entities, multiple informal education entities and public schools and systems from three different geographic areas in the state. Stakeholders and audiences for the Florida COSEE include ocean scientists, K-12 teachers, preservice undergraduates, state and school-district decision-makers and the general public. Specific activities will include workshops and outreach using multiple formats and platforms. There will be a strong focus on diversity with the technology group for the Center located at Florida A and M University, a historically African American institution. On a national

scale, the Center will nurture development of new model programs for educator-scientist training and collaborations. This COSEE Center will establish a dynamic mosaic of partners that have excellent potential to promote the use of the ocean sciences as an interdisciplinary vehicle for effectively integrating research and education at multiple levels in Florida. The key role to be played by the state's primary historically black university will strengthen minority outreach and enhance educational and career opportunities for the diverse mix of ethnic, racial and cultural groups statewide.

0215497: Collaborative: COSEE-West, 1-Sep-02 — 31-Aug-09, PI: Linda Duguay, University of Southern California, \$1,272,717

Associated collaborative proposals:

0215506 PI William Hammer, University of California Los Angeles, \$1,243,467

This award provides support to establish a COSEE West in the greater Los Angeles area with a diverse mix of activities aimed at 1) enhancing regional awareness of ocean sciences, 2) using ocean science as a vehicle to increase general science literacy and 3) increasing the number of students who choose science and ocean science careers. These goals will be addressed by through catalytic, multi-faceted collaboration between the University of Southern California and the University of California at Los Angeles with additional links to the Los Angeles County Museum of Natural History and the greater Los Angeles school districts. A distance learning partnership will be established with the College of Exploration in Virginia. Activities will include an extensive professional development and leadership program for science teachers, a community lecture series, an ocean science web site, a college mentorship program and curriculum development activities.

COSEE West has the potential to enhance science education in a densely populated and diverse major urban area. The program conveys a focused vision and a set of interesting plans for incorporating ocean scientists and their research results into classrooms, informal education activities and public outreach. Because of its focus on the LA basin, this COSEE Center has the potential to have a major impact on science education in school districts within the greater Los Angeles area.

0215500 Collaborative Research: California Center for Ocean Science Education Excellence -1-Sep-02 — 31-Aug-07, PI: Craig Strang, University of California Berkeley, 1,077,506

Associated collaborative proposals:

0215232 PI Cheryl Peach, University of California San Diego, \$823,397

0215225 PI Diedra Sullivan, Monterey Peninsula College, \$616,105

This award provides support to establish a COSEE Center in California with three distributed complementary partners: the Lawrence Hall of Science on the campus of the University of California at Berkeley (informal science partner), Scripps Institution-University of California San Diego (research partner) and Monterey Peninsula College (a public community college and formal education partner) in Monterey. The activities of the proposed COSEE will be organized around four primary initiatives: 1) an outreach effort based at Scripps to engage ocean scientists

in K-14 education and the interpretation of their research, 2) the development of an undergraduate course Communicating Ocean Science designed to increase the involvement of undergraduates, graduate students and scientists in educational outreach, 3) the development of an Ocean Careers web site and 4) developing and testing an Ocean Immersion Site for K-12 education based at Scripps to serve the large and culturally diverse population of the San Diego area.

The work of this COSEE will enhance the integration of research and education in California by linking some of the best ocean science researchers in the world to science education in both formal and informal settings. The California COSEE's focus on working with schools and school districts in the diverse San Diego area will provide additional resources to strengthen science education and increase access to knowledge and careers among underrepresented populations. Several of the initiatives in this proposal will add diversity and balance to the mosaic of approaches and activities to be implemented by the COSEE network. In particular, the extension model is a unique 'user-centered' approach to getting more scientists involved that clearly needs to be developed and its effectiveness assessed. The undergraduate course in communicating science has potential as a professional development vehicle for college faculty, graduate students and undergraduate majors; this component is being co-funded by NSF's Division of Undergraduate Education. The DUE's Advanced Technology Education program is also providing co-funding for the Careers website at Monterey Peninsula College.

0215402 Southeastern Center for Ocean Science Education Excellence: A Systemic Approach to Forming Ocean Science Education Partnerships, 1-Sep-02 — 31-Aug-06, PI Malcolm DeVoe, South Carolina Sea Grant Consortium, \$969,136

This award provides funding for a Regional Center for Ocean Sciences Education Excellence with administrative offices located at the South Carolina Sea Grant Consortium Office in Charleston, SC. The center will focus on the North Carolina, South Carolina and Georgia region, and center personnel will work to forge stronger relationships between research organizations, researchers, schools and informal educational sites in the region. The Southeastern Center for Ocean Sciences Education Excellence (SECOSEE) will also reach out to underrepresented groups in the ocean sciences by creating programs based on the unique African American coastal heritage in the area. Activities include an inventory of existing ocean science materials and programs, awareness workshops for educators and researchers, collaborations between researchers and educators, enhanced professional development opportunities, supplemental school and summer science programs, website development, and evaluation. Substantial funding for the SECOSEE program will be provided by NOAA's Coastal Ocean Services and Office of Ocean Exploration.

0215437 COSEE Central Coordinating Office, 1-Nov-02 — 30-Apr-05, PI: Carolyn Thoroughgood, Consortium for Ocean Leadership, Inc, \$753,688

The Consortium for Oceanographic Research and Education (CORE) will provide coordination, communication, evaluation and strategic planning services to the Centers for Ocean Science Education Excellence network. Central Coordinating Office activities supported by this award will include a series of network PI and outreach meetings to build community consensus and

enhance communications between Centers. The COSEE CCO will also conduct an annual 'value-added' workshop on a topic of concern to the network. Topics will include program and network evaluation and assessment as well as the development of an overall strategic plan for COSEE. In addition, the CCO will handle the recruitment and organization of an appropriate national advisory group for the network. The office's functions will also encompass outreach to non-COSEE educators and scientists as well as agencies and institutions with an interest in ocean science education. A COSEE network website will be established in conjunction with the Bridge website. Subcontractors include the Office of Program Evaluation at the University of South Carolina (evaluation) and the Virginia Institute of Marine Science (website development).

0215456 New England Regional COSEE, 1-Aug-02 — 31-Jan-10, PI: William Spitzer, New England Aquarium Corporation, \$2,601,786

This award provides funding to The New England Aquarium (NEAq), Woods Hole Oceanographic Institution (WHOI), and the University of Massachusetts (UMass) for development of a New England Regional Center for Ocean Science Education Excellence (NER-COSEE). This center will focus on capacity building in the New England region by: 1) providing educators (teachers and other formal and informal educators) with multiple tools to create programs and curricula that convey knowledge of the oceans, and 2) providing research scientists and scholars the means and training to be more effectively involved in K-12 education and undergraduate formal and informal education. All three partners are highly visible centers of public education, outreach and ocean science research and work with a wide network of educators from public, private and informal education centers. In addition, U.Mass has an extensive track record in educating under-served students and has a strong teacher-training program. Activities will include working with informal educators throughout the region via workshops and by providing a pool of resources for prototyping and evaluation; working with researchers to help them learn to communicate effectively with teachers, informal educators, students, and journalists, and providing them with a network by which they may collaborate with educators and the media; working with K-12 educators to develop innovative curriculum modules that teach national and state science standards using ocean science, and to assist in the development of networks and programs that recruit and train more qualified K-12 science teachers. The NER-COSEE will initially work with the Global Learning Center School/New Bedford Public School and Harbor School in Boston to pilot test and evaluate programs. They will also create a Resource Center, housed in the NEAq's Education Center that will make resources available for broad distribution.

0451110 COSEE Central Coordinating Office, 1-Feb-05 — 30-Sep-08, PI: Susan Cook, Consortium for Ocean Leadership, Inc, \$1,471,701

This proposal requests funding to renew the support for the Central Coordinating Office (CCO) for the Centers for Ocean Sciences Education Excellence (COSEE) currently based at the Consortium of Oceanographic Research and Education (CORE). Central Coordinating Office activities supported by this award will include planning and coordinating annual PI conferences, National Advisory Board meeting and specialty workshops focused on the interests and needs of the network. In addition, the CCO will expand its role dramatically to include marketing and outreach activities designed to raise the national profile of both COSEE and ocean sciences

education. Other partners in this effort are the National Sea Grant Program (NSGO) office, the Virginia Institute of Marine Science (VIMS) and the Office of Program Evaluation (OPE) at the University of South Carolina. VIMS will expedite internal network communications and design a comprehensive, nationally recognized web portal integrated with NSF's Digital Library for Earth Systems Education (DLESE) and the Bridge website for educators. Evaluation of the effectiveness of network activities will be handled by the OPE. As the lead institution, CORE will manage the office and its activity and oversee website and evaluation activities. Broader Impacts The very nature of the COSEE program is about broader impacts. The potential impact of the CCO could be unprecedented, if successful, as it will start putting the ocean on the learning map of Americans and their government. CCO and COSEE has enormous potential to enhance the infrastructure for both research and education. As researchers start to realize the enormous pool of expertise and support that COSEE provides, we will start to see more and more collaborations. This will enhance the educational content and experience for teachers and students.

0527849 Center for Ocean Sciences Education Excellence SouthEast: Building on Success, 15-Sep-05 — 28-Feb-11, PI: Lois Spence, South Carolina Sea Grant Consortium, \$2,093,826

This award continues funding for the Center for Ocean Sciences Education Excellence - South East (COSEE SE) with administrative offices located at the South Carolina Sea Grant in Charleston, SC. The proposed regional COSEE effort is focused on the South Atlantic Bight in 3 states (North Carolina, South Carolina, and Georgia). COSEE SE has a centralized administration with a full-time director and geographically distributed team members. Activities include: annual, week-long Ocean Leadership workshops for teachers and scientists at different marine labs in each state, Ocean Awareness Days at many small informal education sites in each state, team-based workshops for middle school teachers based on a curriculum specifically designed for coastal SC, NC and Georgia, workshops to promote the use of regional ocean observing data in classrooms, Coastal Legacy programs that use the local African American heritage to develop activities that will attract these students to marine science, a test of a middle school immersion program for marine science in two schools, and a well developed evaluation effort. COSEE SE provides a significant regional service as the hub of a network for the education and outreach efforts of regional research programs such as SEACOOS and sub-regional, ocean observing programs. The Center will continue to expand this responsibility by reaching out to additional science and education partners, adding them to the existing data base inventory, and helping them have some direct interaction with COSEE SE activities. COSEE SE's efforts will highlight research on the South Atlantic Bight, inventory diversity projects, develop curriculum, and connect to the national COSEE network. COSEE SE will also be an active participant in the national education network for IOOS. COSEE SE and COSEE Mid-Atlantic propose to develop and hold a workshop for scientists and educators to develop applications for the classroom using real-time SEACOOS data. In addition, new partnerships are proposed. These new partnerships are possible because of the networks established in the initial funding period. The program includes an increased diversity outreach component building on the past COSEE SE successes with African-Americans, and will also expand the number and kinds of outreach and workshop programs to increase coastal awareness in the three states.

0528706/ 0707385 Collaborative Research: Centers for Ocean Science Education Excellence - Oceans in the Earth-Sun System, 15-Sep-05 — 28-Feb-10, PI: Annette deCharon, Bigelow Laboratory for Ocean Sciences moved in 2007 to the University of Maine, \$1,627,561

Associated collaborative proposals:

0528702 PI: Lee Karp-Boss, University of Maine, \$444,985

0528686 PI: Janet Campbell, University of New Hampshire, \$321,000

This award establishes a new Center for Ocean Science Education Excellence (COSEE) via awards to the Bigelow Laboratory for Ocean Sciences (0528706), the University of Maine (0528702), and the University of New Hampshire (0528686). The main goals of this thematic Center are to broaden understanding of the oceans in the context of the earth and solar systems and to help the COSEE network reach rural and inland audiences. The PIs will pioneer a system of interfaces, tools, and resources to reach underserved and underrepresented groups, and to bring ocean sciences to inland audiences by presenting it in the context of more familiar components of the earth system, including environmental and space sciences. One goal is to explore the effectiveness of expanding knowledge of the ocean's role beyond being a driver of earth's climate to placing the earth in the context of its unique place in the solar system. Activities include building and training educator-scientist teams to work towards specific goals, e.g., testing strategies for effective use of ocean data, training in the use of concept mapping, and the identification and evaluation of high-quality resources. Evaluation of products, models and information is integrated throughout, with continuous self-assessment. Formal education partners at the University of Maine and University of New Hampshire will test the efficacy of materials with educators whose knowledge of ocean-related content ranges from novice to expert. Maine will be a test bed for the COSEE network to start reaching inland rural populations. The team includes scientists and educators with expertise in the hydrosphere, biosphere, cryosphere, geosphere, and atmosphere. The team will develop concept maps and case studies that show application of ocean topics to the National Science Education Standards.

The Center will develop a formal mechanism for scientific review of materials to ensure the products they recommend are of the highest quality and meet rigorous standards, as well as to provide feedback from educators and scientists to product developers. They will select resources from DLESE, the BRIDGE, NOAA and others and evaluate these for classroom readiness and scientific accuracy using their team of well-trained resource evaluators with first-hand knowledge of earth systems science. They also will do a "gap analysis" of missing resources. The "Gap Analysis" will also inform the science community about avoiding developing materials for well-covered topics. The review process developed by COSEE-OESS, from initial use of NASA's education product review, will be disseminated nationally as a model for evaluating best practices and assessment and evaluation guidelines for education materials. In-service teacher programs will focus on expansion of University of New Hampshire's Coastal Observing Center summer in-service teacher workshops to incorporate OESS content and evaluation of activities ("test bed" for novel materials and activities). These workshops have annual themes focusing on ocean observing systems and the integration of buoy, shipboard, and satellite data (GoMOOS).

Pre-service teachers and general science students at the University of Maine will take a new course created by OESS to learn ocean research methods by focusing on using physical principles, concepts and approaches to explain phenomena in aquatic sciences that are aligned to the NSES. The course will be developed for distribution to teachers after rigorous evaluation. Intellectual Merit of the Center: This thematic center focuses on creating and evaluating a series of interconnected tools and techniques designed to broaden understanding of the ocean in the context of the earth and solar systems. Results will be translated into innovative multimedia products that showcase the ocean in the earth-sun system. Educational resources will be evaluated for science and education impact, and gaps in these resources will be identified and filled. A new undergraduate course to teach about ocean phenomena will be developed, tested, and disseminated nationally. The proposed Center will help COSEE reach inland and rural audiences. Broader impact: This Center will serve as a "learning organization" to deliver excellent products, models, and information that can be applied virtually anywhere. The final products, publication of "Best Practices" (a document that describes the value of system context in terms of learning) and "Strategies to reach inland audiences" will be disseminated throughout and beyond the COSEE network.

0528725 Collaborative Research: Ocean Learning Communities - Center for Ocean Science Education Excellence, 15-Sep-05 — 31-Aug-11, PI: Keil, Richard, WA, University of Washington, \$1,304,275

Associated collaborative proposals:

0528017 PI: Kathy Sider, Seattle Aquarium Society, \$1,002,858

COSEE- Ocean Learning Communities' (COSEE-OLC) central premise is that citizens need to become ocean science literate and informed by current research if they are to be aware of the impact the oceans have on their physical and economic health, and if increased citizen stewardship of the marine environment is to occur. The University of Washington's College of Ocean and Fishery Sciences, the University of Washington's College of Education and the Seattle Aquarium will establish an "Ocean Learning Communities - COSEE" (OLC-COSEE), a thematic COSEE that will foster collaborations among the oceanography research community, the science of learning community, the general public, and the maritime industry. OLC-COSEE will leverage the expertise and resources of the College of Education's NSF-funded Learning in Informal and Formal Environments (LIFE) "Science of Learning" Research Center as well as each of the partners' existing outreach and educational efforts. COSEE-OLC will organize, cultivate and sustain science-based, ocean-informed Learning Communities composed of diverse stakeholders, including the maritime business community, who will collaborate to promote sound oceans education. OLC-COSEE's main catalytic activity will be creating Ocean Learning Communities, or gatherings of traditionally disparate stakeholders such as scientists, educators, representatives from businesses with a connection to the oceans, and citizens who derive economic or recreational sustenance from the oceans. Through structured learning activities, the communities will develop a common language and a commitment to creating collaborations that will improve ocean research and public awareness at the regional and national levels. Citizens and scientists will learn together through the Learning Community. Citizens will become citizen-scientists as they learn basic ocean science concepts and terminology. Scientists will learn how to engage citizens. The learning experiences will create a catalytic cycle of change culminating

in citizens with the skills, commitment and efficacy to work with the COSEE-OLC partners in creating collaborative, science-based signature projects supporting education and outreach. The PI's, the evaluation team, and additional participants from each partner institution have formed a learning community and begun the journey of establishing common language and goals through sustained discussions of issues, partners, and educational possibilities. Guided by the expertise of an Advisory Committee including senators, high-ranking military personnel, a former astronaut, the vice president of the American Museum of Natural History in New-York and the chief executive officer of the United Indians of All Tribes Foundation, the partnership will foster and study new learning models in ocean sciences and attract additional funds to support on-going activities. Very few learning models focus on the interdisciplinary, fast-changing, technology-driven and still exploratory nature of ocean sciences and its associated research questions. The Ocean Learning Communities' approach will provide both science and cognitive research-based educational practices that can be disseminated through the National COSEE Network to advance the oceanography community's understanding of the power of oceanography education for our nation.

0528597 Center for Ocean Sciences Education Excellence: Central Gulf of Mexico (COSEE: CGOM), 1-Sep-05 — 31-Aug-10, PI: Sharon Walker, University of Southern Mississippi, \$1,814,573

This award provides renewed funding for the Center for Ocean Sciences Education Excellence - Gulf of Mexico (COSEE-GOM) with administrative offices located at the University of Southern Mississippi's Marine Education Center and Aquarium in Biloxi, MS. The proposal includes subcontracts to Louisiana Universities Marine Consortium, Dauphin Island Sea Lab in Alabama, Mississippi State University, and the University of Florida. COSEE-GOM makes extensive use of the expertise of regional marine educators as interpreters of ocean and coastal marine science research. PI's will provide a variety of professional development institutes for formal and informal educators and will evaluate the effectiveness of these efforts. Professional development institutes include a two day workshop for researchers and informal educators, a five-day workshop for teachers and researchers followed by ten days of interactive website instruction, and a "Teachers-to-Sea" opportunity for teachers to work with a variety of research equipment while aboard a cruise on the U.S. Navy's Hydrographic Survey ships. Institutes will be held in each state on a bi-annual basis. Funding for this project is provided by the NSF Division of Ocean Sciences and by the NSF EPSCOR program.

0528674 Great Lakes COSEE, 15-Dec-05 — 30-Nov-11, PI: James Diana, University of Michigan Ann Arbor, \$1,250,000

This award establishes a regional Center for Ocean Science Education Excellence (COSEE) in the Great Lakes area. The new Center adds the critical freshwater component to the COSEE network through a diverse set of scientist and educator collaborations across the Great Lakes region. Sea Grant educators will lead the education efforts. Native Americans and urban teachers and students will be targeted in the Great Lakes/ocean literacy effort. A multi-layered set of activities (including use of GLOS data), that is focused on public understanding of ocean/Great Lakes science, will provide nearly 1800 educators with enhanced science knowledge and will engage over 350 researchers in education of new audiences. Fifteen thousand Grades 4-10

students in Great Lakes states will benefit from the proposed activities. The COSEE-Great Lakes will engage in six types of activities: 1) teacher enhancement (Lake Exploration workshops, Lake Guardian workshops, Scholarships for teachers, teachable moments), 2) research scientist interactions, 3) Great Lakes/ocean science for the public, media, and schools, 4) curriculum development linking the Great Lakes and the ocean, 5) forging student connections to Great Lakes science and research, and 6) adding the freshwater component through collaborative activities with the COSEE network. The project is proposed through the University of Michigan Ann Arbor, but includes partnerships with Pennsylvania Sea Grant, Penn State Erie; Illinois-Indiana Sea Grant College, Univ. of Illinois at Urbana-Champaign; Michigan Sea Grant; Great Lakes Sea Grant Network/Great Lakes Environmental Research Laboratory.

0730068 Collaborative Proposal: COSEE Center - Centers for Ocean Sciences Education Excellence - Networked Ocean World (COSEE-NOW), 15-Sep-07 — 31-Aug-11, PI: Harold Clark, Liberty Science Center, Inc., \$306,003

Associated collaborative proposals:

0730719 PI: Janice McDonnell, Rutgers University New Brunswick, \$981,847

0731046 PI: Yoder, James, Woods Hole Oceanographic Institution, \$837,988

COSEE-NOW proposes to use information generated by ocean observing systems (OOS) as a powerful platform to enhance public literacy about the ocean and stimulate public support for ocean research. The mission of COSEE-NOW is to enable use of transformative ocean research and effective education practices to inspire students and the general public in ocean exploration, discovery, and stewardship. COSEE-NOW has identified three key areas of investment that combine the resources and experiences of the project PIs to promote high-quality OOS education and public outreach (EPO) and contribute to the COSEE network. The goals include: 1) assess the knowledge and needs of target OOS audiences: The PIs propose to survey target audiences including the K-16 students/teachers, policy/decision makers, and the science literate public to understand their awareness, knowledge, and attitudes related to OOS. The results of these needs assessments will enable COSEE-NOW and OOS EPO providers to develop useful products while increasing awareness of OOS and its relevance to these audiences. 2) Improve collaboration and coordination among scientists and educators in the OOS community. This proposed effort will support EPO programs within existing OOS networks while helping to develop planned OOS initiatives. Our work will increase the effective translation and dissemination of scientific data and knowledge to broader audiences and improve use of effective education practices among scientists in the OOS community. 3) Increase public awareness of Ocean Observing Systems. COSEE-NOW is externally focused on building public awareness of OOS through innovative media products, K-12 classroom applications, and free-choice learning environments. Through this goal, we expect to increase awareness of OOS and ocean literacy concepts among a variety of target audiences. COSEE-NOW is composed of an accomplished team uniquely qualified to conduct the proposed tasks. COSEE-NOW includes core partners in formal education (Rutgers University), informal education (Liberty Science Center), and research (Woods Hole Oceanographic Institution). Project partners including Virginia Institute of Marine Science (VIMS), Stevens Institute of Technology- Center for Innovation in Engineering & Science Education (CIESE), Monterey Peninsula College Marine

Advanced Technology Center (MATE), and Word Craft also contribute to the COSEE-NOW team.

0730336 COSEE Alaska: People, Oceans and Climate Change, 15-Aug-08 — 31-Jul-11, PI: Paula Cullenberg, University of Alaska Fairbanks Campus, \$1,582,531

Establishing a Center for Ocean Science Education Excellence (COSEE) in Alaska provides a unique opportunity to capitalize on the International Polar Year's spotlight on the Arctic, the wealth of ocean and climate change research currently underway in Alaska, as well as the richness of Alaska's local and traditional knowledge inherent in its indigenous populations. As envisioned, COSEE Alaska will be a cohesive system of infrastructure, educational tools, cultural context, and scientific interactions used to further an ocean literate populace as well as demonstrate the link between the impacts of coastal climate change and human activity. To achieve this vision, COSEE Alaska will create a network of scientists and educators in Alaska dedicated to developing activities that focus on ocean and coastal ecosystems and communities experiencing the impacts of ocean climate change and to sharing results with the COSEE network, and the nation. These activities will address a suite of five objectives: [1] Increase collaboration and interaction among ocean scientists, educators, students, and coastal communities in Alaska and the nation with an emphasis on ocean climate change; [2] Provide tools and services to help ocean scientists effectively participate in education and outreach with a focus on ocean climate change and ocean literacy; [3] Enhance teacher capabilities for incorporating ocean climate change information and "place-based" knowledge into existing curricula; [4] Increase access to and participation in ocean sciences by underrepresented and underserved populations; and [5] Increase and broaden communication about ocean science and traditional knowledge of ocean climate change to audiences in Alaska and the nation, including the COSEE network. Through COSEE Alaska, we provide the training, educational opportunities, outreach, and scientific tools to integrate knowledge from both the peoples of coastal Alaska and the scientific communities concerned with ocean climate change. COSEE not only provides to the public the awareness of how climate change is already impacting the U.S. arctic, but also provides back to coastal communities information on the global attempts to study and mitigate the impacts of change. Through its partnerships with other COSEEs and the COSEE Network, its ocean climate change web portal for educators, use of distance learning techniques, and informal education activities for Alaska tourists, COSEE Alaska will broaden its impact far beyond the Alaska population.

0730884 COSEE Coastal Trends, 15-Sep-07 — 31-Aug-11, PI: Laura Murray, University of Maryland Center for Environmental Sciences, \$1,080,000

A major environmental challenge for our generation is to comprehend and ultimately manage the myriad of changes occurring in the coastal ocean. Understanding how climatic and anthropogenic factors drive these coastal trends requires basic science literacy. The goal of the present project is to increase literacy in ocean science with a focus on understanding coastal trends through partnerships among scientists, educators and the general public. This COSEE Coastal Trends project brings together experienced science educators and coastal ocean research scientists in collaboration to analyze, integrate and interpret current scientific knowledge on ocean science principles and focus on coastal trends. The project will generate educational

modules addressing these issues for teachers, students and the general public. The project builds on previous COSEE experience and uses creative partnerships with coastal ocean scientists (e.g., Long Term Ecological Research projects in MA, VA and GA) and end-user groups (e.g., National Park Service, VA Aquarium, National Geographic Society, NOAA NEERS) to develop and deliver unique and exciting educational materials (e.g., video clips, pod-casts, web tutorials) that address National Science Education Standards and Ocean Literacy Principles. Unique Fellowship Teams comprised of an educator, a scientist, a graduate student and an under-represented college student (supported by a science communicator, webmaster and evaluator) will be assembled to develop twelve coastal trend modules (three per year). These Fellowship Teams will serve to integrate research and education to generate Coastal Trend Modules, which will be field-tested in diverse institutes, courses and mentoring activities. This sequence of synergistic interactions will deliver materials that end-user groups can apply and disseminate to K-12 and public education venues. COSEE funds will be effectively leveraged by fostering synergism with scientists at little cost and by forming broad, creative partnerships. A staggered time-line insures development, delivery, field-testing, evaluation, and feedback. The project's scope is designed to build with increasing experience over the course of its duration. The effectiveness of project institutes and modules will be continually assessed through interactions between external and internal evaluators that optimize feedbacks.

0731338 The Pacific Center for Ocean Science Education Excellence -COSEE Pacific, 15-Sep-07 — 31-Aug-11, PI: Janet Hodder, University of Oregon Eugene, \$2,049,570

COSEE Pacific Partnerships is a regional collaboration among members of the Western Association of Marine Laboratories, Pacific community colleges, and informal science education institutions. The primary goal of the collaboration is to integrate marine research and education for audiences that traditionally have had limited access to an understanding of the ocean. The project will develop five partnerships based at marine labs (the University of Oregon's Institute of Marine Biology, Oregon State University's Hatfield Marine Science Center, Humboldt State University Marine Laboratory, California, the Kewalo Marine Laboratory, University of Hawaii and Western Washington University's Shannon Point Marine Center). Each marine lab will partner with one or more community colleges and informal science education institutions to undertake a series of actions to promote ocean education. The COSEE partnerships will develop a number of model activities that increase educational and professional development opportunities for community college faculty, which in turn will improve the ocean literacy and career potentials of community college students. These activities include opportunities for faculty to conduct research and outreach at marine labs, courses designed to increase opportunities for ocean literacy at community colleges, and internships and career information for community college students. The partnerships will expand the role of marine-lab scientists in education and outreach by providing workshops that show scientists how to communicate their research results to a general audience effectively. COSEE Pacific Partnerships will develop multilevel educational and professional development opportunities in ocean literacy for informal science education professionals and volunteers by working with marine lab scientists, Sea Grant personnel, and community college faculty. These opportunities will include formal certificate-based programs for informal science education professionals and a Master Coastal Naturalist program for informal science education volunteers and staff.

0707385 Collaborative Research: Centers for Ocean Science Education Excellence - Oceans in the Earth-Sun System, 1-Dec-06 — 31-Aug-11, PI: Annette deCharon, University of Maine, \$1,627,561

This award establishes a new Center for Ocean Science Education Excellence (COSEE) via awards to the Bigelow Laboratory for Ocean Sciences (0528706), the University of Maine (0528702), and the University of New Hampshire (0528686). The main goals of this thematic Center are to broaden understanding of the oceans in the context of the earth and solar systems and to help the COSEE network reach rural and inland audiences. The PIs will pioneer a system of interfaces, tools, and resources to reach underserved and underrepresented groups, and to bring ocean sciences to inland audiences by presenting it in the context of more familiar components of the earth system, including environmental and space sciences. One goal is to explore the effectiveness of expanding knowledge of the ocean's role beyond being a driver of earth's climate to placing the earth in the context of its unique place in the solar system. Activities include building and training educator-scientist teams to work towards specific goals, e.g., testing strategies for effective use of ocean data, training in the use of concept mapping, and the identification and evaluation of high-quality resources. Evaluation of products, models and information is integrated throughout, with continuous self-assessment. Formal education partners at the University of Maine and University of New Hampshire will test the efficacy of materials with educators whose knowledge of ocean-related content ranges from novice to expert. Maine will be a test bed for the COSEE network to start reaching inland rural populations. The team includes scientists and educators with expertise in the hydrosphere, biosphere, cryosphere, geosphere, and atmosphere. The team will develop concept maps and case studies that show application of ocean topics to the National Science Education Standards. The Center will develop a formal mechanism for scientific review of materials to ensure the products they recommend are of the highest quality and meet rigorous standards, as well as to provide feedback from educators and scientists to product developers. They will select resources from DLESE, the BRIDGE, NOAA and others and evaluate these for classroom readiness and scientific accuracy using their team of well-trained resource evaluators with first-hand knowledge of earth systems science. They also will do a "gap analysis" of missing resources. The "Gap Analysis" will also inform the science community about avoiding developing materials for well-covered topics. The review process developed by COSEE-OESS, from initial use of NASA's education product review, will be disseminated nationally as a model for evaluating best practices and assessment and evaluation guidelines for education materials. In-service teacher programs will focus on expansion of University of New Hampshire's Coastal Observing Center summer in-service teacher workshops to incorporate OESS content and evaluation of activities ("test bed" for novel materials and activities). These workshops have annual themes focusing on ocean observing systems and the integration of buoy, shipboard, and satellite data (GoMOOS). Pre-service teachers and general science students at the University of Maine will take a new course created by OESS to learn ocean research methods by focusing on using physical principles, concepts and approaches to explain phenomena in aquatic sciences that are aligned to the NSES. The course will be developed for distribution to teachers after rigorous evaluation. Intellectual Merit of the Center: This thematic center focuses on creating and evaluating a series of interconnected tools

and techniques designed to broaden understanding of the ocean in the context of the earth and solar systems. Results will be translated into innovative multimedia products that showcase the ocean in the earth-sun system. Educational resources will be evaluated for science and education impact, and gaps in these resources will be identified and filled. A new undergraduate course to teach about ocean phenomena will be developed, tested, and disseminated nationally. The proposed Center will help COSEE reach inland and rural audiences. Broader impact: This Center will serve as a "learning organization" to deliver excellent products, models, and information that can be applied virtually anywhere. The final products, publication of "Best Practices" (a document that describes the value of system context in terms of learning) and "Strategies to reach inland audiences" will be disseminated throughout and beyond the COSEE network.

0731182 Collaborative Research: Centers for Ocean Sciences Education Excellence — California, PI: Craig Strang, 1-Oct-07 — 30-Sep-11, \$1,090,337

Associated collaborative proposals:

0730485 PI: Cheryl Peach, University of California-San Diego Scripps Inst of Oceanography, \$901,960

0729977 PI: Peter Tuddenham, the College of Exploration, \$ 100237

This award provides continued funding for COSEE California (COSEE CA), which has demonstrated its ability to develop successful, catalytic activities that spark and nurture collaborations among scientists and educators to advance ocean literacy. COSEE CA combines the resources and expertise of original partners, Scripps Institution of Oceanography and Lawrence Hall of Science, University of California, Berkeley, with two new partners, San Diego Unified School District and The College of Exploration. With the goal of increasing public awareness and understanding of the ocean, COSEE CA will embark on three major initiatives: 1) Supporting the Ocean Literacy campaign (developing and validating an ocean sciences learning progression to accompany the Ocean Literacy scope & sequence, and disseminating the Ocean Literacy framework); 2) Strategic national dissemination of Communicating Ocean Sciences to Formal and Informal Audiences by streamlining the implementation process to reach large numbers of new institutions; and 3) supporting sustained partnerships among teachers, facilitators and researchers to develop cutting-edge educational tools that promote inquiry through the use of technology-mediated visualizations, simulations and investigations. Together, these three initiatives comprise a coherent strategy for building the nation's capacity for putting into practice the Essential Principles of Ocean Literacy at all levels of formal education. COSEE CA is focused on the following objectives: 1) bring the content knowledge and technology tools of ocean scientists into the world of K-12 and postsecondary education; 2) build Network-wide collaborations that provide COSEE with national standing and a collective voice; 3) develop and disseminate model programs that increase the public's understanding of the ocean; and 4) conduct educational research to bring ocean sciences into mainstream science education curriculum and standards.

0753224 COSEE-West, Community-based Ocean Sciences Education, 1-Oct-07 — 31-Aug-10, PI: Linda Duguay, University of Southern California, \$2,083,232

Over the past 5 years, COSEE-West has successfully catalyzed community-based ocean sciences education in southern California, engaging faculty from 13 universities and research institutions,

educators from at least 8 informal science education centers, and over 350 teachers from 30 school districts, including the second largest school district in the nation. We propose to build on this legacy of success through synergistic partnerships and entrepreneurial catalytic activities.

The overarching goals of COSEE-West remain the same:

- 1) Increase public awareness of ocean sciences;
- 2) Use ocean sciences as an incentive to increase general science and ocean literacy; and
- 3) Increase the number of students that choose science and ocean sciences careers.

We have already created a robust and thriving network of ocean researchers, K-12 educators, informal education centers, students and the general public. In 2007-2012, University of Southern California, UCLA, College of Exploration, Los Angeles Unified School District, Cabrillo Marine Aquarium and many other institutions will build on our previous accomplishments and expand the impact and reach of COSEE-West activities. We will do this through four synergistic objectives that promote broad participation of diverse groups in ocean sciences and enhance community infrastructure of ocean sciences education:

[1] Reach a National Audience with Scalable Educational Models. We will develop model programs for reaching large audiences through new uses of online services. We will build programs to reach teachers, informal educators, students from high school through college levels, and the general public with online services that expand a previously tested distance learning education model and leverage the role of undergraduates in outreach education, reaching far more educators and providing effective mentoring.

[2] Institutionalize Professional Development Programs. We will build on our existing professional development approach to reach more science teachers at a regional scale by leveraging and institutionalizing our successful teacher workshops. We will extend the effectiveness of our COSEE-West teacher workshops by enlisting master teachers to provide additional professional development workshops and by demonstrating the value of district funding to create a sustainable mechanism for ocean sciences teacher training.

[3] Improve the Effectiveness of Informal Science Education. We will enhance the outreach and education goals of our informal science education partners by fostering opportunities for collaboration with ocean scientists, and delivering cutting edge ocean sciences content in an easily understood and implemented format. We will create opportunities for close interaction between scientists, informal educators, students and teachers through science exhibit retreats and informal educator professional development.

[4] Expand Diversity in Ocean Science. Our final objective is a central theme woven into all of our objectives: to expand the diversity of people with ocean literacy. Our online workshops have great potential to reach a wide and diverse audience of high school and community college students and help lower the intimidation factors that prevent many minority students from considering ocean sciences majors. Working with University support programs for minorities will further reduce barriers to equal inclusion of all races and ethnicities in ocean sciences. Additionally, a more concerted effort to reach diverse public audiences through informal

education partners and engage under-served minority students in science exhibit retreats will also advance our objectives in this area.

0827953 Collaborative Research: Centers for Ocean Sciences Education Excellence - The National Central Coordinating Office, 1-Oct-08 — 30-Sep-13, PI: Gail Scowcroft, University of Rhode Island, \$998,405

Associated collaborative proposals:

0828142 PI: William Spitzer, New England Aquarium Corporation, Cooperative Agreement, \$88,182

0827983 PI: Annette deCharon, University of Maine, \$271287

This award provides funding for management and support of national networking activities for the Centers for Ocean Science Education Excellence (COSEE). There are eleven separate Centers within the U.S. that are coordinated via the Central Coordinating Office (CCO). The CCO will be organized by three PIs; Gail Scowcroft, Associate Director, Office of Marine Programs, University of Rhode Island Graduate School of Oceanography will act as the National Network Coordinator (NNC); Annette deCharon, University of Maine, will organize the development of a national website and support more centralized web development at all Centers; and Dr. Billy Spitzer, New England Aquarium, will help with long-term strategy development and organization of the National Advisory Committee (NAC). This project builds on their prior work as the National Interim Leadership Team, a group that was formed to serve the COSEE Network during a one-year funding hiatus for the existing CCO. The proposed CCO team will work closely with the National COSEE Council, the NAC, and the NSF Program Officers to address a national gap in the coordination of ocean science education, facilitate communication between the Centers, and improve overall network functioning. The CCO will move the Network forward on a number of key initiatives that strengthen it, reduce duplication, and enhance the overall impact of COSEE. One important role of the CCO is the facilitation of the transfer of best practices between Centers. Site visits will allow the CCO team to investigate activities and products from Centers that might further other Centers' goals. By facilitating such transfers, the CCO provides a unique and useful addition to the current network. Perhaps one of the most significant tasks of the CCO in achieving intellectual merit is to increase the number of ocean scientists who participate in ocean science education and outreach. The CCO plans to annually expand the number of ocean scientist/educator partnerships formed through COSEE activities. Documentation is key to sharing lessons learned; thus CCO deliverables include user friendly, accessible national evaluation database and a national website. The Broader Impacts of this proposal include developing materials and providing support for ocean science educational outreach to the public and to K-12 teachers and students. The CCO will also strive to broaden the participation of under-represented and under-served (U/U) students in the various activities supported by the COSEE network by developing partnerships with U/U groups and professional societies.

0828783 Pacific Ocean Literacy for Youth, Publics, Professionals and Scientists (Polypps), 15-Sep-08 — 31-Aug-11, PI: Lemus, Judith, University of Hawaii, \$149,997

Ocean sciences faculty and educators in the University of Hawaii system and the Center for Ocean Sciences Education Excellence California (COSEE CA) propose a new collaboration to extend the COSEE CA courses Communicating Ocean Sciences (COS) and Communicating Ocean Sciences for Informal Audiences (COSIA) to the Central Pacific region. The new project, Pacific Ocean Literacy for Youth, Publics, Professionals and Scientists (POLYPPS), will be based in Hawaii. It will focus on training educators and scientists to effectively communicate ocean sciences to a multi-ethnic population within a range of cultural contexts. Lead by the University of Hawaii at Manoa (UHM) School of Ocean and Earth Science and Technology (SOEST), POLYPPS is a collaboration with a broad set of partners, including universities, community colleges, research institutes, professional societies, aquariums, museums, community organizations, governmental agencies, and private companies. The partners advocate that education in the ocean sciences should involve teaching students to apply ocean literacy concepts and use inquiry-based learning to improve not only their own lives but also their local, national, and global communities. The primary objective of the POLYPPS collaboration with COSEE CA reflects the COSEE network's mission of integrating research and education in the ocean sciences. Intellectual Merit: POLYPPS will engage researchers, educators and a range of community partners in a network that builds ocean literacy for (1) Hawaii's youth (K-16 students) and public, including Hawaii's substantial, year-round transient tourist population; (2) professionals working in ocean-related businesses; and (3) scientists engaged in ocean research. We will adapt and implement the COSEE CA COS and COSIA courses for our island setting. Broader Impacts: The training for these courses and the teaching of them will create relationships to bridge formal and informal education, research, traditional cultural practices, and public activities. During the three-year period, POLYPPS will help educators employ contextual, place-based ways to engage students in STEM courses. POLYPPS' long-range goal is to build a collaborative network that connects ocean research and teaching with traditional knowledge to facilitate active engagement in stewardship and policy by all ocean users. The main activities of POLYPPS will be: [1] Organize a training workshop in collaboration with COSEE CA staff that will train a cadre of professionals in Hawaii to teach the COS/COSIA courses; [2] Organize both COS/COSIA as either credit or non-credit courses throughout the University of Hawaii System for: (a) graduate science students participating in GK-12 programs and other graduate students with an interest in education and for community college students in ocean sciences who may consider a career in education; (b) pre-service and in-service K-12 educators; (c) informal educators in non-profit organizations, aquaria, museums, and government educational agencies; and (d) ocean-related businesses, hotels, and tour operators; and [3] Develop new course components that will integrate Hawaii resources, including unique traditional cultural practices and ocean policies, current research on ecosystems of particular relevance to local and regional communities and exemplary curriculum materials.

0827805 COSEE - New Collaborations: A Partnership to Assemble "An Introduction to Our Dynamic Ocean" Course, 1-Sep-08 — 31-Aug-11, PI: Laura Murray, University of Maryland Center for Environmental Sciences, \$150,000

The goal of this proposed new collaboration between the Center for Ocean Sciences Education Excellence (COSEE) Coastal Trends and Queen Anne's County Public School (QACPS) district is to use the Ocean Literacy: Essential Principles and Fundamental Concepts as the foundation for formalizing a semester-long entry level secondary school ocean science course. We propose a

partnership between COSEE Coastal Trends, housed at an ocean research institution (University of Maryland, Center of Environmental Science, Horn Point Laboratory) and QACPS in rural coastal MD. Curriculum team members will assemble an entry level Ocean Science course entitled *An Introduction to Our Dynamic Ocean* from existing lessons designed to utilize real-time and near real-time data and scientific discoveries. The course will be pilot-tested by teachers in Queen Anne's County, Maryland and throughout the COSEE Coastal Trends region (MD, DE, and VA). Once published, it will be disseminated as a model for other school systems in Maryland and the COSEE Network. In making this an active course based on ocean research and exploration, we will engage students in learning about the ocean and its impact on Earth's processes. Such newly gained knowledge directly answers the call for better public understanding of the ocean and its role in our lives. Integrating ocean research and exploration into the course will assure a connection to authentic science. Rigorous assessment and evaluation of the course development process and the course curriculum will result in both a successful partnership between a scientific and an education entity, and a model ocean science course for entry level secondary science students. By targeting all students as they enter secondary school, this course will reach out to students underrepresented in the sciences. Increasing ocean science literacy among this population will support the community-wide goal of increasing ocean science literacy in the general public. The influence of this project will be expanded by dissemination of the assembled, pilot-tested, refined and formalized course to other school districts in the Mid-Atlantic region and throughout the COSEE network.

0828805 Center For Ocean Science Education Excellence - the Colorado Collaborative (CCC), 1-Sep-08 — 31-Aug-11, PI: Lesley Smith, University of Colorado at Boulder, \$149,960

The Center for Ocean Science Education Excellence -- the Colorado Collaborative (CCC) proposes to develop a synergistic partnership between the University of Colorado-Boulder (CU) and COSEE-West (University of Southern California and University of CA at Los Angeles) to bring ocean sciences education to inland audiences, make it personally relevant to their lives and increase ocean literacy. By combining the intellectual strengths of each organization, CCC will expose non-coastal teachers and students to high quality ocean sciences education. The hallmark of CCC will be an ocean scientist lecture series combined with a Summer Teacher Institute that will engage regional ocean scientists in ocean sciences education to facilitate the integration of ocean sciences research and education. Each year will have a different focus on cutting edge ocean science research, such as air-sea interactions and regional climates; polar ice and sea level; and oceans, climate and public policy. Running themes of the CCC will include stewardship of the oceans and a systems approach to earth science. The use of videoconferencing to deliver presentations to teachers across Colorado and in the Los Angeles Unified School District, along with a summer teacher exchange program, will allow teachers from diverse geographic and cultural backgrounds to interact and develop a camaraderie that will carry to their students' classroom experiences. By reaching out to teachers and schools with ethnic, socioeconomic and geographic diversity, we hope to increase opportunities for under-represented populations to participate in ocean sciences education and consider careers ocean science.

The overall intellectual merit of this project is in the value of collaboration between coastal and inland research scientists, classroom teachers and outreach educators to develop ocean literate

students, who will in turn impact their community and become informed voters. The intellectual merits and anticipated outcomes of the proposed partnership include: enhanced teaching and communication skills of the research scientists and graduate students; K-12 students who are motivated and excited about ocean sciences and are exposed to new ideas, resources and potential careers; interaction of teachers with scientists will allow teachers to incorporate cutting edge research into their teaching; and interactions between teachers in Colorado and California will promote a global awareness of the impacts of a changing hydrosphere in different regions, as well as cross-fertilization of ideas and future collaborations among teachers and scientists. Evaluation of the program will help elucidate the ocean science education needs of inland audiences, which will be shared with the COSEE Network. The broader impacts of the proposed program are three-fold. First, we will deliver a high quality teacher professional development program to a segment of Colorado school districts, the rural schools, which are traditionally under-served. This program will open new pathways for students who rarely get a chance to interact with scientists or get first-hand knowledge of the ocean-- a realm that to some may seem light-years away from their home. Second, we plan to develop the scientist lecture/Summer Teacher Institute program into a sustainable model CU scientists can plug into when proposing their education outreach portion of their research proposals. Finally, the partnership between COSEE-WEST and CCC will yield a richer program that combines the intellectual strengths of each organization and will have impact beyond their local school districts.

0828074 COSEE: Education Aquanauts Educator Enhancement Collaboration, 1-Sep-08 — 31-Aug-11, PI: Russell Cuhel, University of Wisconsin-Milwaukee, \$150,087

The Centers for Ocean Science Education Excellence (COSEE) seek to promote partnerships between research scientists and educators, disseminate best practices in ocean sciences education, and promote ocean education as a charismatic, interdisciplinary vehicle for creating a more scientifically literate workforce and citizenry. One way to increase public awareness of the oceans and their importance in economic and environmental considerations is through educator enhancement and public outreach activities based on scientific inquiry. COSEE Great Lakes is uniquely situated to take advantage of mounting global concern over freshwater resources. The Great Lakes may demonstrate faster response times to global climate change, as already evidenced by a longer ice-free season on the lower lakes. The Great Lakes have also been susceptible to an onslaught of invasive species appearances, predominantly through the shipping lanes of the St. Lawrence Seaway. Research activities on Lake Michigan ecosystem dynamics by the PIs at the Great Lakes Wisconsin Aquatic Technology and Environmental Research (WATER) Institute can provide an ideal opportunity for research education collaboration supporting the mission of COSEE, especially COSEE Great Lakes. During the last decade, more than half a dozen animal species have invaded the upper Great Lakes, some of them causing unequivocal and perhaps cataclysmic alterations in large lake ecosystems. Lake Michigan in particular provides readily accessible opportunities for sampling and understanding of invasive species ecology. These issues are widespread in marine environments as well, and comparative learning can be stimulating. COSEE Great Lakes provides the perfect venue for development and dissemination of exciting hands-on, interactive aquatic science experiential learning opportunities. This program seeks to provide exciting, immersion science learning and resource exposure for teachers of middle and high school students and informal science educators. Specific objectives are: (1) expand educator awareness of exotic species occurrence and

activities in local waters as a means for introducing larger topics of aquatic ecosystem processes; (2) engage educators in 1-week, intense hands-on workshops using modern-day tools both onboard a research vessel and analytical instrumentation at the laboratory bench to test specific, tractable hypotheses; and (3) assist the COSEE Great Lakes in providing educators with resources to access current environmental research activities and results in their own region and nationally. Participating science teachers serving primarily middle and high school audiences, and informal science educators will be recruited through collaboration with COSEE Great Lakes, drawing in part upon our own substantial existing base of participants in JASON and other outreach programs.

0828940 COSEE New Collaborations: Toward broader Ocean Learning Communities through field research learning, 1-Sep-08 — 31-Aug-11, PI: Frederick Stahr, Ocean Inquiry Project, \$133,396

Ocean Inquiry Project (OIP) will collaborate with COSEE Ocean Learning Communities (COSEE-OLC) to create, promote, and study learning collaborations among diverse communities that care about the oceanic environment, a specific goal of COSEE-OLC. Both OIP and COSEE-OLC share the goal of making citizens more knowledgeable about ocean science and informed by current research in order to become better, more involved stewards of the marine environment. COSEE-OLC is currently developing an Ocean Learning Community composed of the following communities: volunteer-based marine conservation and environmental groups, ocean scientists, formal and informal educators, local business leaders, and science-learning experts. To this end COSEE-OLC provides speaker presentations, community gatherings, workshops, and field experiences during which participants interact and learn from each other's expertise and experiences. All events are designed to facilitate ocean sciences learning and foster continued dialogue about related issues. OIP provides inquiry-based, ship-board oceanographic field experiences to a diverse population of primary and secondary students, community college groups, and clubs serving inner-city disadvantaged groups. Collaborating with OIP will provide research cruises as a vehicle for interaction between volunteer-based organizations, local businesses groups, and ocean scientists. The cruises facilitate two-way communication between volunteers and scientists in a non-academic, real world setting. COSEE-OLC learning community members benefit through acquisition of ocean science knowledge, better understanding of oceanographic research and techniques, the impact of large-scale oceanographic processes on their work, and new connections with ocean scientists. Participating scientists will gain experience by delivering material to non-scientific audiences, seeing new perspectives and questions to ponder, and making new connections to local groups interested in science. Collaborating to provide field-learning experiences will augment the range of learning experiences that COSEE-OLC is developing and testing. The two-way interaction through a field experience furthers the overarching goal of the center to cultivate functional, contributing and ocean-literate citizens who are aware of the impact oceans have on their daily lives. With this approach, the center progresses toward building a common language among diverse groups to promote science-based ocean education and learning at the public level. By exposing volunteers from environmental organizations, informal educators, and local business leaders to oceanographic research during field learning experiences on Puget Sound, OIP complements and enhances the work of COSEE-OLC. These groups, in turn, reach audiences that the center would not directly affect: the general public engaged in casual interaction with volunteers on a beach at

low tide, a fellow corporate executive chatting after a business meeting, or conservation activists during a wetlands project. One significant means of expanding ocean literacy is through word of mouth distribution to make ocean science principles part of common knowledge. Further, oceanography graduate students who participate in these field experiences will be exposed to a range of citizen-level activities they should be knowledgeable about and appreciate for the beneficial effects on the marine environment. Over all, this collaboration will reach a far more diverse and widely distributed audience than that which it directly engages due the free-choice learning character of the activities of these groups.

0829177 COSEE National Network Evaluation, 1-Oct-08 — 30-Sep-13, PI: Mark St. John, Inverness Research, Inc., \$410,000

This is a proposal to conduct the national evaluation of the COSEE Network. In this proposal we lay out an approach for designing and conducting the evaluation. This approach centers around collaborative design, creating a community of evaluators within the COSEE network, and taking a broad perspective on the ways in which the investment in COSEE is making contributions to the field. The major evaluation tasks we propose include an annual survey of Centers, the creation of an evaluator community, and direct data gathering from Centers in the form of interviews and site visits. We see COSEE as an investment in a national infrastructure for Ocean Sciences education: a network of Centers and associated partners that can not only provide educational services but also build the capacity of the field for doing higher quality and more extended Ocean Sciences education. We believe that the evaluation of COSEE should focus on both the direct educational contributions that COSEE is making, but also on the more intangible contributions in terms of generating leadership, collaborations, knowledge and advocacy for the field. We also argue that the evaluation should help COSEE better understand itself, improving its design, informing its management, and refining its implementation. The COSEE Network represents a sophisticated arrangement that creates a national network linking together distinct Ocean Sciences Education Centers. The evaluation plan proposed here draws upon and adds to a knowledge base of the design principles underlying networks, centers, and science education improvement. The evaluation will not only document the contributions of the network to public and professional audiences, but also study the network as an example of an improvement infrastructure for Ocean Sciences education. This conceptualization will help to create an evaluative framework that will allow for a richer understanding of the multiple dimensions of NSF's investments in large complex network projects. The evaluation will thus contribute to the knowledge base that informs the design and evaluation of large-scale, field-building initiatives. This proposed evaluation plan will promote the improvement of education, particularly science education, in multiple ways. First, it will help COSEE understand the investment made in the Network by studying the ways in which and the extent to which the network is serving its intended audiences and providing well-designed opportunities for a variety of audiences to learn Ocean Science. Second, the evaluation will help the COSEE Network better manage the use of its resources, by understanding the needs and opportunities for refining the way in which the Network operates. Third, the evaluation will contribute to a better understanding of ways in which the Network builds both individual and collective capacity for doing high-quality Ocean Sciences education. And finally the evaluation will contribute to a better understanding of how this design -- a network of independent centers -- can be used in other arenas to further develop a national improvement infrastructure for science education.

This proposal will be awarded using funds made available by the American Recovery and Reinvestment Act of 2009 (Public Law 111-5).

0943472 Collaborative Research: Centers for Ocean Sciences Education Excellence - National Network Partnerships, 1-Sep-09 — 31-Aug-13, PI: Gail Scowcroft, University of Rhode Island, \$849,236

Associated collaborative proposals:

0943292 PI: Annette de Charon, University of Maine, \$305, 603

This award provides funds to support the Centers for Ocean Sciences Education Excellence (COSEE) Central Coordinating Office (CCO) in a set of projects that will focus on identifying best practices in ocean science education and develop internal and external Network partnerships. Specifically, this award provides funds for the development of an online COSEE Community Center to network teachers, ocean researchers and the public.

The COSEE program, now in its seventh year, has a mission to bridge the gap between the ocean science research enterprise and science education, both in the formal and informal sectors. This is accomplished through activities at individual COSEE Centers, each a consortium of up to 30 several diverse ocean science institutions and education partners. Center activities include the development of catalytic partnerships among these diverse institutions, the integration of ocean science research into high-quality educational materials, and the establishment of pathways that enable ocean scientists to interact with educators. The National COSEE Network is comprised of 12 Centers and a Central Coordinating Office (CCO).

The PI's propose funding to develop a program for creating new COSEE partnerships among institutions and organizations that are not currently partners in COSEE. In addition, they propose to coordinate the identification of best practices within the COSEE community by holding a series of workshops focused on issues common to most Centers (e.g. teacher workshops), to develop a speakers series, and to develop an online COSEE Community Center.

The need for improved ocean science literacy is related to the need for improved overall science literacy. Ocean science education is not only important in itself, but it can also provide a motivating context for learning about many aspects of science, technology, engineering, and mathematics. Through COSEE initiatives, inquiry-based ocean science activities can integrate current scientific research and meet a critical educational need for the nation.

This proposal will be awarded using funds made available by the American Recovery and Reinvestment Act of 2009 (Public Law 111-5).

0943671 Moving Beyond the Basics: An Ocean Science Lecture Series to Increase Ocean Literacy, 1-Oct-09 — 30-Sep-11, PI: Christina Hoekenga, Smithsonian Institution, \$144,371

The Smithsonian's National Museum of Natural History (NMNH) and the National COSEE (Centers for Ocean Sciences Education Excellence) Network propose an ocean science education program to promote public understanding of current issues in ocean science. The centerpiece is a lecture series that will bring top ocean scientists to DC to increase public awareness of ocean science research and how humans interact with and are connected to the ocean. Topics include climate change and the ocean, ocean biodiversity loss, the ocean and human health and coastal hazards. The lectures will be webcast and archived on the Smithsonian Ocean Portal (scheduled to launch in September 2009). The scientists will also participate in the "The Scientist Is In" program in the Sant Ocean Hall at the NMNH. This provides NMNH visitors an opportunity to meet with and learn from top ocean scientists in a casual setting. The final element to this program will be the incorporation of related COSEE education materials for NMNH use. The goals of this program are to increase public awareness of ocean science research and foster a deeper public understanding of how our actions and choices impact the ocean.

This project's broader impacts are advancing understanding of ocean sciences and promoting learning and decision-making based on sound science. The lecture series allows scientists to expand their research's impact by: 1) being part of a prominent lecture series at the Smithsonian; 2) having the lectures and "The Scientist Is In" programs recorded and archived on the Ocean Portal where they can be used beyond the initial presentations. The project's intellectual merit is in the science content provided to the public in terms that they can understand. The Smithsonian Institution and the National COSEE Network propose this project to promote an ocean-literate society able to make informed decisions regarding the health of the ocean.

This proposal will be awarded using funds made available by the American Recovery and Reinvestment Act of 2009 (Public Law 111-5).

0943509 Enhanced Engagement by Scientists for Broader Societal Impacts, 1-Sep-09 — 31-Aug-11, PI: Sharon Walker, University of Southern Mississippi, \$576,332

This proposal requests funds to develop a series of twenty engaging, multi-media case studies of ocean scientists addressing the Broader Impacts activities of their research. This effort will involve representatives of all Centers for Ocean Sciences Education Excellence (COSEE) in identifying scientists who have formulated effective methods to convey the Broader Impacts of their research activities to students, educators, and the public. These case studies will be available in various electronic media, including the internet.

Since 2002, COSEE has worked collaboratively to become a truly integrated national network for improving ocean sciences education and outreach. COSEE is establishing communications and resources to become a leading force in the improvement of ocean sciences education, with significant partnerships among federal, state, and local agencies and businesses.

The Intellectual Merit of proposed activities lies in the network-wide effort to compile insights and information regarding existing programs that will identify the most effective practices by which scientists improve the broader societal impacts of their work, while possibly developing new methods for engaging scientists. Resulting electronic resources will broaden awareness of the diversity and success of COSEE programs and communicate the most effective practices

scientists use to convey the broader societal impacts of their research to students, educators, and the public.

The Broader Impacts of these efforts include recognizing and distributing examples of excellent education and outreach activities developed within the ocean sciences research community. It is expected that these high-profile examples will illustrate effective means by which scientists can develop their own engaging Broader Impacts activities to serve the public interest.

0943448 Collaborative Research: Linking Researchers and Graduate Students through COSEE Tools and Services, 15-Sep-09 — 31-Aug-11, Annette deCharon, University of Maine, \$173,621

Associated collaborative proposals:

0943411 PI: Cheryl Peach, University of California-San Diego Scripps Inst of Oceanography, \$81,829

0943430 PI: Janice McDonnell, Rutgers University New Brunswick, \$95,316

0943387 PI: Duguay, Linda, University of Southern California, \$65,500

This proposal will be awarded using funds made available by the American Recovery and Reinvestment Act of 2009 (Public Law 111-5). This award provides funds to conduct workshops aimed at improving the broader impacts efforts of scientists. Through professional development workshops, scientist-graduate student teams will produce interactive materials based on the Ocean Literacy and Climate Literacy principles that can be specifically designed for a variety of audiences. The primary target audiences for this project are the research scientists and graduate students who participate in the project workshops. Through team-building and COSEE-facilitated long-term contact, the project will provide sustained professional development training opportunities that result in deeper content understanding and/or confidence in teaching to lay audiences, for researchers and graduate students alike. The secondary audience is on-line users who will benefit from the project outputs: namely the interactive ocean-climate content and user-centered data tools developed as part of this effort. Learning and interaction data of target audiences will be collected and evaluated by participating COSEE Centers. These evaluation results will be used to refine the approach, workshop model, and resulting online products throughout the project.

0943509 Enhanced Engagement by Scientists for Broader Societal Impacts, 15-Sep-09 — 31-Aug-11, PI: Sharon Walker, University of Southern Mississippi, \$576,332

This proposal will be awarded using funds made available by the American Recovery and Reinvestment Act of 2009 (Public Law 111-5). This proposal requests funds to develop a series of twenty engaging, multi-media case studies of ocean scientists addressing the Broader Impacts activities of their research. This effort will involve representatives of all Centers for Ocean Sciences Education Excellence (COSEE) in identifying scientists who have formulated effective methods to convey the Broader Impacts of their research activities to students, educators, and the public. These case studies will be available in various electronic media, including the internet. Since 2002, COSEE has worked collaboratively to become a truly integrated national network for improving ocean sciences education and outreach. COSEE is establishing communications

and resources to become a leading force in the improvement of ocean sciences education, with significant partnerships among federal, state, and local agencies and businesses. The Intellectual Merit of proposed activities lies in the network-wide effort to compile insights and information regarding existing programs that will identify the most effective practices by which scientists improve the broader societal impacts of their work, while possibly developing new methods for engaging scientists. Resulting electronic resources will broaden awareness of the diversity and success of COSEE programs and communicate the most effective practices scientists use to convey the broader societal impacts of their research to students, educators, and the public. The Broader Impacts of these efforts include recognizing and distributing examples of excellent education and outreach activities developed within the ocean sciences research community. It is expected that these high-profile examples will illustrate effective means by which scientists can develop their own engaging Broader Impacts activities to serve the public interest.

1039190, COSEE-TEK: Center for Ocean Science Education Excellence - Technology & Engineering for Knowledge, 15-Sep-10 — 31-Aug-11, PI: Ivar Babb, University of Connecticut, \$400,000

The goal of this proposed national thematic Center for Ocean Science Education Excellence-Technology and Engineering for Knowledge (COSEE-TEK) is to innovate and adapt approaches to improve the quality, availability, and impact of ocean science education by linking ocean science, technology, and engineering to catalyze learning and communication of STEM topics for teachers, students, scientists, and the public. To achieve this goal we propose the following objectives: 1) provide effective activities that enhance knowledge, pedagogical insights, community connections and experiences for the research community in formal and/or informal education environments to strengthen broader impacts; 2) develop innovative resources to improve the quality, availability, and impact of ocean science and technology in education efforts; and 3) foster communications and collaborations amongst the ocean science, technology, education and public outreach communities. Each of these objectives will be met through a series of innovations and activities that continually seek to link ocean science and technology with education and outreach. We will showcase ocean technologies with emerging information and communications technologies. The intellectual merit of this proposal lies in its important focus on the tools and technologies that are critical to ocean science. From the earliest research vessels to SCUBA and occupied submersibles to remote sensing and sampling to observing systems, ocean technologies and engineering have been essential to the advancement of ocean science. The Center will seek to develop innovative teaching resources derived from ocean science and the exciting new technologies being applied and developed to address a host of socially relevant topics. Furthermore, this project will catalyze learning and communication opportunities for researchers, STEM (Science, Technology, Engineering, and Mathematics) educators, both formal and informal, students and the public. The Center will also evaluate the effectiveness of a number of approaches (Technology Teams, lectures, Technology Institutes) and media (webinars, online encyclopedia of technology) to deliver and disseminate science and technology content. The intellectual merit is based on the technology and engineering that enables ocean science and integrating these with education, outreach and workforce development. The technical and engineering information being conveyed through COSEE-TEK activities and materials will be presented in a way that is easy to understand for any layperson, from students' parents, to the visitors at an Aquarium, to the senior citizen attending a public lecture. A diverse

network of partners will be utilized to affect broader impacts of COSEE-TEK's work. Many of the activities of this proposed COSEE will use information and communications technology, allowing for global participation and access to resources. We will partner with the American School for the Deaf to address the needs of underrepresented deaf and hard of hearing and efforts will be made include educators from the deaf community and ensure that educational materials can be readily used by deaf persons. We will forge additional partnerships with the National Association of Black Scuba Divers, the Louis Stokes Alliance for Minority Participation. We will engage ocean industries in our Technology Teams and work with the Connecticut Center for Advanced Technology to integrate the needs and opportunities for ocean technology in the development of STEM workforce. An undergraduate course module on the history of ocean technology will be developed and made available online for other colleges, universities and educational facilities to use. The audience will include people entering the work force, as well as their mentors, who will gain valuable knowledge to help prepare them not only for careers in ocean science, but in computer science, the shipping and transportation industry, electronics, acoustics, data management and transfer, data telemetry (satellites, radio waves, microwaves), and more.

1038397 COSEE SE: Addressing New Challenges, 1-Oct-10 — 30-Sep-11, PI: Lois Spence, South Carolina Sea Grant Consortium, \$399,992

The Center for Ocean Sciences Education Excellence Southeast (COSEE SE), serving North Carolina, South Carolina and Georgia, is engaging its collaborative partners to advance innovative strategies to improve the transfer of ocean sciences research processes and information to reach broader audiences. COSEE SE will use communities of practice as tools to initiate two major new efforts--one targeting ocean scientists and the other targeting elementary grade science teachers. COSEE SE will address challenges facing scientists to achieve the most effective practices for broader impacts. This includes how scientists interact with informal audiences about their research and what opportunities exist for creative avenues for developing sophisticated broader impact statements in their proposal. Three different approaches will be tested, each evaluated, and a paper identifying the results will be produced to assist the regional scientists. (1) Locally developed and executed "Brown Bag" lunch programs in a university setting; (2) short workshops at established regional, informal science education sites with each workshop having 10 scientists and 10 educators discussing presentation and engagement strategies for concepts surrounding a single topic; (3) a K-12 Outreach Conference in partnership with The Science House, NCSU that reaches a number of scientists in one location at one time. COSEE SE will also address the challenges that face elementary school teachers who teach sciences by providing resources, professional development and mentoring in Charleston County School District (CCSD). Demographic statistics of the CCSD indicate that elementary school students are predominately African American. Other educational research has revealed that most elementary teachers have had little training in science education and practically none in ocean sciences. As a result, CCSD represents a model set of schools that are not connected to their coastal environment and teachers with few resources and relationships with scientists. While this effort is restricted to one county, evaluation of the effort has the potential to reach other coastal counties. While it is not in the scope of this effort to assess the long-term impact of COSEE SE on elementary students, there is research that reveals students who have at least one exciting moment in ocean science have greater potential of considering ocean sciences as a career. In

addition, COSEE SE will continue to distribute ocean science information through its database and web presence. The COSEE SE team will continue to use its extensive regional network to assist researchers and educators as they communicate science.

1038786 Collaborative Research: COSEE: Ocean Systems - Building Capacity through Collaboration, 1-Oct-10, 30-Sep-11, PI: Annette deCharon, University of Maine, \$373,239

Associated collaborative proposals:

1038803 PI: Mark Wiley, University of New Hampshire, \$52,155

1038809 PI: Ashanti Johnson, Institute for Broadening Participation, \$45,199

1038737 PI: William Spitzer, New England Aquarium Corporation, \$59,187

This award provides renewed funding for the Centers for Ocean Science Education Excellence - Ocean Systems (COSEE-OS). Through its ongoing efforts, COSEE-OS has identified key areas for future growth, including: (i) facilitating the creation of Science, Technology, Engineering, and Mathematics (STEM) resources that are conceptually linked to ocean-climate content; (ii) scaling up ocean scientists' impacts by taking advantage of networking infrastructure; and (iii) building tools to assess the quality of consensus-based products created by diverse communities. The Center will expand its successful model of creating software that is flexible, transferrable, and user focused for the ocean science community. OS will share this model via workshops for scientists at other COSEE's. OS will scale up its regional initiatives to have national impact, with a focus on rural and inland audiences. In addition, a new partnership with the Institute for Broadening Participation is improving engagement of underrepresented minorities in OS opportunities, and will serve as a model for the greater Network. By supporting existing educational programs, OS will assist two small, but prestigious, research laboratories -- Mount Desert Island Biological Laboratory and Bigelow Laboratory for Ocean Sciences -- in meeting their goal of providing effective research experiences for K-12 educators and "young scientists" in training. The Center's goal is to build Capacity nationwide, honing individuals' abilities to develop effective "Broader Impacts" (BI) activities. This is accomplished, in part, by engaging informal education institution partners such as Seacoast Science Center (SSC) and New England Aquarium (NEAq) to aid in the development of BI activities with scientists. The Center also supports the New England Ocean Sciences Education Collaborative (NEOSEC), a diverse network of over 40 organizations coordinated by NEAq, to build regional capacity by training its educators in planning and implementing BI activities for ocean scientists. This ensures that the content and products of current ocean science research can efficiently reach a broad audience in a timely fashion. A newly formalized partnership with the Northeastern Regional Association of Coastal and Ocean Observing Systems (NERACOOS) unites the New England cadre of ocean science educators and their students to the NERACOOS scientists, providing opportunities to increase the BI for scientists. The Center's joint efforts with New England regional Sea Grant Extension staff to field test new analytical tools that aid consensus building about climate change issues in New England coastal communities is another opportunity for scientists to increase their BI activities.

1039130 Collaborative Research: COSEE: Ocean Communities in Education And social Networks (COSEE-OCEAN), 1-Oct-10, 30-Sep-11, PI: Chen, Robert, University of Massachusetts Boston, \$305,000

Associated collaborative proposals:

1038853 PI: Friedman, Alan, New York Hall of Science, \$44,912

The University of Massachusetts, American Society of Limnology and Oceanography (ASLO), New York Hall of Science, and Boston Public Schools propose a thematic COSEE Center that will greatly broaden the impacts of the COSEE Network. COSEE-OCEAN will use existing social and professional relationships to strategically engage ocean scientists in education and outreach activities by offering them professional development workshops at annual ASLO meetings and connecting them to COSEE Network outreach activities. COSEE-OCEAN will efficiently leverage these existing networks to expand and enhance a two-way exchange of innovation, experience, educational products, professional development models and best practices between COSEE and mainstream STEM formal and informal education communities. Our vision is that within five years, all ocean scientists will be aware of and have access to education and outreach opportunities within the COSEE Network; the COSEE Network will be able to exchange knowledge and resources with STEM programs nationwide; informal education institutions will have increased their capacity to address public ocean literacy; and a model for implementing a high quality ocean curriculum in diverse, non-coastal urban school districts will be widely disseminated. Our goals are: 1) To engage more Ocean Scientists in high quality education and outreach opportunities provided by the COSEE Network, 2) To deliver high quality Ocean Science instructional materials to a diverse audience in large urban school districts, especially in non-coastal states, and 3) To promote Ocean Literacy through a network of Informal Science Education institutions and individuals. Intellectual merits of COSEE-OCEAN are to strategically strengthen the interactions between existing networks in order to catalytically utilize COSEE resources in a broader context and to gain capacity from the networks' output, COSEE-OCEAN aims to reach ALL ocean scientists, to target under-represented minority students in urban school districts, to effectively engage students in non-coastal states, and to form connections between existing educational networks. Broader impacts of this proposal include expanding the COSEE Network to include existing networks of ocean scientists (ASLO), informal educators (ASTC, CAISE), and urban educators (Lawrence Hall of Science and Boston Public Schools), which will strengthen the capacity of that overall network to deliver high quality ocean education to K-12 and public audiences. By using distance learning and working with urban school districts in non-coastal states, we will vastly broaden the reach of COSEE to include a diverse population of students who do not have opportunities to directly experience the ocean. In addition, we will link effectively with COSEE-China to extend the reach of COSEE beyond US borders.

1039107 Collaborative Research - COSEE Florida: Water as Habitat, 1-Oct-1- —30-Sep-11, PI: Edwin Massey, Indian River Community College, \$177,515

Associated collaborative proposals:

1038998 PI: Richard Tankersley, Florida Institute of Technology, \$87,531

1039014 PI: Edith Widder, Ocean Research & Conservation Association, Inc., \$139,173

1038990 PI: Valerie Paul, Smithsonian Institution, \$124,228

Because the state of Florida has over 1,350 miles of salt-water coastline, the state represents a significant, untapped opportunity for the Centers for Ocean Science Education Excellence (COSEE) network to expand its geographic and programmatic reach. Our proposed center, COSEE Florida: Water as Habitat, will build statewide connections with Florida's ocean research community. This project will provide professional development opportunities for scientists to improve their ability to communicate the value and importance of their science to nonscientific audiences and achieve a better understanding of their role in supporting STEM education. Founding partners for COSEE Florida are the Indian River State College, the Smithsonian Marine Station at Fort Pierce, the Ocean Research & Conservation Association, and the Florida Institute of Technology. Our content theme "Water as Habitat" is engaging and appealing to students and the public and will allow us to place naturally charismatic marine organisms and ecosystems within a systems framework linking physical, chemical and geological ocean processes to biodiversity, marine ecology, climate change, threats to human health, and stewardship actions. COSEE Florida will advance ocean science literacy through the implementation of three strategic initiatives: 1. Professional Development Workshop Series for Scientists: Ocean scientists will participate in workshops to improve their effectiveness in communicating their research to non-scientific audiences. COSEE staff will also provide assistance to scientists who wish to develop quality outreach programs to broaden the impact of their research. Six workshops will be conducted around the state each year. 2. A new Ocean Science Concentration for Pre-Service Educators: Ocean science focused educational content will be added to the Bachelor of Science STEM Education degree for middle school science at Indian River State College in Ft. Pierce, Florida. Students will participate in a suite of courses, research opportunities and high quality practicum situations. The program will be disseminated to additional State College campuses in year 5. 3. COSEE Florida Ocean Science Learning Network: This initiative is the linchpin that brings scientists, educators and the public together to communicate and collaborate. Water as Habitat events will feature ocean-based interactive presentations, educator workshops, and opportunities for continued participant engagement at regional nodes throughout the state. On-line communication tools will be developed to facilitate post-event collaborations and resource sharing. At least five regional Learning Community nodes will be established around the state. Our work will engage a spectrum of people and organizations from across Florida. Ocean researchers, higher education faculty, informal education institutions, educators and the general public will participate in a wide range of activities. Through our initiatives we will (1) involve up to 90 Florida ocean scientists in effective outreach and education each year, (2) expand the skills and strengthen the ocean science content of at least 200 pre-service undergraduates, 100 in-service teachers and 100

informal educators over a 5 year period, (3) improve the ocean literacy of over 3000 Florida residents and tourists and (4) learn from and contribute to the work of other Centers in the National COSEE Network. The ocean science content of our programs will draw on current research findings from Florida's leading ocean scientists (Intellectual Merit) and significantly expand public awareness of the significance of their work (Broader Impacts). Scientists will also develop a deeper understanding of the challenges facing STEM (Science, Technology, Engineering, and Mathematics) education today (Intellectual Merit) and contribute to improving the quality of teaching and learning in Florida through the integration of cutting edge research into K-16 education (Broader Impacts).

1038836 Collaborative Research: COSEE-Ocean Learning Communities - Connecting Communities around the World's Ocean, 1-Oct-10 — 30-Sep-11, PI: Richard Keil, University of Washington, \$272,858

Associated collaborative proposals:

1038852 PI: Kathy Sider, Seattle Aquarium Society, \$212,159

1038857 PI: Fredrick Stahr, Ocean Inquiry Project, \$2,000

This effort extends the activities of the Center for Ocean Science Education Excellence: Ocean Learning Communities (COSEE-OLC) located in Washington State. COSEE-OLC fosters the development of communities around ocean issues. It engages these communities, which include the general public and students of all levels, by organizing learning activities across a broad range of informal and formal settings. Throughout the proposed efforts we will work to increase participation of underrepresented persons in ocean research and education, especially through citizen science and associated science learning experiences.

We have developed a strong relationship with the Puget Sound region's Marine Volunteer Community (MVC) with whom we engage in ocean awareness and research activities. The MVC has a high amplification factor owing to its broad reach to families and schools visiting beaches up and down the coast and Puget Sound. Second, we will continue to study how and why people learn about the ocean in formal and informal situations in ways that are personally consequential, and we will promote the interdisciplinary Learning Sciences research perspective more generally. We will leverage both of these activities to develop tools and approaches that support scientifically and educationally rigorous citizen science efforts on a variety of ocean research topics.

We will engage diverse K-12 students, teachers and adult volunteers in citizen science research and associated learning experiences in partnership with ocean scientists. Learning scientists and informal education staff will design and study educational experiences and curricula to support meaningful learning about the ocean at the Seattle Aquarium, in classrooms, and out in the field. These efforts will include collaboration with programs and institutions already engaged in citizen science to help strengthen and extend the reach of such efforts. Resources and publications will be developed to promote these educational models more broadly.